Clonmacken Residential, Condell Road

LCC – C62 – 159

Forward/Strategic Planning,
Economic Development Directorate,
Limerick City and County Council,
Merchants Quay,
Limerick

Our Ref: 160607
Your Ref: N/A

6th September 2021

Re: Submission to the Draft Limerick Development Plan 2022-2028 in relation to residential development and the zoning of lands to the South of Condell Road, Limerick City.

Dear Sir/Madam,

MKO have been appointed by the Clonmacken Partnership Ltd to prepare and lodge this submission to the draft Limerick Development Plan 2022-2028, on their behalf. There is a significant concern that this plan does not go far enough in predicting future residential growth of the city and urban area, nor does it include sufficient amounts of zoned land for residential development.

This submission relates to the predicted housing targets and the residential zoned lands proposed for Limerick City and County to bring forward sufficient residential development over the coming years. The purpose of this submission is to specifically request that the Local Planning Authority reinstate the residential zoning of the subject site to the extent of the red line illustrated in **Figure 1** below, which is currently subject to an SHD application and can be made safe from flood risk in its entirety.

The site subject to this submission is located in Clonmacken, to the south of the Condell Road (R527), approximately 1.6 km to the northwest of Limerick City Centre. This is a suburban city site, located on a key arterial route to and from Limerick City Centre, situated within the city boundary between the City Centre and the Jetland Shopping Centre, a district centre for retail and shopping. The site, which is approximately 4ha in size, is currently zoned for residential development, with a number of residential dwellings located to the north and along the eastern boundary of the subject site and the River Shannon located approximately 150 meters directly to the south and west of the site. The subject site is in close proximity to numerous public facilities/amenities including schools, sporting facilities, churches, public parks, shopping/retail areas along with various other community facilities. As noted, the subject site is also located approximately 1.6 km to the west of Limerick City Centre and is considered to be well served in terms of facilities and amenities. It is also located approximately 1.4 km from the Jetland Shopping Centre (and approximately 1km from the site via pedestrian/cycle routes), a District Centre. The topography of the site consists of undulating greenfield land, high above the floodplain land to the south. An element of engineering works will be required to develop these lands.

This site currently subject to Strategic Housing Development (SHD) discussions with Limerick City and County Council's planning department and An Bord Pleanála for new residential development (Ref: ABP-311114-21), with Section 247 meetings having taken place, and a Section 5 Tripartite Meeting expected to take place in the coming weeks to discuss the detail of this proposed residential development.

Figure 1: Site Location proximate to Limerick City and Environs. Source: Google Maps (as edited by MKO)

The draft plan sets out in policy **CSP P1**, relating to the implementation of the core strategy, that it is a policy of the Council to ensure the core strategy for Limerick is consistent with policies at a national and regional level. However, as is set out below, there is a concern that this plan, as drafted, will not be consistent with national and regional policy, particularly in relation to densities and meeting the residential need of the City and County over the plan period.

Table 2.7 of the draft plan sets out the settlement hierarchy for the city and county as a whole, referencing the City and Environs as a Level 1 settlement which is predicted to grow almost 37% (34,177 new residents) with 11,274 new households forecast by 2028. However, it is not clear what the quantum of zoned land required to accommodate additional growth in ha would be for this settlement. This table sets out that there is capacity on the existing zoned land which is undeveloped and available for approximately 12,322 new residential units. However, it is difficult to see how these figures could be accurate given the quantum of lands which have been proposed to be down zoned within the City and Environs and the proposal to implement lower Density Zones on much of the lands within the city and environs, with only a handful of zoned sites in the draft plan being included within the Density Zone 1 and 2 areas (of 100dph and +45dph respectfully). Therefore, it is considered that there is much more work required to be done and significant proportions of land required to be zoned in the City and Environs plan to meet the predicted population figures within the plan period.

Further, as was reported by the Central Statistics Office (CSO) on 31st August 2021, for the first time since 1851 Ireland's population has surpassed 5 million people. The NPF had predicted that the population of Ireland was expected to reach almost 5.7million people by 2040. This prediction may be surpassed or met sooner, with the need for even more residential development to be planned in the coming years to facilitate the population growth predicted up to and beyond 2040. Therefore, Development Plans should be robust enough so as to ensure that the population targets can be met, particularly if there is a potential for them to increase over the plan period.

As is set out below, in order to meet the population targets and ensure that there are sufficient new residential units for the growing population of Limerick City and Environs up to 2028, the Development Plan needs to ensure that

1. The extent of the Residential Zoning on this site must be reconsidered and increased,

2. That there are a sufficient number of sites/areas zoned for residential development for the entire plan period, and

3. Appropriate Density Zones are applied to the City and Environs.

1. Extent of the Residential Zoning on the Subject Site at Condell Road

The subject site, which is currently being assessed by An Bord Pleanála and the Local Planning Authority at the pre-application stage, is considered to be wholly suitable for residential development. The site is currently zoned for residential development in its entirety, with much of the surrounding land zoned for residential development. However, the draft Development Plan has significantly reduced the extent of the residential zoned land in this location. This reduction is assumed to be largely due to the flood risk on this site, which a significant proportion of the overall lands to the south of the subject site located in Flood Zone A. There are different flood zones across the subject site. The majority of the land within the red line is located within Flood Zone C, with no risk of flooding. However, due to the topography of the site and its location proximate to the River Shannon, there are elements on the edges of the subject site which are currently located within Flood Zones A and B and have a risk of flooding.

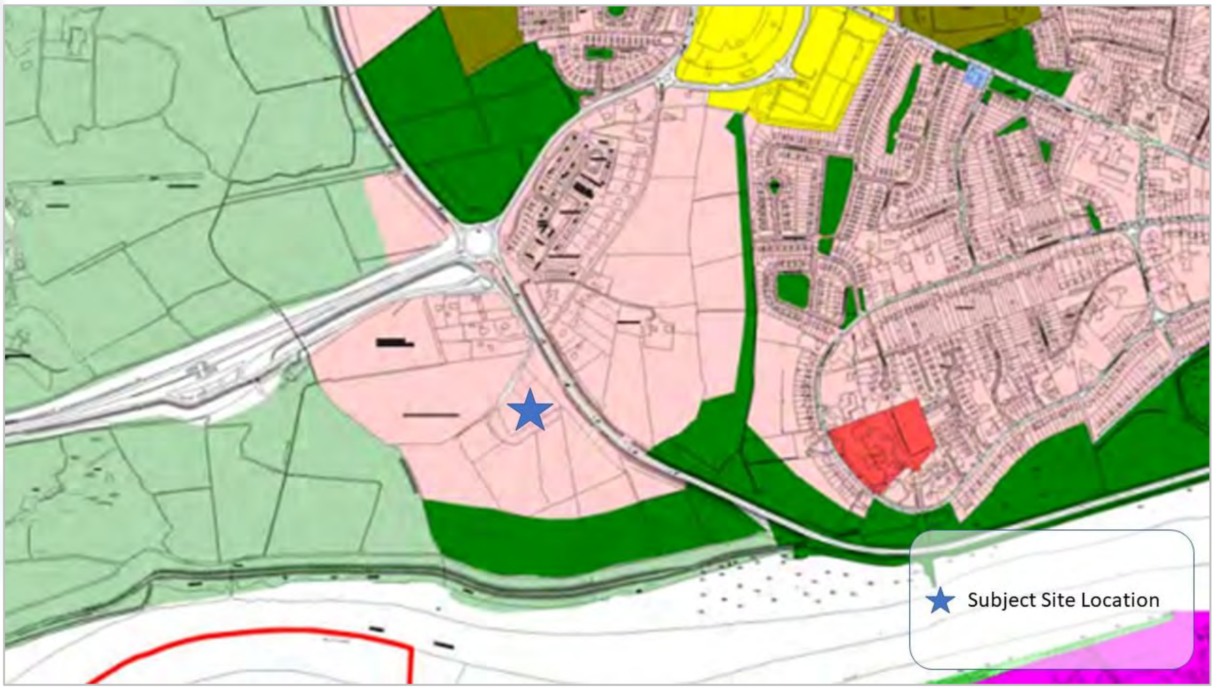


Figure 2: Extant Zoning of Site. Source: Limerick City Development Plan 2016

Figure 3: Proposed New Residential Zoning (brown colour), Existing Residential Development (orange colour) and Flood Zones A (light blue colour) and B (dark blue colour) overlaid on map. Source: LCCC Virtual Room - Interactive Map

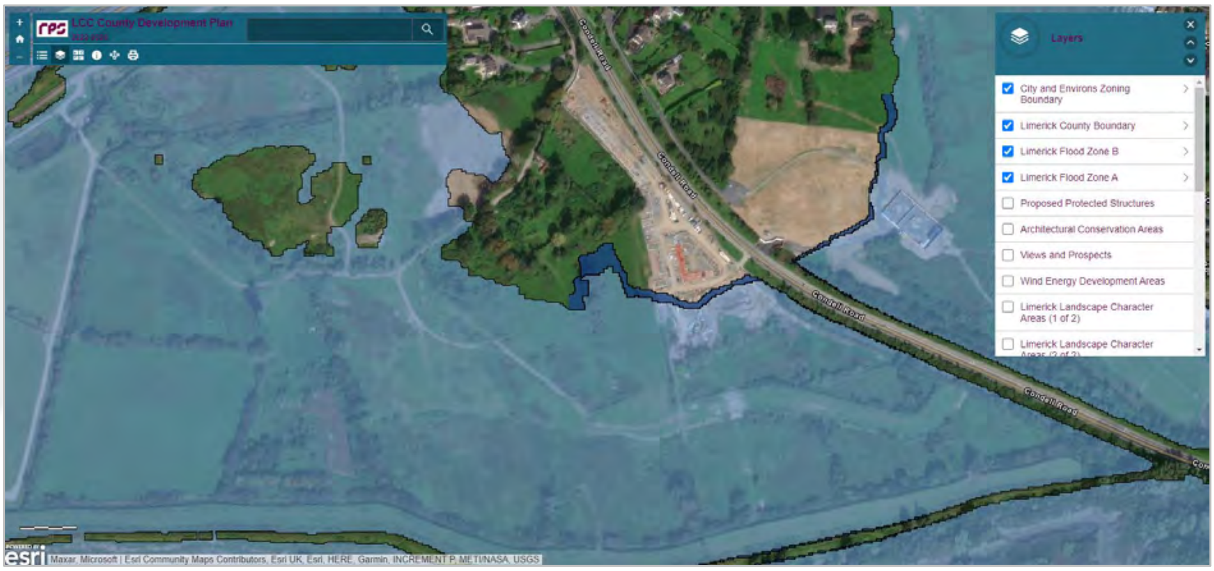


Figure 4: Flood Zones A (light blue colour) and B (dark blue colour) overlaid on aerial map. Source: LCCC Virtual Room - Interactive Map

While it is acknowledged that the subject site has some existing challenges in terms of topography and flood risk overall, it is well known by, and evidence has been supplied to, the Local Planning Authority to demonstrate the levels of engineering works which would be required to take place to develop this site and facilitate new residential development which is entirely safe from flood risk. In addition, the proposed zoning alterations appear to follow the Flood Risk Zones on this site, as illustrated on **Figure 6** above, however, it is noted that on the site to the immediate east, which is currently being developed, residential development extends into both Flood Zones A and B, as illustrated on **Figure 7** above. Should this site have been able to justify that residential development was appropriate on site, the justification put forward for this subject site should also be considered appropriate for residential zoning as it can be demonstrated that it can safely accommodate residential development.

Research and Survey work has been done on this site, which has demonstrated that the site levels to bring the site out of Flood Risk Zones A and B, and into Flood Risk Zone C, which is safe for residential development, is 4.71m OD Malin. It has been demonstrated and included in reports submitted to both Limerick City and County Council and An Bord Pleanála, that much of this site lies above this level and it is possible to carry out enabling works which would bring much more of this site out of the at-risk zones and into Zone C, therefore safe for residential development. This site is located in a strategic and highly sustainable location, which would be suitable to accommodate a significant level of residential development, at a high density, which fits well within the character of the area and is in accordance with proper planning and sustainable development. As such, we would respectfully ask the Local Planning Authority to reconsider and reinstate the extent of the residential zoning on this site.

The Planning System and Flood Risk Management Guidelines for Planning Authorities were published in 2009 to introduce mechanisms for the incorporation of flood risk identification, assessment and management into the planning process. At the city and county level, where development on an area of flood risk has to take place due to no suitable alternative sites being available in lower areas of flood risk, the risks should be mitigated and managed through location, layout and design to ensure that flood risk is reduced to an acceptable level. As set out in paragraphs 12 to 14 of these guidelines, an application is required to include the appropriate flood risk assessment and justification test to demonstrate how this site is appropriate for residential development and how mitigation measures have been included to ensure the risk of flooding has been reduced. This has been justified within the SHD application, and the relating Site-Specific Flood Risk Assessment prepared by Hydro Environmental Consultants, has been included in **Appendix 1** of this submission.

As set out in the FRA, there are no stream channels passing through the proposed site area and the nearest major drainage channel is the OPW back drain that runs along the toe of the Tidal Embankment and which outfalls to the Shannon via a number of flapped sluices through the tidal embankment. There are two streams adjacent to the Site the Shannabooly Stream to the East (just east of the site access road) and the Clonmacken Stream c. 200m to the west. These are small local streams that discharge into the back drain system. It is explained that the function of the back drains is to store local drainage water from the surrounding local catchments within the channel inside the embankments until such time that the tide has sufficiently retreated to allow opening of the flap gate and the outflow under gravity (head difference). The predicted undefended 200year and 1000year tidal Storm Surge with seiche and wind setup for the Shannon Estuary adjacent to the Clonmacken Site at Condell Road give flood levels of 4.43m OD and 4.71m OD respectively. These undefended levels are used to establish the flood zones on the site as required by the flood risk management planning guidelines. **It is considered that the raising of the site above 4.71m, will result in those elements of the site which are currently at risk of flooding, being safe from flooding.** This approach is proposed to be taken on any future residential development scheme on this site and will apply to the residential building footprint area, the green space areas and the internal roads. In order to remove flood risk from the development site, each dwelling will have a minimum finished floor level (FFL) of 5.5. A justification test for the development of these lands to provide new residential units was also carried out and determined that the development, as proposed, is suitably justified, and determines that "*Based on the above it is considered under the flood risk management planning guidelines (2009) that **the proposed development passes the flood Risk management Justification Test and represents sustainable development in respect to flooding currently and in the future***" (Our emphasis added).

Further, the existing shortfall of residential units required for Limerick City along with the lack of new dwelling completions within Limerick, the zoning of the land for residential development, the established residential nature of the area, and the excellent pedestrian and cycleway connectivity of the site with the City Centre and Jetland District Centre, should provide ample justification for the

MKO, Tuam Road, Galway, Ireland. H91 VW84
+353 (0)91 735611 | info@mkoireland.ie | www.mkoireland.ie | @mkoireland
McCarthy Keville O'Sullivan Ltd. t/a MKO. Registered in Ireland No. 462657. VAT No. IE9693052R.

development of this site, as a whole within the red line boundary, in a residential capacity given the clear ability to mitigate the minor flood risk of the site, as set out in the Flood Risk Assessment.

The FRA appended to this submission concludes that

"In summary the proposed development site is currently zoned for residential development and is considered a strategic site located within 1.6km of the city centre area and representing the only greenfield zoned site within the West Limerick city area that is sufficiently elevated, with much of the site within Zone C and accessed by public roads from flood Zone C. It is feasible to infill this site in order to manage flood risk on the slightly lower lands that fall into flood zones A and B without causing significant displacement of back-drain storage or causing significant increase in flood levels or flood risk to other properties and lands".

As such, any proposed residential development should be considered acceptable and the residential zoning of this site within the red line reconsidered, to increase the extent of land zoned for residential development on this site.

It is, therefore, respectfully requested that the extent of the existing residential zoning on this site is amended to include all land within the extent of the above red line boundary, which has been demonstrated in the attached Appendix, to be within Flood Zone C and therefore suitable for residential development in its entirety when raised above the 4.71m OD Malin site level.

2. General Residential Zoned Lands

It must be noted that there is a grave concern that this development plan is not ambitious enough in its overall proposed zoning of new residential areas, despite its proposed policy **CSP P3** relating to the availability of land and the policy of the Council to ensure that sufficient land is zoned and available for the projected population and employment growth over the plan period.

It is evident in the draft development plan that the extent of the residential zoning on this site has been significantly reduced and this does not seem to be reflected in the draft plan housing targets in Table 2.7 of the draft Plan. This could potentially have a major impact on the viability of new residential development and the ability for a key site in such a well connected and strategically beneficial area to be developed to its full potential. It is therefore, respectfully, requested that both the overall residential zoning proposals for Limerick City and Environs is revisited and reconsidered, and as discussed above that the extent of the residential zoning on our client's site on the Condell Road be reconsidered to ensure that a sufficient proportion of the overall site has the ability to be developed for residential development.

Chapter 10 relating to Compact Growth and Revitalisation expressly states on page 240 that "*Successful compact growth requires enhanced connectivity and accessibility for pedestrians and cyclists, as well as the provision of viable public transport services through the concentration of higher density developments at strategic employment locations and along public transport nodes*". Further, Policy **CGR P1** relating to Compact Growth and Revitalisation states that it is a policy of the Council to achieve sustainable intensification and consolidation in accordance with the core strategy, through the integration of land use and transport, the use of higher densities in development and appropriate mixed-use development.

While this policy appears to be appropriate and ambitious for the future of Limerick, it's actual putting into practice through the zoning and density zoning of lands within the draft development

MKO, Tuam Road, Galway, Ireland. H91 VW84
+353 (0)91 735611 | info@mkoireland.ie | www.mkoireland.ie | @mkoireland
McCarthy Keville O'Sullivan Ltd. t/a MKO. Registered in Ireland No. 462657. VAT No. IE9693052R.

plan appears to fall significantly short of complying with this Policy **CGR P1**. The lands within the City and Environs of Limerick are clearly well connected and accessible via pedestrian, cycle and public transport (existing and proposed) modes, and additional available lands with higher densities should be zoned for residential development accordingly.

The extant Development Plan appears to have approximately 358ha of undeveloped and available land, according to Table 2.7 of the draft plan, however, there are only approximately 63 no. sites proposed to be zoned for new residential development in the emerging draft plan, many of which are extremely small in size, with limited capacity to accommodate significant levels of development. While it is not clear how many hectares of land are zoned for new residential development, it is expressly clear that it is significantly less than existing. Further to this, there are sites such as our client's, which remain zoned in the emerging plan, but have been significantly reduced in terms of the extent of the zoned area, which, even without taking the aforementioned density restrictions into account, will likely further exacerbate the issues of providing sufficient numbers of residential development to meet the Council's predicted targets.

It is, therefore, respectfully requested that a realistic and practical review of residentially zoned land particularly within the City and Environs is conducted, and reconsideration is given to the amount of proposed zoning for new residential development carried out prior to the adoption of this development plan.

3. Density

Further to the above concerns regarding to the extent of the residential zoning applied to Limerick City and Environs, and our client's site in particular, reference must also be made to Section 2.3.5.2 of the Draft Plan. This section sets out that the density zones for the City and Environs have been determined and applied depending "*on the location of that site, which settlement it belongs to, where that settlement fits within the settlement hierarchy, the site's position with respect to the urban core, the proximity to public transport corridors and to major employment zones. Where communities live in areas of medium to high residential densities, the prospects improve for local services and amenities, use of sustainable transport modes for daily journeys and the reduction of unsustainable travel patterns*". Further, Table 2.6 of the Plan sets out that in Intermediate Urban Locations/Transport Corridors, a minimum density of +45 dwelling units per hectare (dph) are required at appropriate locations within 800m of certain listed facilities/services, 500m of high frequency exiting or proposed urban bus services and 400m of reasonably frequent urban bus services.

It is noted on **Figure 2.2** (on the Draft Plan) illustrating the proposed density zones for the city and environs that there is a significant proportion of the city afforded a density of +35 dph, including the area relating to the site subject of this submission. There is a concern that the designation of +35 dph is ambiguous and does not necessarily mean up to 45dph. Should a site come forward in this zone proposing +40dph, there is a worry that the proposed density could be considered too high, despite being under the 45dph. This is particularly concerning considering the Country is amidst a housing crisis, with a significant shortage of zoned lands proposed in Limerick City and Environs.

The criteria for areas to be given a Density Zone 2: Intermediate Urban Locations/Transport Corridors (+45dph) area include being located within 500m of a proposed high frequency urban bus service and 400m of a reasonably frequent bus service. The draft plan sets out throughout Chapter 7 relating to Sustainable Mobility and Transport, that it is a key objective of the plan to promote and support the emerging Bus Connects plan and the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS). These plans currently demonstrate the proposed bus routes throughout the city and its environs, which will have frequent bus stops along them. The draft LSMATS illustrates the proposed bus routes as follows:

Figure 5: Proposed Bus Routes as part of the Bus Connects Plan. Source: Draft LSMATS Report.

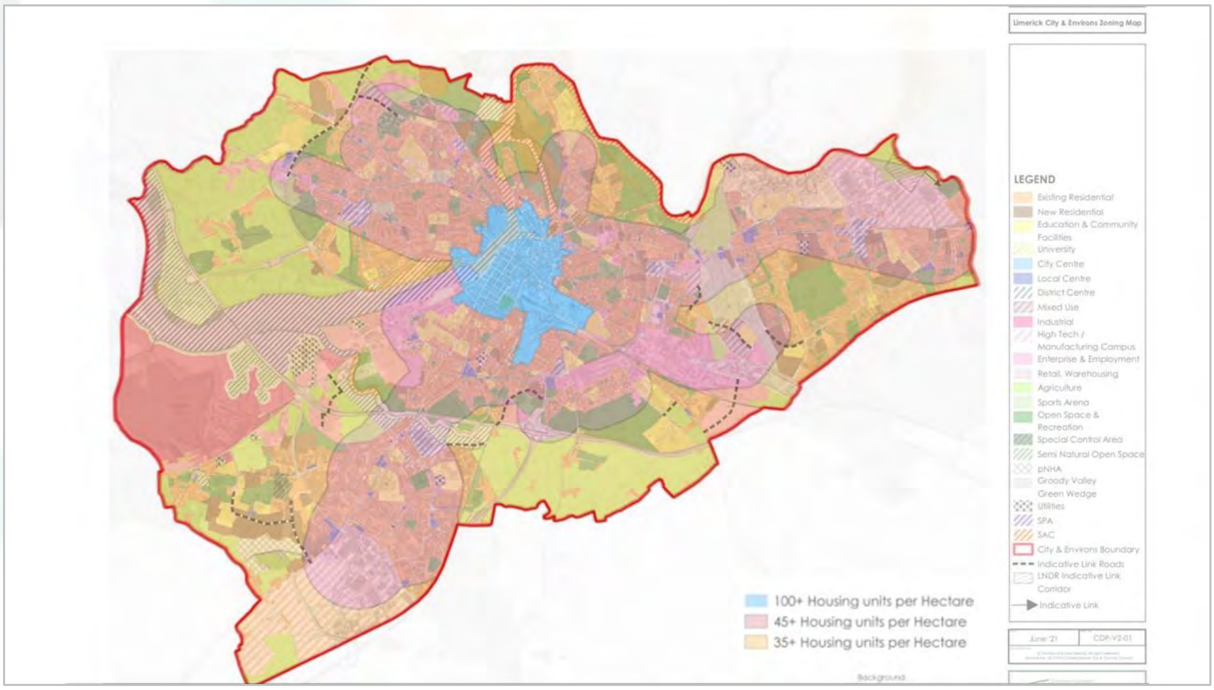


Figure 6: Draft Zoning Map overlaid on Draft Density Zoning Map. Source: LCCC Draft Development Plan (As edited by MKO)

MKO, Tuam Road, Galway, Ireland. H91 VW84
+353 (0)91 735611 | info@mkoireland.ie | www.mkoireland.ie | @mkoireland
McCarthy Keville O'Sullivan Ltd. t/a MKO. Registered in Ireland No. 462657. VAT No. IE9693052R.

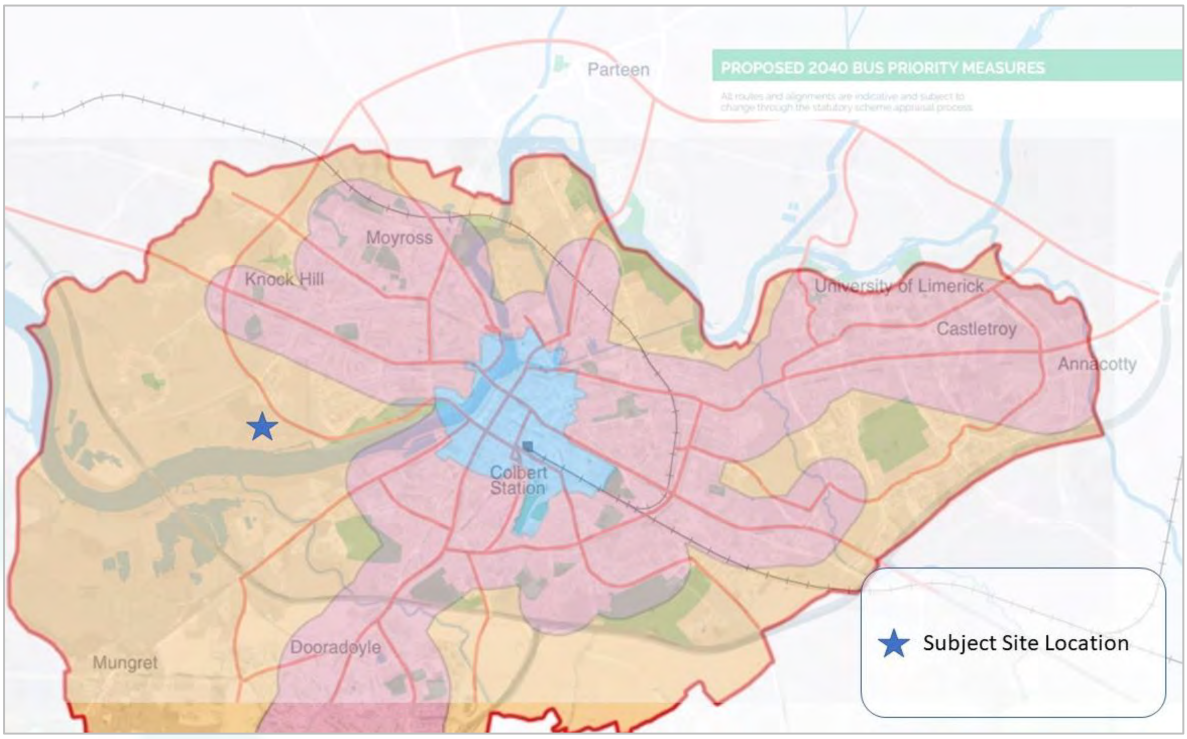


Figure 7: Proposed Bus Routes and Density Zoning Map. Source: Draft LSMATS Report and LCCC Draft Plan (as edited by MKO)

It is considered especially pertinant to ensure appropriate densities are set in areas such as the location of our client's site, which is only 1.6km from the City Centre, is 1.5km from a District Centre and has a designated cycle lane to the City Centre, taking approximately 4 minutes to reach via bicycle.

The National Planning Framework's number one goal for Ireland up to 2040 is Compact Growth, which the draft development plan states is at the forefront of the plan and its proposed policies, however this is not reflected in the proposed density zoning map. Densities in the City and Environs of one of Ireland's main cities should be much more ambitious and seek to provide more residential units that currently targeted. Particularly given the constraints of the City and its Environs in relation to flooding and the apparent significant down zoning of much of the City's residential development. It is difficult to see how the Council and developers will be able to bring forward the true required housing stock for the plan period and beyond, with such restrictive densities proposed.

The criteria for setting out how the Density Zonings are selected, is also concerning, with no consideration for sites in close proximity to the City Centre, District Centres or Local Centres. This should be considered by the Local Planning Authority in the interests of complaince with National Policy, Ministerial Guidance and proper planning and sustainable development.

It is therefore, respectfully requested that reference in the emerging plan be made to the acceptability of developments within the denisty zoning areas be considered up to the zoning bracket above, i.e. lands within Zone 3, being applied a +35dph, be considered to have an appropriate density between 35 - 45dph, where justfiable and appropriate.

MKO, Tuam Road, Galway, Ireland. H91 VW84
+353 (0)91 735611 | info@mkoireland.ie | www.mkoireland.ie | @mkoireland
McCarthy Keville O'Sullivan Ltd. t/a MKO. Registered in Ireland No. 462657. VAT No. IE9693052R.

Conclusions

Overall, as discussed above, there is a grave concern that this Draft Development Plan is not sufficiently ambitious to achieve its targeted residential development figures in accordance with the predicted population growth of the City and its Environs over the coming years to 2028.

The reduction in the extent of the zoning of our client's site would again further reduce the developability of the site in a sustainable and viable manner, and place further strain on the Council's population and residential development targets. To reiterate, as stated in the conclusion of the Site-Specific FRA conducted on the subject lands

*"In summary the proposed development site is currently zoned for residential development and is considered a strategic site located within 1.6km of the city centre area and **representing the only greenfield zoned site within the West Limerick city area that is sufficiently elevated, with much of the site within Zone C and accessed by public roads from flood Zone C. It is feasible to infill this site in order to manage flood risk on the slightly lower lands that fall into flood zones A and B without causing significant displacement of back-drain storage or causing significant increase in flood levels or flood risk to other properties and lands**"* (Our emphasis added).

It is therefore respectfully requested that the extent of the existing zoning be reinstated to the red line boundary of the proposed application site and carried forward into the emerging development plan, given the justified removal of flood risk, in the interests of proper planning and sustainable development.

Further, the severe lack of zoned land in the emerging plan, much of which will suffer from lower density constraints if the plan is adopted as it currently is drafted, will create an impossible task of meeting the residential development targets set for the City and its Environs and must be revisited and resolved prior to the adoption of the emerging development plan.

Additionally, the proposed Density Zones as set out in Chapter 3 of the draft plan should be reviewed with those lands within the +35dph zones to be considered acceptable for developments of a density **up to** 45dph, given the provisions of National and Regional Policy in relation to densities, and the emerging proposed Bus Connects corridors, which will significantly improve the bus connections throughout the City and its Environs.

Yours sincerely,

Áine Bourke

____

Áine Bourke *BA(Hons) MPlan MRTPI MIPI*

Planner

MKO

ENCL -

Appendix 1 - Site Specific Flood Risk Assessment as prepared by Hydro Environmental Consultants

MKO, Tuam Road, Galway, Ireland. H91 VW84
+353 (0)91 735611 | info@mkoireland.ie | www.mkoireland.ie | @mkoireland
McCarthy Keville O'Sullivan Ltd. t/a MKO. Registered in Ireland No. 462657. VAT No. IE9693052R.

Appendix 1

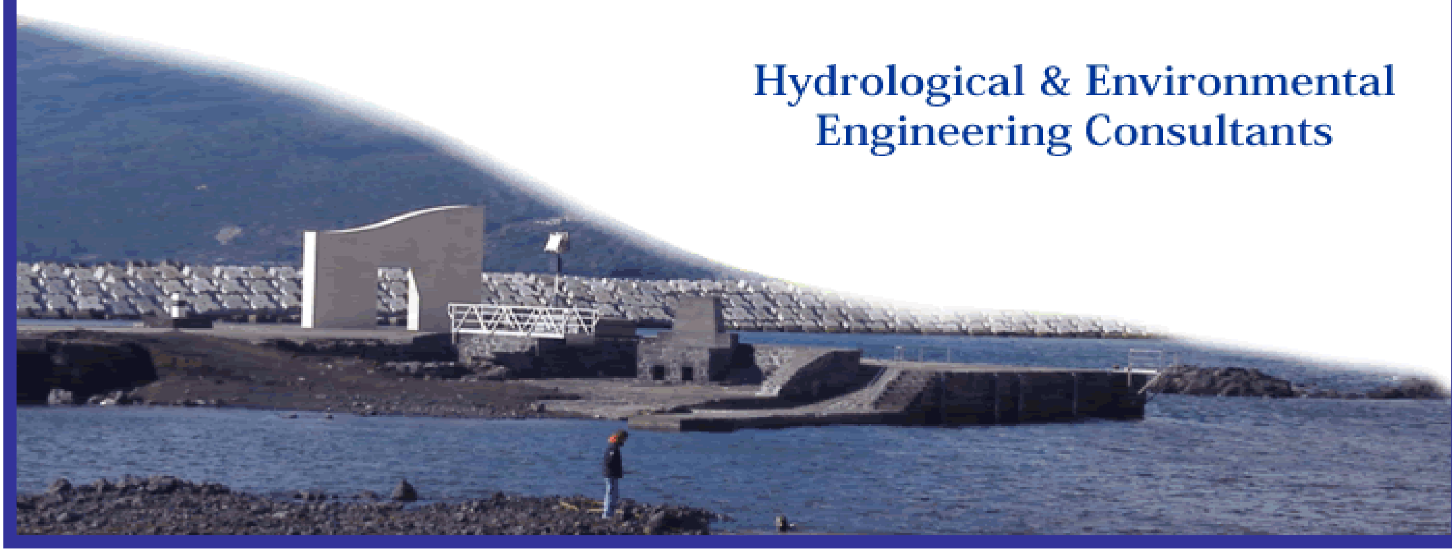
Site Specific Flood Risk Assessment as prepared by Hydro Environmental Consultants

Hydro Environmental Ltd

Flood Risk Assessment for Residential Housing Development at Clonmacken, Limerick

On behalf of
Clonmacken Partnership

June 2021



Hydrological & Environmental Engineering Consultants

Flood Risk Assessment for Residential Housing Development at Clonmacken, Limerick

Hydro Environmental Ltd
No. 4 Caiseal Riada,
Clarinbridge,
Galway,
Ireland.
Tel/Fax: 091 796734

Job No.:	221501
Report No.:	HEL221501v1.1
Prepared by:	Anthony Cawley BE, M.EngSc, CEng MIEI
Date:	25th June 2021

DISCLAIMER

This report has been prepared solely as a Flood Risk Assessment report for a residential development on Development Lands at Clonmacken, Limerick for the Clonmacken Partnership. Hydro Environmental Ltd accept no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned.

Table of Contents

1. Introduction

Hydro Environmental Ltd. was appointed by The Clonmacken Partnership to carry out a site-specific Flood Risk Assessment (FRA) study of a proposed residential housing development at Clonmacken, Limerick. This FRA is carried out in accordance with the Flood Risk Management Planning Guidelines (November 2009).

A residential development by its nature is considered to be high vulnerability development, in respect to flood risk and ideally, through the measures of avoidance, should be located in Low Flood Risk lands of Flood Zone C category having a flood risk of less than 0.1% annual exceedance probability (AEP). AEP of 0.1% is equivalent to the 1000year return period flood event (i.e. a 1 in 1000year probability of occurring in any given year). The Limerick City West Area that includes Clonmacken, Coonagh, Caherdavin, Westfield, the Ennis Road and the Condell Road are generally low-lying and the majority of that area is classified as defended lands from tidal flooding. These lands are protected from the Shannon Estuary by a large tidal earthen embankment which is under the supervision of the OPW Mungret Arterial Drainage Office. These flood defences over the majority of its extents are historically for Agricultural land protection as opposed to an urban flood defence. However, sections closer to Limerick city at the eastern section of the Condell Road have recently been upgraded to a higher urban defence standard as result of the severe tidal flooding in 2014 and provide a standard of protection of 200year.

The definition of a flood risk zone in the planning guidelines (2009) neglects the presence and assistance of any flood defences, such as flood walls and embankments. This is to allow for the fact that there is always a permanent residual risk of flooding behind the defences due to overtopping or breach and that there may be no guarantee that the defences will be maintained in perpetuity. Flood mapping shows extensive areas of land within the Limerick City West area both developed and undeveloped that are located in the high and moderate coastal flood risk zones A and B, refer to Figure 2. This map clearly demonstrates scarcity of potential development lands that are located in flood zone C within the Limerick City environs west of the River Shannon.

The subject site at Clonmacken within the red line boundary is 6.43ha in area and is located to the south of the Condell Road, refer to Figure 1. The housing development site area on excluding the access road from the southeast and the proposed storm water attenuation area to the south is 4.0ha in area.

The lands proposed for development have been zoned under the previous and current Limerick City Development Plan. A previous planning permission for extensive residential development on the site ref. 072530 for 397 houses, 18 apartments and a Creche was granted which had a significantly larger footprint area within the overall site at Clonmacken and had included residential development within the lower-lying lands on the site to the south through infilling and raising these lands. A large section of the site proposed for development has been raised over the past two decades under planning ref 051000 and generally the proposed development site represents raised ground generally above 3 to

3.5m OD Malin level. Much of the site is naturally elevated forming part of a small hill at Clonmacken.

This study uses the latest available flood inundation and risk mapping information including the finalised OPW CFRAM study, whose flood risk and extents mapping went to public consultation in 2015 and the catchment flood risk management plans and preliminary options engineering report in September 2016.

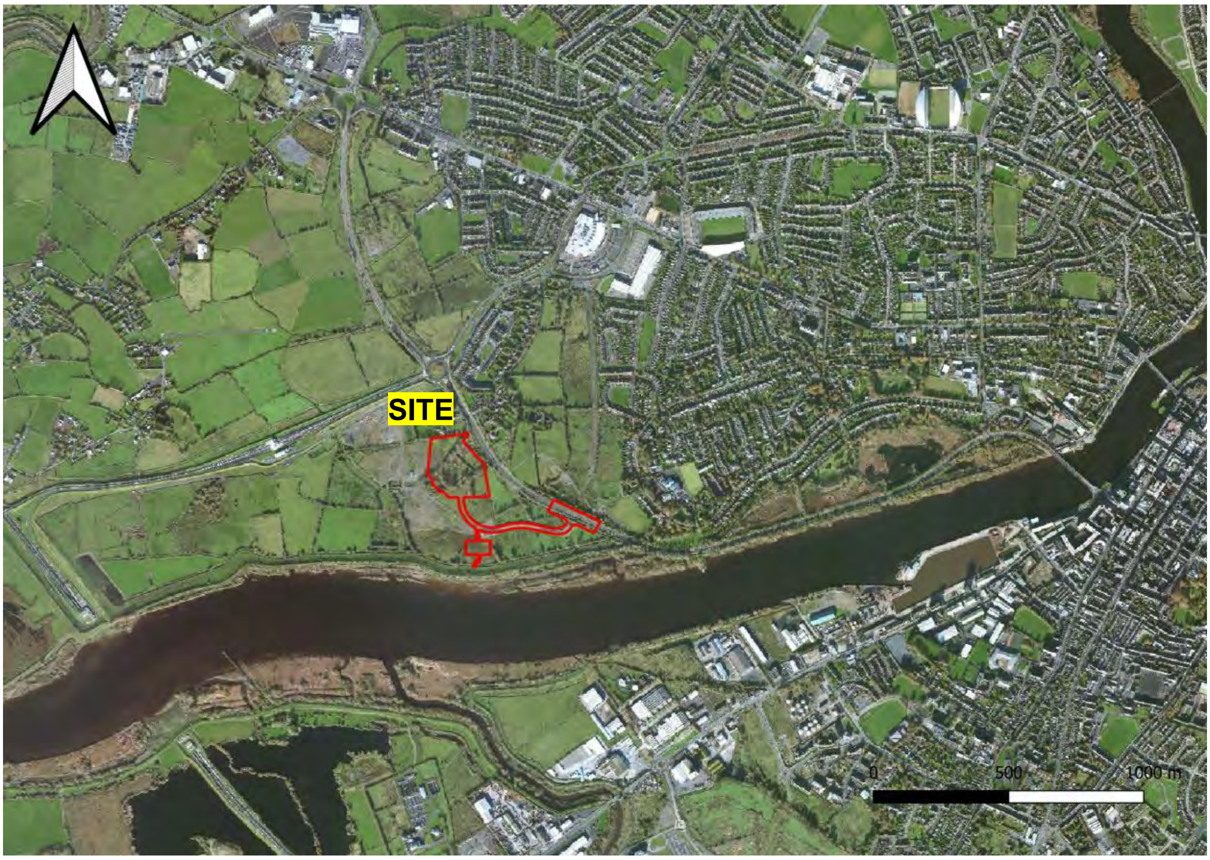


Figure 1 Site Location to the north of the Condell Road Limerick

This site specific flood risk assessment study presented in this report quantifies the flood risk to the site and proposed development, applies the principals from the DOELG (2009) Flood Risk Management Planning Guidelines, makes recommendations as to safe finish floor levels for the residential units which includes for potential future climate change, identifies and minimises / prevents any flood impacts and assesses the residual flood risk both present day and future subject to climate change.

The primary flood risk management measure proposed for this planning application is through raising the development lands above the flood risk where such areas are low. It will be demonstrated that such additional infilling of lands will not have any perceptible impact on the Coastal Flood Risk to surrounding lands or the proposed development itself.

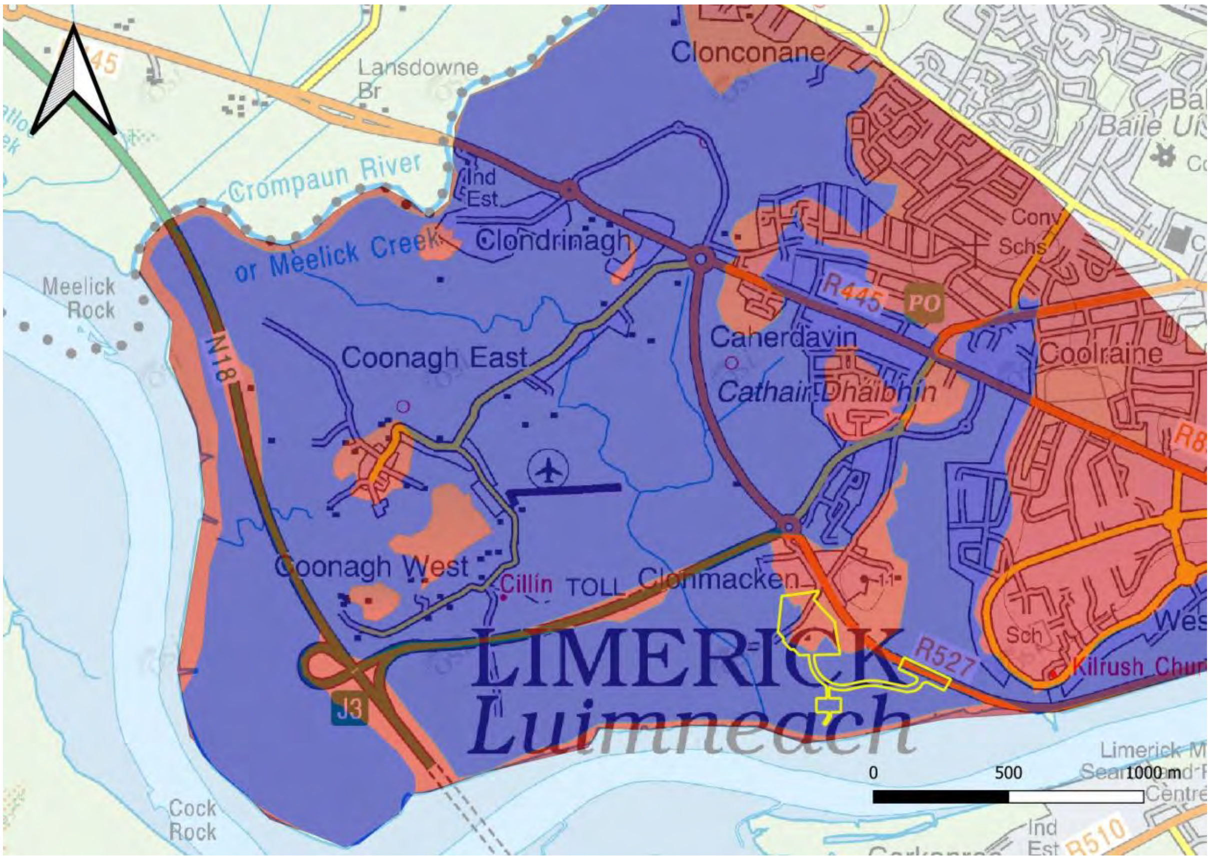


Figure 2 Coastal Flood Risk Areas for West Limerick City (red represents low risk Zone C lands and blue represents high and moderate risk)

Sources of information that informs this FRA study include

- Various historical topographical surveys of the site provided by the client
- CFRAM – Catchment Flood Risk and Management Study by OPW and consultant Jacobs
- CFRAM Hydraulics Report – unit of Management 25/26 – Final Report (June 2016)
- CFRAM Hydrology Report – unit of Management 25/26 – Final Report (July 2016)
- CFRAM Preliminary Options Report – unit of Management 25/26 – Final Report (July 2016)
- OPW Preliminary Flood Risk Assessment Mapping (July 2016)
- OPW Irish coastal Protection Strategic Study – South West Coast including Shannon Estuary (2013)
- Historical Flooding from Floodmaps.ie and floodinfo.ie
- OPW Arterial Drainage Maintained Channel mapping and Land benefitting mapping

A recent detailed topographical survey of the development area of the site for use in the Flood Risk mapping of the proposed development was carried out by NCW Surveys in November 2019.

2. Site Description

The site located in the townland of Clonmacken to the south of the Condell Road is within the back drain catchment behind the tidal defences. The total site area measures 6.43 ha and sections of this site is located within the OPW defended lands of the Shannon Estuary flood embankment scheme.

The topographical survey information for the site is presented in the form of a colour contour plot presented in Figure 3 below. On this mapping the blue colour represents lands below 3m OD, dark blue is generally below 2m OD and the green reflects lands between 3.5 and 6m OD. This plot clearly shows the site is substantially more elevated than the surrounding area to the south and east. Lands below the 2m OD contour are generally wet with ponding of direct rainwater and shallow depth to the groundwater table.

The more elevated northern section of the site where the development is proposed has subsoils of limestone till and a top-soil classified as grey brown podzolics and brown earth basics. From the site inspection the soil is quite silty and sticky and is considered to be of low permeability (represents a gley soil) with likely high runoff coefficient and limited infiltration capacity. The made ground on the site is extensive and is local material gained during the construction of the M18, link roads and Shannon Tunnel.

There are no stream channels passing through the proposed site area and the nearest major drainage channel is the OPW back drain that runs along the toe of the Tidal Embankment and which outfalls to the Shannon via a number of flapped sluices through the tidal embankment. There are two streams adjacent to the Site the Shannabooly Stream to the East (just east of the site access road) and the Clonmacken Stream c. 200m to the west. These are small local streams that discharge into the back drain system.

The strategic flood storage for the protection of the back-drain lands from flooding is the lower-lying lands adjacent to the back-drain channel that are at elevations of 1.0 to 2.5m OD (i.e. Blue coloured areas in Figure 3).

3. Description of Proposed Development

The proposed planning application is for the construction of a residential development comprising of 167 residential units, a 400m^2 creche facility and all associated and ancillary site and engineering works. The 167 no. residential units comprises:

a. 45 no. houses (3 no. 2-bed units, 41 no. 3-bed units and 1 no. 2 -bed bungalow)
b. 42 no. duplex units (21 no. 2-bed ground floor units, 13 no. 3-bed upper floor units, 8 no. 1-bed upper floor units)
c. 80 no. apartment units (22 no. 1-bed units, 56 no. 2-bed units and 2 no. 3-bed units).

The Storm Water from the Development will be attenuated at the greenfield runoff rate in a surface Pond system and discharged directly to the Back Drain System to the south of the site.

The foul effluent from the development will be collected and discharged into the Irish Water Foul Sewer.

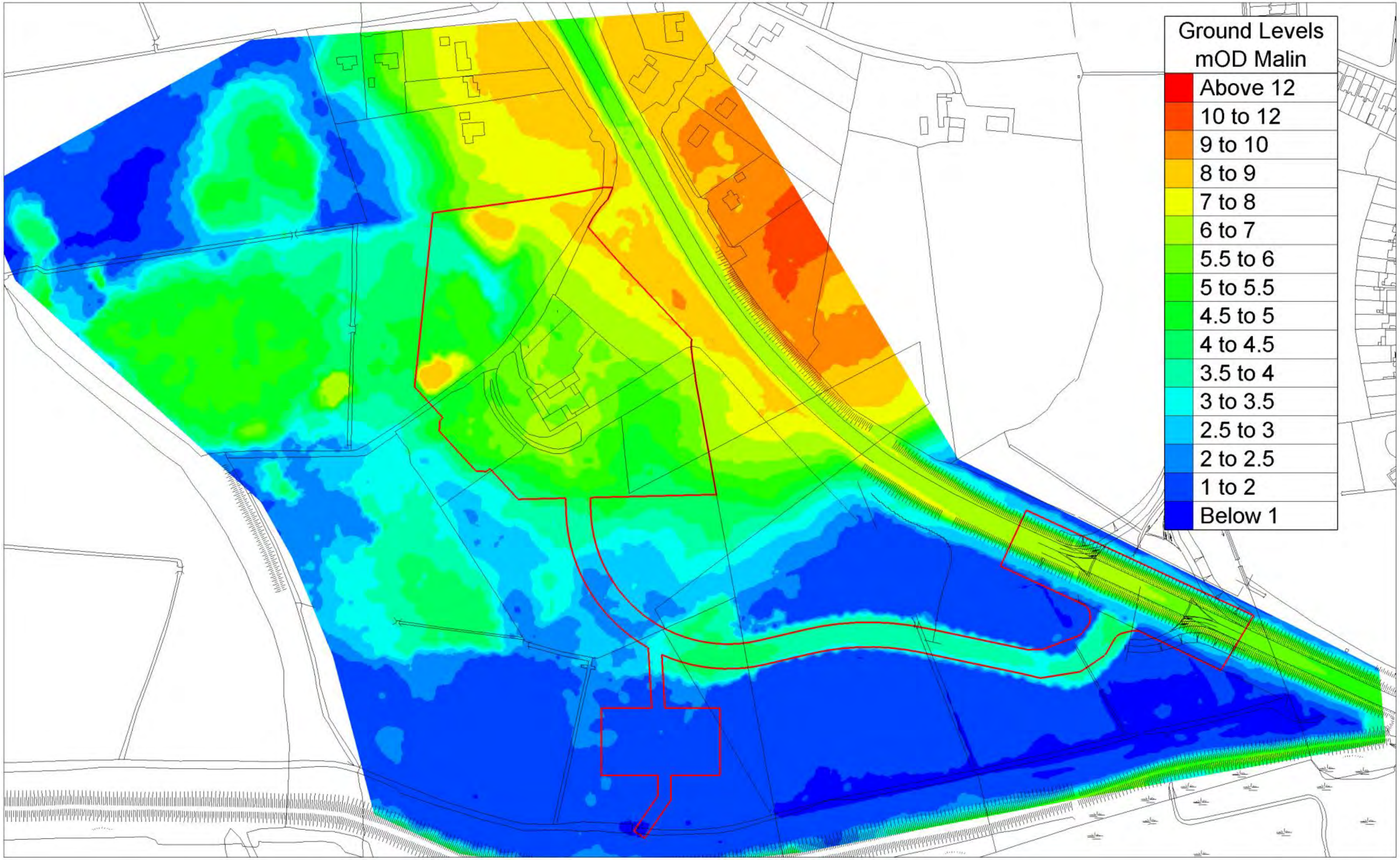


Figure 3 Contour plot of the Proposed Clonmacken Site

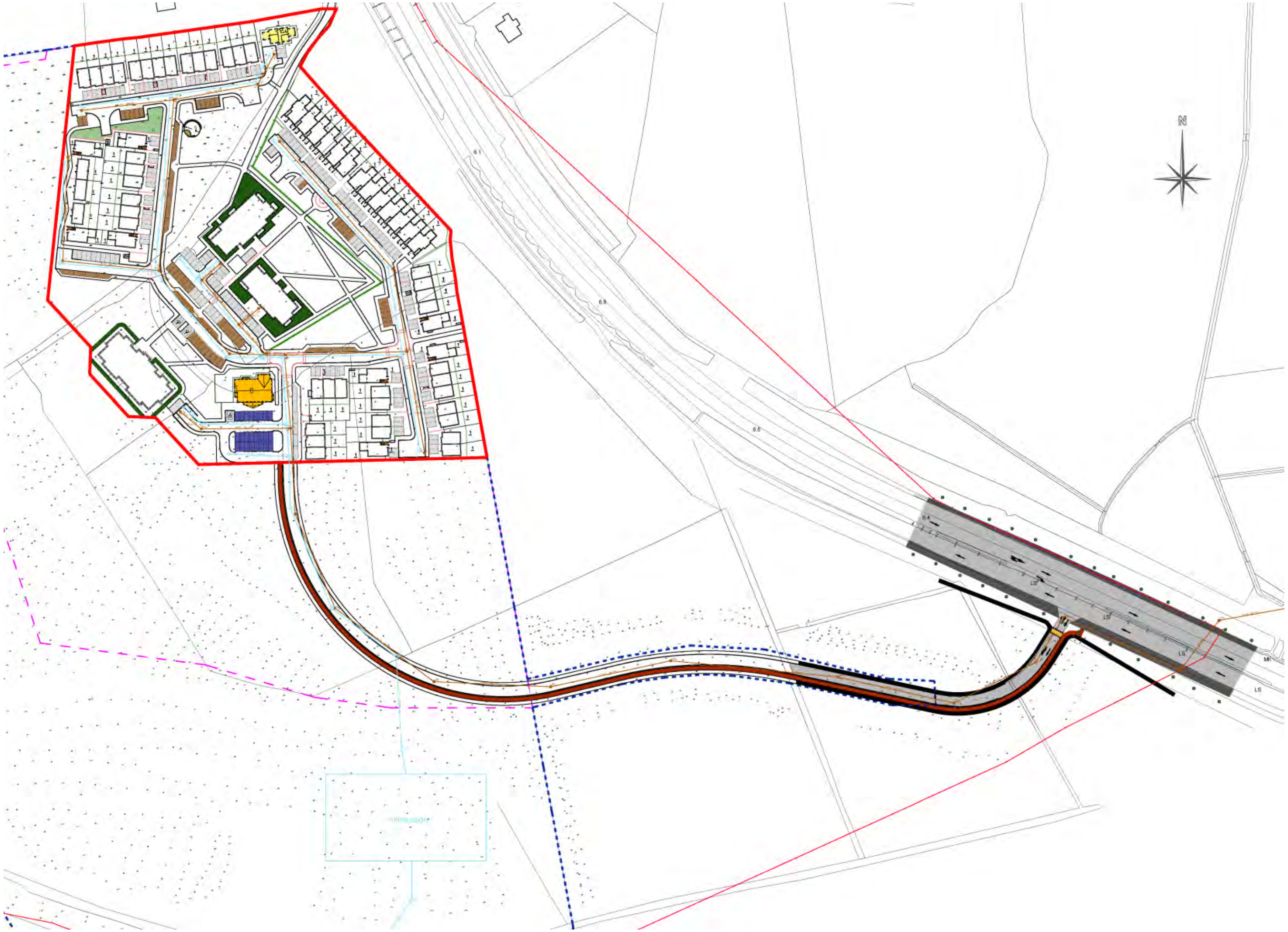


Figure 4 Proposed Site Layout

4. Flood Risk Management Planning Guidelines

4.1 Background

In November 2009 the OPW and DoEHLG jointly published for public consultation Flood risk management planning guidelines entitled "The Planning System and Flood Risk Management" which are aimed at ensuring a more consistent, rigorous and systematic approach to fully incorporate flood risk assessment and management into the planning system, both at the strategic level of county/city and local area plans and at the specific level of planning application assessments. The aim of these planning guidelines are a tiered system of avoidance of flood risk where possible, substitution with less vulnerable development where avoidance is not possible, Justification of development where avoidance and substitution are not possible and mitigate and manage to reduce flood risk and damage to acceptable levels where justification test permits the development.

The flood risk management planning guidelines sets out how to assess and manage flood risk potential and includes guidance on the preparation of flood risk assessments by developers.

The recommended stages of assessment are:
Screening Assessment – to identify whether there may be flooding or surface water management issues related to a plan area or proposed development site that may warrant further investigation;

Scoping assessment to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding and potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures;

Appropriate 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.

4.2 Site Specific Flood Risk Assessment

Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and local area plans (LAPs) or a proposed development site that may warrant further investigation at the appropriate lower level plan or planning application levels.

Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or 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.

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 or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

All stages may not be needed in the FRA in order to inform the decision making process and often a Stage 2 assessment is sufficient at the strategic level to inform the decision making process. This will depend on the level of risk, the level of conflict with the proposed development and the scale of mitigation measure being proposed. For the purposes of applying the sequential approach, once a flood risk has been identified it can be avoided. Where development is planned in flood risk areas, a detailed assessment may be carried out within the FRA, so that the potential for development of the lands and their environmental and flood impact can be assessed.

Mapping:

- A location map
- A Plan that shows existing site and proposed development(s)
- Identification of any structures which may influence the hydraulics.
- Flood Inundation map showing flood zone areas on the subject site / area

Surveys:

- Site levels related to Ordnance Datum
- Appropriate cross-section(s) showing finished etc. Or other relevant levels in respect to flooding.

Design Standards

- The FRA should generally be undertaken on the basis of a design event of the appropriate design standard:-
- 100 year Fluvial Flood or 1% Annual Exceedance Probability (AEP) for River Flow
- 200 year combined Return Period event or 0.5% AEP for tide affected sites

Assessments:

A site-specific flood risk assessment should in general include the following assessments

- All potential sources of flooding that may affect the site
- Flood alleviation measures already in place

- The potential impact of flooding on the site and consideration of flood zones in which the site falls within and the demonstration that development meets the vulnerability criteria set out in the guidance.
- The potential impact of the proposed development on the flooding and flood risk to other lands and properties.
- How the layout and form of the development can reduce those impacts, including arrangements for safe access and egress, which may include an evacuation plan for the development.
- Proposals for surface water management according to sustainable drainage principles
- The effectiveness and impacts of any necessary mitigation measures
- The residual risks to the site after the construction of any necessary measures and the means of managing these risks

4.3 Decision Making Process

Management of flood hazard and potential risks in the planning system is based on

1. Sequential Approach
2. Justification Test

1. Sequential Approach

The aim of the sequential approach is to guide development away from areas at risk from flooding. The approach makes use of flood risk zones, ignoring presence of flood protection structures, and classifications of vulnerability of property to flooding.

ZONE	DEFINITION
Zone A High Probability – Highest risk of flooding	More than 1% probability of river flooding and more than 0.5% probability of tidal flooding. Development should be avoided and/or only considered through application of Justification test. Only water compatible development , such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports and recreation and essential transport infrastructure that cannot be located elsewhere would be considered appropriate for this zone (i.e. not requiring application of Justification test).
Zone B Moderate Probability	Between 1 and 0.1% probability of river flooding or between 0.5 and 0.1% probability of coast flooding. Development should only be considered in this zone if adequate land or sites are not available in Zone C or if development in this zone would pass the Justification Test.
Zone C Low Probability	Less than 0.1% probability of river or coastal flooding. Development in this zone is appropriate from a flooding perspective.

These flood zones are determined on the basis of the probability of river and coastal flooding only and should be prepared by suitably qualified experts with hydrological experience. The derivation of these zones is broadly in line with those in common usage internationally. They are based on the current assessment of the 1% and the 0.1% fluvial events and the 0.5% and 0.1% tidal events, without the inclusion of climate change factors.

The provision of flood protection measures in appropriate locations, such as in or adjacent to town centres, can significantly reduce flood risk. However, the presence of flood protection structures should be ignored in determining the flood zones. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of the defences and the fact that there may be no guarantee that the defences will be maintained in perpetuity. The likelihood and extent of this residual risk needs to be considered, together with the potential impact on proposed uses, at both development plan and development management stages, as well as in emergency planning. The finished floor levels within protected zones will need to take account of both urban design considerations and the residual risk remaining.

Development Type Vulnerability Classification

In determining the suitability of the Development within the various flood zones the vulnerability class of the development is taken into consideration. Three categories of vulnerability are considered as described in Table 1 and 2 below:

Table 1 Classification of Vulnerability of Different Types of Development

Vulnerability Class	Land uses and types of development which include*:
Highly Vulnerable development (including essential infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding • Hospitals • Emergency access and egress points • Schools; • Dwelling houses, student halls of residence and hostels • Residential institutions such as residential care homes, children's homes and social services homes • Caravans and mobile home parks • Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility • 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
Less Vulnerable development	• Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions • Land and buildings used for holiday or short-let caravans and

Vulnerability Class	Land uses and types of development which include*:
	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 • Local transport infrastructure
Water Compatible development	• 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 • Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan)
	• Uses not listed here should be considered on their own merits

Table 2 Requirement for Justification Test based on Vulnerability group and Flood Zone Category

Vulnerability Class	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less Vulnerable development	Justification Test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

The Sequential Approach is based on the following principles:

AVOID

Preferably choose lower flood risk zones for new developments

SUBSTITUTE

Ensure proposed development type is not especially vulnerable to the adverse impacts of flooding

JUSTIFY

Ensure that the development being considered is for strategic reasons

MITIGATE

Ensure that flood risk is reduced to acceptable levels

PROCEED

Only where Justification Test passed. Ensure emergency planning measures are in place.

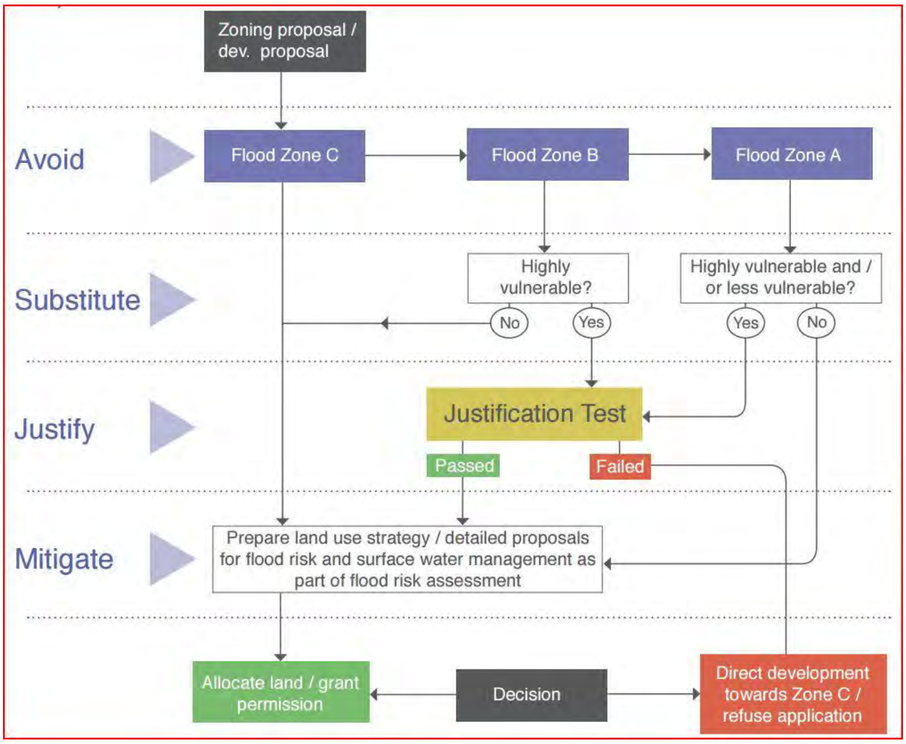


Figure 5 Sequential Approach Mechanism in the Planning Process (copy of Fig. 3.2 from the Planning System and the Flood Risk Management Planning guidelines)

2. *Justification Test*

Further sequentially-based decision making should be applied when undertaking the Justification Test for development that needs to be in flood risk areas for reasons of proper planning and sustainable development:

1 within Zone or site, development should be directed to areas of lower flood probability;

2 where impact of the development on adjacent lands is considered unacceptable the justification of the proposal or Zone should be reviewed

3 where the impacts are acceptable or manageable, appropriate mitigation measures within the site and if necessary elsewhere should be considered.

Application of the Justification Test in Development management.

Where a planning Authority is considering proposals for new development in areas at a high or moderate risk of flooding that include types of development that are vulnerable to flooding and that would generally be inappropriate, the planning authority must be satisfied that the development satisfies all of the criteria of the Justification Test as it applies to development management outlined in Box 5.1

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.

5. Climate Change and Flood Risk

5.1 Introduction

There is a high degree of uncertainty in relation to the potential effects of climate change, and therefore a precautionary approach is required. Examples of precautionary approach include:

- Recognising that significant changes in the flood extent may result from an increase in rainfall or tide level and accordingly adopting a cautious approach to zoning lands in these potential transitional areas.
- Ensuring that the finish levels of structures are sufficient to cope with the effects of climate change over the life time of the development.
- Ensuring that structures to protect against flooding (e.g. defence walls) are capable of adaptation to the effects of climate change when there is more certainty about the effects (e.g. foundations of flood defence designed to allow future raising of flood wall to combat climate change).

5.2 Climate Change Allowance for Fluvial Flood Flows

Climate change scenarios suggest for UK and Ireland fluvial floods in the 2080's increasing by up to 10% (low and medium low scenarios) or by up to 20% (medium high and high scenarios). Present recommendations are to include in the design flow a 20% increase in flood peaks over 50 years return period as a result of climate change. This scenario based on the Irish growth curve will result in a present day 100 year flood becoming a 25-year flood in approximately 50 years time. The extent and expected levels of flooding are derived based on these flows.

Other predicted climate change effects for the UK are:

- A 4mm to 5 mm per annum rise in mean sea level
- Additional intensity of rainfall of 20%
- An additional 30% Winter rainfall by the 2080's
- A reduction of 35%/45% rainfall in Summer
- The 1 in 100 year rainfall storm to increase by 25%

<u>DEFRA Guidance</u>
In the UK research is ongoing to assess regional variations in flood allowances and the rate of future change. Current research thus far does not provide any evidence for the rate of future change let alone consider regional variations in such a rate. The UK Flood and Coastal Defence Appraisal Guidance (DEFRA, 2006) gives the climate change ranges as

per Table 3 below and as a pragmatic approach it is suggested that 10% should be applied up to 2025, rising to 20% beyond 2025.

In Ireland general practice is to use a medium range climate change allowance for flood flows of 20% over the next 100 years. This rate has been adopted by the OPW for all of its Catchment Flood Risk Assessment and Management Studies (Lee, Dodder, Tolka CFRAMs, Shannon, West, etc.).

UK Flood and coastal appraisal guidance (DEFRA, 2006)				
Parameter	**1990 – 2025**	**2025 - 2055**	**2055 - 2085**	**2085 - 2115**
Peak rainfall intensity (preferably for small catchments)	+5%	+10%	+20%	+30%
Peak river flow (preferably for larger catchments)	+10%	+20%		

Table 3 UK flood and coastal defence appraisal guidance (DEFRA, 2006)

5.3 Sea level rise

Scientists predict that global sea level rise will have two main causes. Firstly, as the oceans heat up the water expands. At present this thermal expansion accounts for about half of the observed increase in sea level. The other cause is melting land ice from glaciers and ice caps. The rate of melt and the volumes of water locked within these sources are uncertain and this is a cause for concern.

In recent years, ice shelves have broken off huge ice sheets in Antarctica and Greenland. The ways in which they are melting is only now beginning to be understood fully enough to allow estimates of how fast this melt is occurring and how much this will affect sea levels. If they melt as fast as is now thought to be possible, sea levels could rise dramatically over the next century, flooding many of the world's major cities and much of the world's most productive farmland. Consequently, guidance on sea level rise allowances for flood risk management is continually changing as more scientific research is published with allowances likely to increase as opposed to decrease in future years.

The biggest threat to coastal flood risk areas is from sea level rise. Global mean sea levels are predicted to increase from a combination of thermal expansion of the water column and melt from the glaciers and reduction of liquid water storage on land. The Intergovernmental Panel on Climate Change Third Assessment Report (*IPPC TAR)* that preceded the published *IPCC Fourth Assessment Report* (2007) has been used as the basis of future sea level projections for Ireland. A best estimate increase of 480 mm to year 2100 has been suggested by Sweeney et al (2003) and used in the *Greater Dublin Strategic Drainage Study* (GDSDS 2005). This value was not directly challenged in the 2007 *IPCC* report, with a range of 0.2 - 0.51 m given for the prudent Medium-High A2 emission scenario.

The UK DEFRA (2006) publication suggests for the UK and globally that significantly higher rates of sea level rise, particularly towards the end of the century, than the 500mm allowance that is currently considered.

Table 4 **The UK Flood and Coastal Defence Appraisal Guidance (DEFRA, 2006) Regional Net Sea Level Rise Allowances**

Region	Assumed vertical land movement (mm/yr)	Net Sea-Level Rise (mm/yr)				Previous Allowances
		1990-2025	2025-2055	2055-2085	2085-2115	
East of England	-0.8	4.0	8.5	12.0	15.0	6mm/yr constant
South West and Wales	-0.5	3.5	8.0	11.5	14.5	5mm/yr constant
NW & NE England, Scotland	+0.8	2.5	7.0	10.0	13.0	4 mm/yr constant

The latest IPCC fifth Assessment Report (2014) has investigated the current and future trends in global mean sea level rise (GMSLR) and have concluded with a high level of confidence under various emission scenarios considered (four modelled RCPS (Representative Concentration Pathways) that thermal expansion of the sea due to warming will increase Global mean sea level by between 0.15 to 0.3m by 2100. This report predicts at medium confidence the contribution of glacier mass loss to GMSLR for the four RCP scenarios. The global glacier volume is projected to decrease by 15 to 55% for RCP2.6, and by 35 to 85% for RCP8.5 and in between these rates for the other two RCP scenarios. RCP2.6 is representative for scenarios leading to very low greenhouse gas concentration level, it is a so called “peak” scenario with radiative forcing reaching a peak level of 3.1 W/m^2 mid-century and returning back to 2.6W/m^2 by 2100. RCP8.5 is characterised by increasing greenhouse gas emissions overtime leading to high greenhouse gas concentrations by 2100.

Projections of GMSLR by 2100 under the high RCP8.5 scenario are 0.53 to 0.98m with rises of 8 – 16mm/annum during 2081 to 2100 and under the low RCP2.6 scenario are a rise is 0.28 to 0.61mm.

Observations of GMSLR show that from 1901 to 1990 1.5mm per annum mean rise and from 1993 to 2010 the mean rise was 3.2mm per annum.

The IPCC concluded that it is very likely that sea level will rise in more than about 95% of the ocean area. About 70% of the coastlines worldwide are projected to experience sea level change within 20% of the global mean sea level change. GMSLR during 1901–2010 can be accounted for by ocean thermal expansion, ice loss by glaciers and ice sheets, and change in liquid water storage on land. It is very likely that the 21st-century mean rate of GMSLR under all RCPs will exceed that of 1971–2010, due to the same processes. It is virtually certain that global mean sea level rise will continue for many centuries beyond 2100, with the amount of rise dependent on future emissions.

The Irish Coastal Protection Strategy Study prepared by RPS on behalf of the OPW (RPS, 2010) uses a Mid-Range Future Scenario (MRFS) reflecting changes that are within the typical range projected for mean sea level rise of 500mm. The glacial isostatic adjustment for land movement along the west coast is projected to be very minor. An allowance of 500mm mean sea level rise to the year 2100, which accounts for a 500mm increase in mean sea level and no increase for isostatic land movement adjustment was included in that study to simulate a potential mid-range future climate change scenario.

The Flood Risk Planning Guidelines recommends a precautionary approach to climate change effects in respect to flooding due to the high level of uncertainty in predicting its effects. It recommends the following in this respect:

- Caution in zoning lands in these potential transitional areas that would be impacted if climate change predictions occur
- Ensuring that the level of structures designed to protect against flooding are sufficient over the lifetime of the design to cope with the effects of climate change
- Ensuring that structures to protect against flooding and the development are capable of adaption to the effects of climate change when there is more certainty as to the effects

Notwithstanding the above precautionary principle, the flood risk zones defined in the Flood Risk Planning Guidelines are based on the present-day assessment of the 100 year (1%) and 1000 year (0.1%) return period for fluvial flooding and the 200 year and 1000 year for tidal flooding. The OPW provide specific guidance as to the allowances in their publication entitled "Assessment of Potential Future Scenarios, Flood Risk Management Draft guidance, 2009 and these allowances are summarised in Table 5.

Table 5 Climate Change Allowances for Future Scenarios 100 year

Criteria	Mid-Range Future Scenario MRFS	High-End Future Scenario HEFS
Mean Sea Level Rise	+500mm	+1000mm
Land Movement	-0.5mm/year	-0.5mm/year
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%

Mid-range scenario adopted in the CFRAM studies

5.4 Summary

The recommended climate change allowance in respect of impact assessment and setting of safe finish levels is based on the medium range scenarios of 20% fluvial flood increase and 500mm sea level rise plus adjustment for isostatic tilting of the land mass -50mm giving an overall allowance of 550mm. Such an approach meets the current OPW practices in respect to Section 50 approval and CFRAM mapping.

In respect to identifying flood risk zones and in keeping with the Flood Risk Management Planning guidelines the flood risk Zones A, B and C are defined based on present day estimates (without Climate Change) of the 100year and 1000year flood levels.

6. Flood Hydrology

6.1 General

The proposed development site located in Hydrometric Area 26 (Lower Shannon) drains to a the OPW back-drain system to the south that discharges to the Shannon Estuary some 200m downstream (south) of the Condell Road.

The backdrain runs uninterrupted along the toe of the tidal embankment and outfalls through flapped sluices at a number of locations (c. 5 locations between Barrington's Pier and Meelick Creek over 5.5km of Back Drain and tidal embankment. The nearest outfall location is to the 160m to southeast of the access entrance off the Condell road (referred to as the Joe Murphy junction) to the west of Barrington's Pier. This outfall has two No. 600mm diameter sluices refer to Plate 1. The Shannon Estuary has a history of large tidal surge events with a portion of the overall proposed site within defended lands protected from the tide.

6.2 Flood Defences

Historically (many centuries ago) the Clonmacken/Coonagh lands located to the west of Limerick City were active tidal plains of the Shannon Estuary which were regularly inundated by the tide, particularly during spring tides. For agricultural land reclamation purposes these lands were protected by earthen embankments that prevented tidal inundation (except for the more significant tidal and storm surge events) and allowed drying and improvement of the lands to support agricultural grassland. The OPW took in charge these embankments and provide on-going maintenance and improvements to these earthen embankments that run along both sides of the Shannon Estuary. Associated with these tidal embankments is a back-drain and collector drain system and numerous drainage outfall sluices fitted with flaps to prevent back flow from the Shannon Estuary at times of high tide (refer to Plate 1). The invert level of these sluices is generally at -1.25 to -1.5m OD Malin.

The function of the back-drains is to store local drainage water from the surrounding local catchments within the channel inside the embankments until such time that the tide has sufficiently retreated to allow opening of the flap gate and the outflow under gravity (head difference). The ground levels adjacent to the back-drains area generally at 1.0 to 1.5m OD Malin.

Generally, these protected lands are free from flooding with flood levels rarely exceeding 1.5m OD Malin. Over time, as a consequence of larger tidal storm surge events these embankments near Limerick City and other towns have gradually been raised, particularly near Urban areas. For example, the embankments around Limerick City including Clonmacken were strengthened following the large Hurricane Debbie in 1961 storm surge event. The recent January and February 2014 coastal flooding in Limerick City believed to be the worst in living memory saw the embankment along a portion of the Condell Road in front of Ted-Russell Park being substantially overtopped. This section of embankment is not part of the original OPW arterial drainage scheme and had a much lower standard of protection (SOP of 10% (10year) annual exceedance probability AEP). This embankment has since been upgraded in 2016 with the embankment raised, refer to Plate 2. The OPW tidal embankment that protects the Clonmacken area has an CFRAM (2016) estimated (standard of protection of 1% AEP (i.e. 100year return period) (CFRAM 2016), refer to Plate 3 for view of embankment.

The earthen tidal embankment protecting the Coonagh, Clonmacken and Caherdavin lands runs from the River Shannon in Limerick City out along the meandering Shannon Estuary channel and returns northwards along the east side of Meelick Creek until it eventually meets high ground above the tidal flood zone. This involves over 8.5km of OPW embankment from Barrington's Quay at St. Munchin's and a further 1.5km of embankment along the Condell Road from Westfields east to the River Shannon to protect the Limerick City West Area, refer to Figure 7. The OPW land benefitting map is presented in Figure 8 for the Clonmacken / Coonagh area which demonstrates the extensive area of lands being protected by the OPW maintained Shannon Estuary tidal embankments. These benefitting lands also represent defended lands, potentially at risk of flooding, should embankments fail or become overtopped as a result of a significant tidal storm surge event in estuary.

Plate 1 Flapped outfall to Shannon Estuary - twin 600mm diameter pipes

Plate 2 More recently raised embankment (in 2015) along the Condell Road in front of Ted Russell Park

Plate 3 Section of OPW Flood Embankment in background protecting the Clonmacken Area

6.3 Flooding in the Shannon Estuary

Generally downstream of Limerick Docks flooding is primarily influenced by tidal flooding with the River Shannon fluvial component having a very limited effect on peak flood levels at the more extreme 100year/200year events due to the wide and deep estuary available to conver River Shannon Floodwaters. This is particularly so for reach at Clonmacken and westward to the sea, where the highwater width is over 300m wide and has an available cross-section area at the historical maximum flood levels of 4.5mOD Malin of approximately 1100m^3.

The critical wind conditions for tidal flooding in the Shannon Estuary at Limerick are prevailing southwest and westerly storms in the Atlantic accompanied by a local westerly wind blowing up along the estuary causing a seiching effect. These wind conditions will generate offshore tidal surge and will push and elevated the tides up along the estuary to Limerick City. Such wind conditions can prolong and delay the highwater period.

6.3.1 Prediction of Fluvial Flood Flows in The River Shannon at Limerick City.

The River Shannon has a catchment area to its outflow point into the Shannon Estuary of 11,645km^2 and a catchment area of 10,802km^2 to the ESB gauge at the Ardnacrusha head race / Parteen Spillway. There is 84years of Annual maximum flood records available from the ESB for the Shannon to the Parteen Spillway. Statistical Analysis of this record gives the following Return period flood flows in the River Shannon and which have been adjusted based on Catchment descriptors to represent the Shannon inflow to the Estuary at Limerick City.

Table 6 Estimated Return Period Flow magnitudes in the River Shannon at Limerick

Return Period T (years)	Peak Flood Flow magnitude QT (cumec)
5	661
10	730
50	882
100	946
1000	1158

Note peak Flood flow magnitudes represent daily average peak flow magnitudes

The local drainage Catchment contributing to the Back-drains system is shown in Figure 6 and is 8.28km^2 in area. Also shown is the OPW maintained channels including the back-drain that runs parallel to the Shannon Estuary and the Meelick Creek (Crompaun River). The Crompaun River catchment is much larger and is separated from the local drainage by embanking the tidal flood zone to upstream of Meelick Bridge and keeping it separated from the back-drain system. Typically the back drain provides 3m^3 of storage per metre run which for c. 6.5km represents a back-drain storage of 19,500m^3.

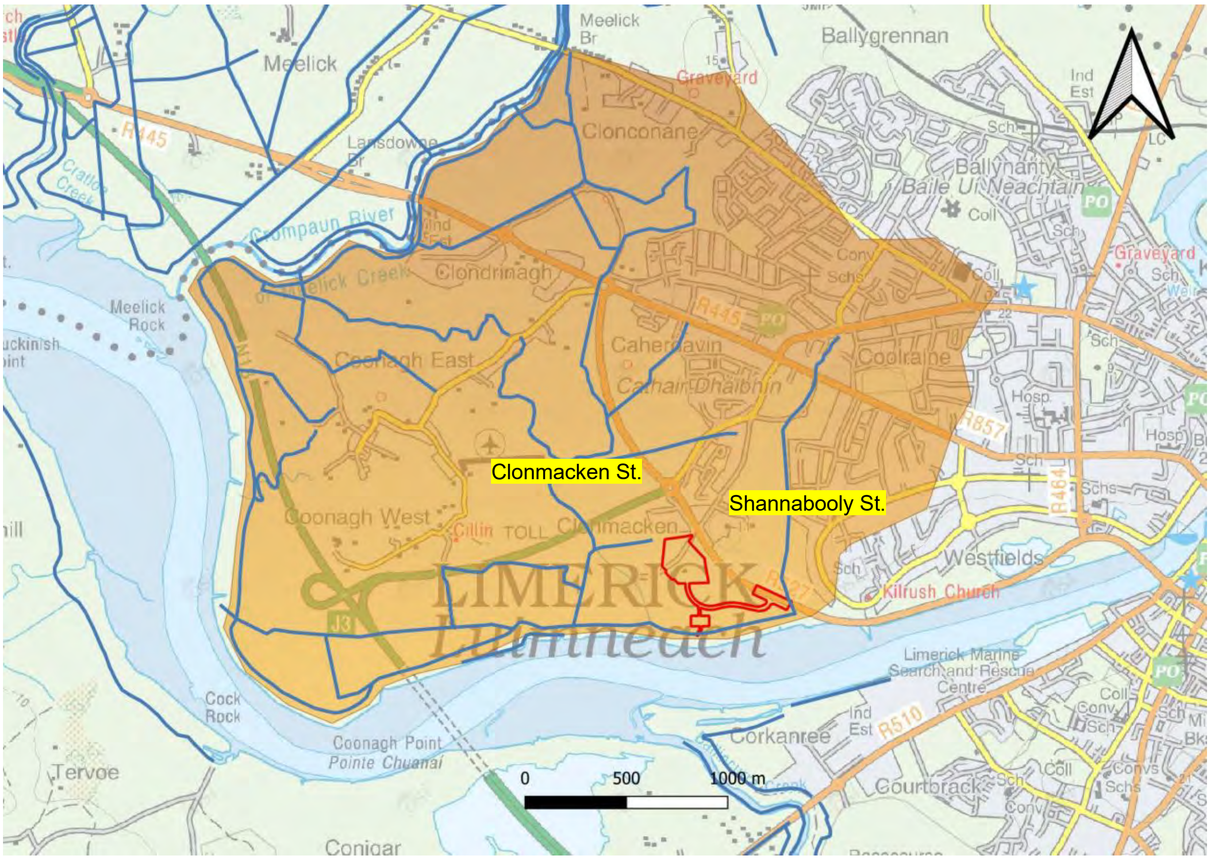


Figure 6 Local contributing catchment area to the Coonagh/Clonmacken Back-drain System.

6.3.2 Tides and Storm Surge Estimates for Limerick City

The mean high and low water spring tides for Limerick City are presented below in Table 7 based on measured tide levels for Limerick Docks.

Table 7 Mean spring and neap tide high and low water levels for Limerick Docks

Water Levels in Metres OD Malin			
MHWS	MHWN	MLWN	MLWS
2.98	1.48	-2.01	-2.72

The Irish Coastal Protection Strategic Study carried out by RPS for the OPW, used a coastal and estuarine 2-dimensional hydrodynamic model to predict total water levels (tides and surges) for all Irish coastal Waters. This study included the Shannon Estuary from west of Carrigaholt to Limerick City and was modelled using a reasonably refined model with fixed grid spacing throughout the estuary of 45m. The Shannon Estuary model was calibrated and validated against available tidal gauge and admiralty information for the Shannon Estuary (included Carrigaholt, Tarbert and Limerick Docks) and was deemed by RPS suitable for predicting the extreme water levels within the estuary.

Historic storm surges (hindcasting) above set critical tide / water level thresholds at the available network of Irish tidal gauges were selected for modelling. A total of 82 events were simulated for the various storm events from November 1959 to January 2009. The meteorological and tidal conditions that accompanied these events were used to drive the hydrodynamic model and the predicted peak water levels at various selected reference points were outputted. There were 26 output reference nodal points covering the Shannon Estuary (S1 to S26) at which this simulated data was output and processed. The closest node to Limerick City is Node S26, near O'Brien's Point and the Whelp's, some 7km downstream of Clonmacken. At each of these nodal output points the predicted maximum water levels from the 82 events were fitted with a truncated Gumbel statistical probability distribution and using peaks over threshold method the return period events of 2, 5, 10, 20, 50, 100, 200 and 1000year were estimated. The predicted return period storm tide levels for Node S26 relevant to Limerick City is summarised below in Table 8.

Table 8 Estimated Return Period storm surge tide levels in the Shannon Estuary at Prediction Node S26

Return Period T (years)	Peak Tidal Level HT (mOD Malin)
5	3.64
10	3.82
50	4.24
100	4.41
200	4.59
1000	5.00

A seiche / set-up allowance of 0.15m is included for in the above estimates.

The CFRAM study for Limerick City using a mean spring tide profile extracted from tidal records for Limerick Docks and combined with the ICPSS extreme tide and surge water levels for Node S26 was used to simulate 30hr duration return period Storm Surge events within the estuarine reach at Limerick City. To investigate the combined effect of the Shannon fluvial flow and tides a joint probability analysis for fluvially and tidally influenced flooding was carried out. The following Table of Joint Probabilities were used for the Shannon Estuary

Table 9 Tide and flow Joint Probability Scenarios

Scenario	Joint Event Return Period (yrs)	Fluvial Event Return Period (yr)	Tidal Event Return Period (yr)
1	2	2	0.2
2	2	0.2	2
3	5	5	0.2
4	5	0.2	5
5	10	10	0.5
6	10	0.5	10
7	50	50	2
8	50	2	50
9	100	100	5
10	100	5	100
11	200	200	10
12	200	10	200
13	1000	1000	50
14	1000	50	1000

For the Limerick City Reach three other Joint Probability scenarios were tested

- 100year Fluvial combined with 2 year Tidal
- 2 year Fluvial combined with 200year Tidal
- 50year Fluvial combined with 50year Tidal

The estuarine modelling of these events found that for the Limerick City Reach which includes Clonmacken reach the sensitivity to joint probability events is only acute for a very short 600m reach section from Corbally Weir upstream to Athlunkard Bridge and that above Athlunkard Bridge the return period flood levels are generated from fluvial events and downstream of Corbally Weir by tidal events.

In the CFRAM Flood simulations and mapping the Return period flood events are combined with a 2year Tide for all simulations in the fluvial dominated reach upstream of Athlunkard Bridge and for the tidal dominated reach downstream of Corbally Weir with a 2year fluvial Flow. The predicted Flood Levels in the Shannon Estuary for the Reach section adjacent to Clonmacken are summarised here in Table 10.

Table 10 Predicted Return Period Flood levels in the Shannon Estuary at Clonmacken and Limerick Docks from the CFRAM/ICPSS

Return Period T (years)	Clonmacken Flood Level HT (mOD Malin)	Limerick Docks Flood Level HT (mOD Malin)
5	3.79	3.83
10	3.95	3.98
50	4.34	4.35
100	4.51	4.53
200	4.70	4.71
1000	5.16	5.17

Irish Coastal Wave and Water Level Modelling Study 2018 (RPS Oct 2020)

An update to the ICPSS Study was carried out by RPS on behalf of the OPW in respect to coastal Flood Risk nationally and this included the Shannon Estuary as a specific study site with predictions at 26 nodal points throughout the estuary. The update study included additional tidal and storm surge events up to 2018 and importantly examined the relationship between mean sea level (MSL) and the OSI datum as OSGM02 Malin Head. Significant difference was found between the previous ICPSS MSL to OSGM02 conversion and the ICWWL conversion at 0.48m. The consequence of this is that the previously predicted ICPSS return period tidal surge flood levels should have been lower , refer to copy of Table in Appendix L for the Shannon Estuary from the ICWWL 2018 report. below:

Table 11 ICWWL 2018 report showing predicted return period tidal flood levels for nodes 21 to 26 both ICWWL and ICPSS predictions.

			S21	S22	S23	S24	S25	S26
	Coord-inate	Longitude	-9.019	-8.958	-8.906	-8.879	-8.821	-8.745
		Latitude	52.633	52.678	52.669	52.686	52.682	52.677
ICWWS 2018	MSL to OD Malin (OSGM02)		0.11	0.19	0.19	0.20	0.21	0.22
	Water Level - metres to OD Malin (OSGM02) (including seiche/set-up)	50%	3.16	3.32	3.37	3.42	3.50	3.66
		20%	3.28	3.45	3.49	3.56	3.64	3.80
		10%	3.36	3.54	3.58	3.66	3.75	3.90
		5%	3.44	3.64	3.66	3.75	3.85	4.00
		2%	3.55	3.76	3.78	3.88	3.98	4.13
		1.00%	3.63	3.85	3.86	3.97	4.08	4.23
		0.50%	3.71	3.94	3.95	4.07	4.18	4.32
		0.10%	3.90	4.16	4.14	4.29	4.41	4.55
ICPSS	MSL to OD Malin (OSGM02)		-0.25	-0.25	-0.25	-0.26	-0.26	-0.26
	Water Level - metres to OD Malin (OSGM02) (including seiche/set-up)	50%	3.03	3.12	3.18	3.22	3.29	3.40
		20%	3.20	3.31	3.37	3.42	3.50	3.64
		10%	3.32	3.44	3.52	3.57	3.66	3.82
		5%	3.45	3.58	3.66	3.72	3.81	4.00
		2%	3.61	3.75	3.86	3.92	4.02	4.24
		1.00%	3.74	3.89	4.00	4.07	4.17	4.41
		0.50%	3.86	4.02	4.15	4.21	4.33	4.59
		0.10%	4.15	4.33	4.48	4.56	4.68	5.00

Node S26 from the ICPSS and ICWWL study is the nearest prediction Node to the Clonmacken area and shows that the 200year tidal flood level is reduced by 0.27m and the 1000year by 0.45m between the current ICWWL study and the previous ICPSS study. Given that the CFRAM modelling was based on the ICPSS Study this suggests that the 200year flood level for Clonmacken is reduced from 4.7m OD to 4.43m OD and the 1000year prediction is reduced from 5.16m OD to 4.71m OD.

Based on this more recent and extensive study the tidal Storm Surge including Seiche/ wind set-up Return Period estimates for the Clonmacken Site are presented below in Table 12

Table 12 Revised Return Period Tidal Storm Flood Levels for Clonmacken/Coonagh Shannon Estuary reach

Return Period T (years)	Clonmacken Flood Level HT (mOD Malin)
5	3.95
10	4.03
50	4.23
100	4.33
200	4.43
1000	4.71

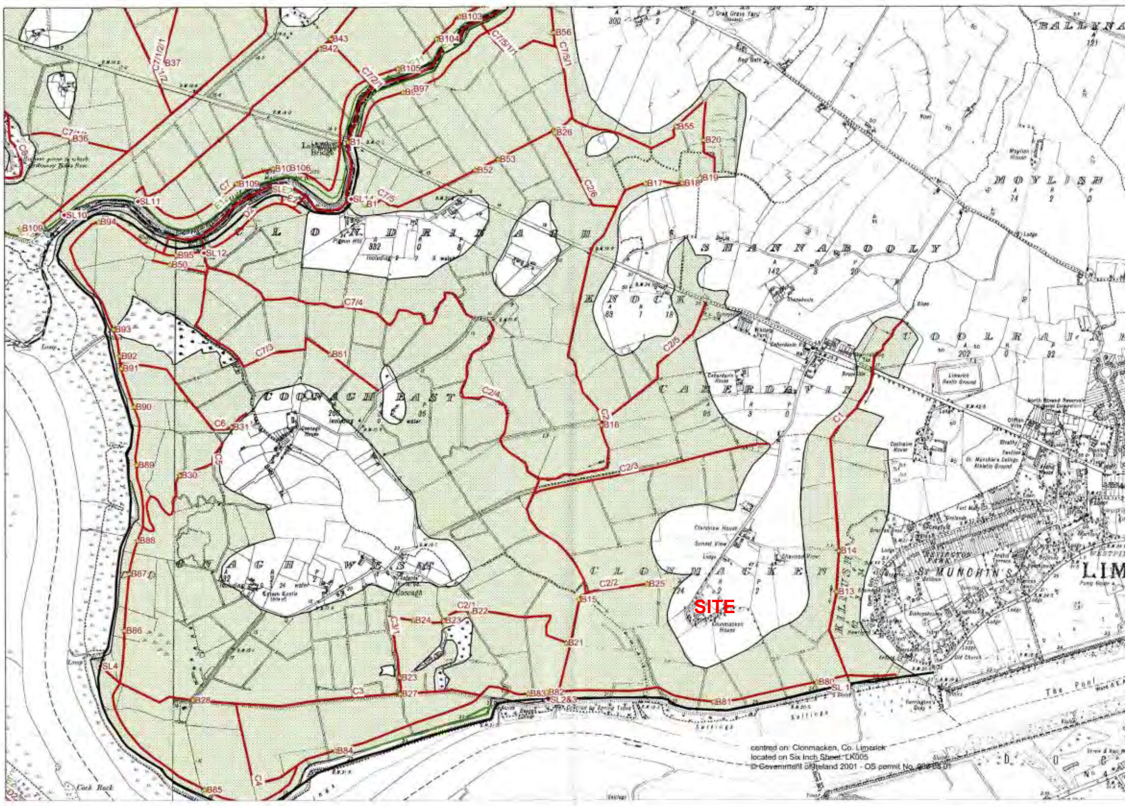


Figure 7 OPW Maintained Drainage Scheme with Shannabooly stream referenced as C1 and part of the OPW maintained arterial drainage channels.

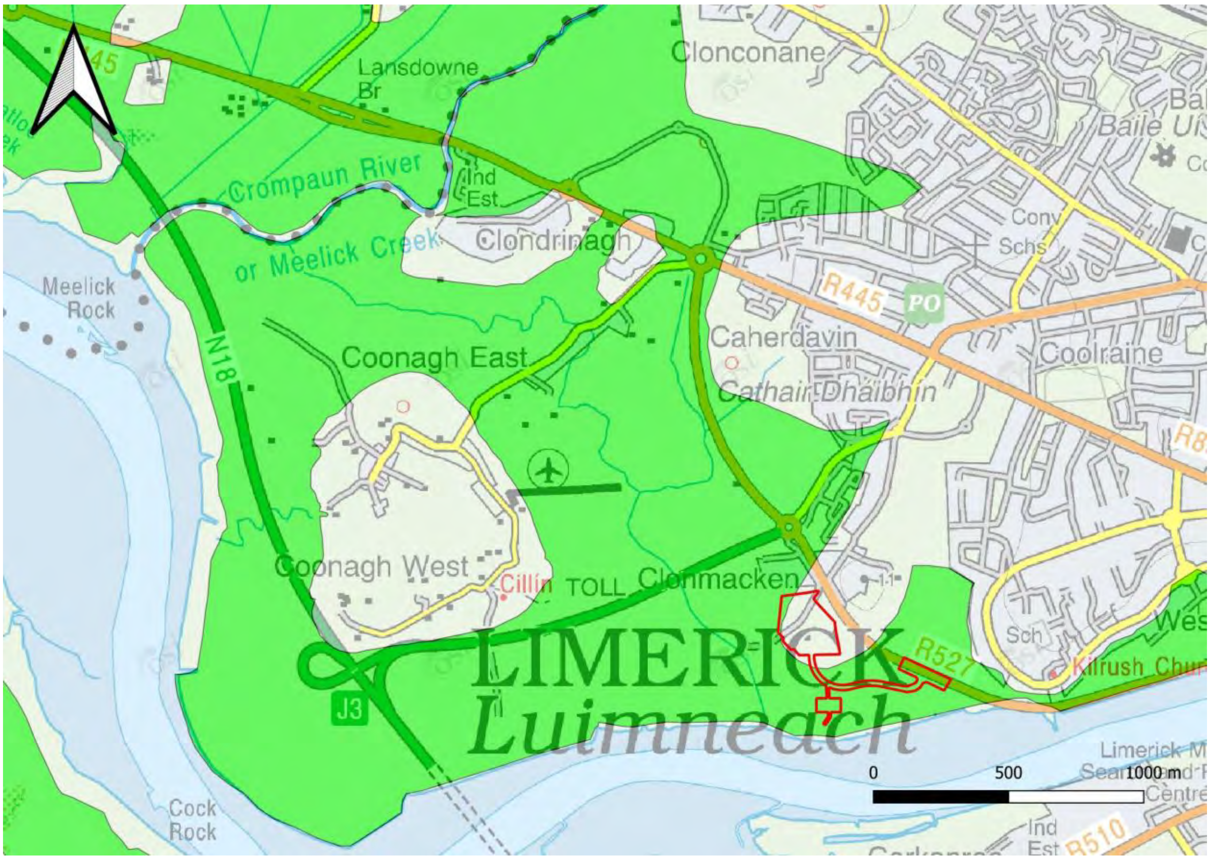


Figure 8 OPW and Land Commission Benefitting Mapping showing estimated extent of defended lands at Limerick City West

7. Flood Risk Assessment

7.1 Flood risk identification

It is clear from the available mapping for the Clonmacken area and other flood information sources that sections of the proposed development site is subject to tidal flood risk. This is identified in the OPW Arterial drainage land benefitting mapping presented earlier in Figure 7 and 8, the preliminary Flood Risk Mapping pFRA mapping in Figure 10, and the Irish Coastal Protection Strategic Mapping presented in Figure 11. The CFRAM flood extents mapping presented in Figures 12 show the entire site free of flooding.

A flood hazard map used in the current development plan is presented in Figure 9 which uses various sources of information including the ICPSS and the OPW pFRA flood mapping.

7.2 Historical Flooding

A review of Floodmaps.ie of recorded historical flood events in the vicinity of the site returned three events (refer to figure 13). The first record is a complaint from residents of Ashbrook Gardens regarding flooding of their back gardens during the winter 1994/1995 which appears to be attributed to poor drainage control during the construction of Ashbrook Lawns development with the developer proposing a new drainage channel to prevent flooding of the gardens.

The second event was a tidal flood event occurring on the 1st February 2002 which saw tide levels breach the Condell Road flood embankment over an 80m length opposite Westfields and flood the road to a maximum depth of 150mm.

The third event is associated with the more recent tidal Surge event on the 3rd January 2014 where the Condell Road embankment adjacent to Westfields was overtopped at three locations and inundated the road to a depth of 500mm in and around high tide. There was no account of flooding further upstream or on the subject lands at Clonmacken or in the Shannabooly Stream or at the Ashbrook Gardens estate from this event.

A slightly larger tidal flood event occurred at the start of February 2014 which caused the extensive flooding of St. Mary's King's Island. There is no account of overtopping of the Condell road during this tidal event possibly due to the earlier deployment of sand bags to raise the crest of the embankment there, so as not to overtop.

Tidal / combined flooding was also associated with tidal storm surges on the 10th February 1997 and January 1995 with the a highwater level of 4.19m OD recorded at Limerick Docks for the 1st February 2002, Other information suggests that the flood level had reached 4.27m OD Malin. The flood level associated with the Hurricane Debbie September 1961 tidal flood event is understood from the Port authority to have reached c. 4.2m O.D. A flood level of 4.2m is also understood to have occurred on the 24/25th December 1999 associated with very high spring tides and a large River Shannon Flood Flow. The highest recorded flood level in at least 60years and possibly 100years of record is associated with the February 2014 event of 4.51m OD followed by the 3rd January 2014 tidal surge. This Flood level of 4.51m OD occurred in the tidal reach well upstream of Clonmacken and the flood level in the estuary adjacent to Clonmacken is likely to have been lower.

There is anecdotal evidence that in the past, sections of the OPW tidal embankment in the Coonagh area was overtopped particularly where embankment settlement problems occurred. It is reported that significant sections of the embankment in the Coonagh / Clonmacken area were overtopped during hurricane Debbi as they were much lower at that time and were subsequently raised and strengthened significantly after Hurricane Debbi. It is understood that much of the embankment is at a crest level of 5.3 to 5.6mOD.

The CFRAM mapping presented in Figure 12 presents overtopping of flood defence scenarios based on existing embankment crest levels and therefore there is limited length of of overtopping and time to significantly inundated the back drain lands and as such shows relatively limited flooding.

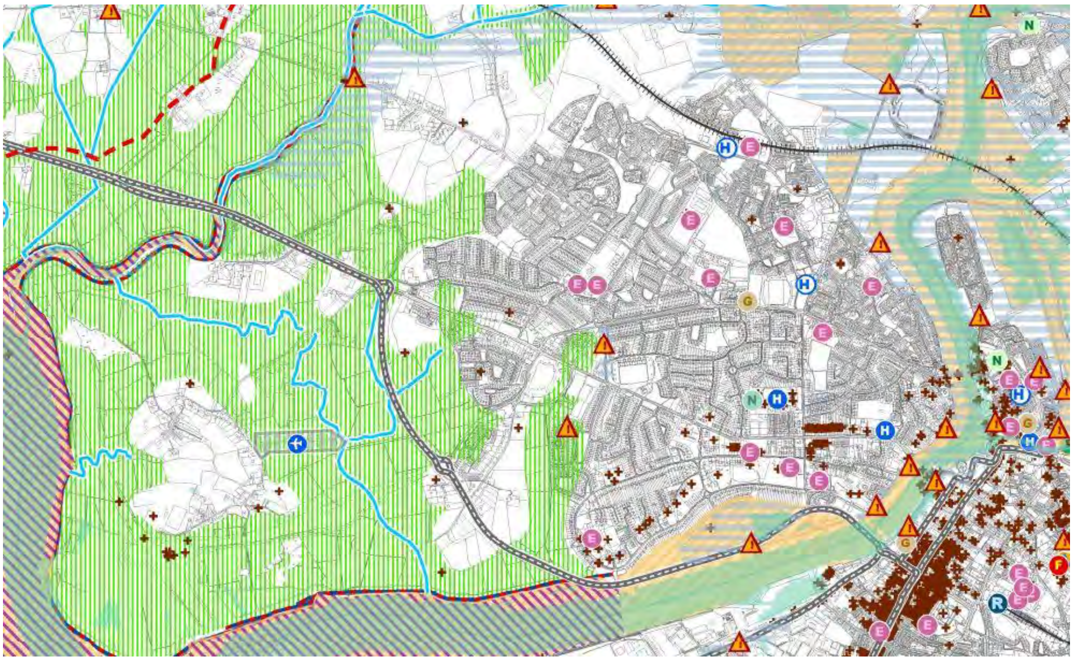


Figure 9 Flood Hazard Map for Limerick City West and Historical Flood Locations

7.3 Storage Relationship for Coonagh-Clonmacken Back-drain system

The estimated stage-storage relationship for the Back drain lands in the 8.3km^2 West of Limerick drainage catchment is presented in Figure 10 below.

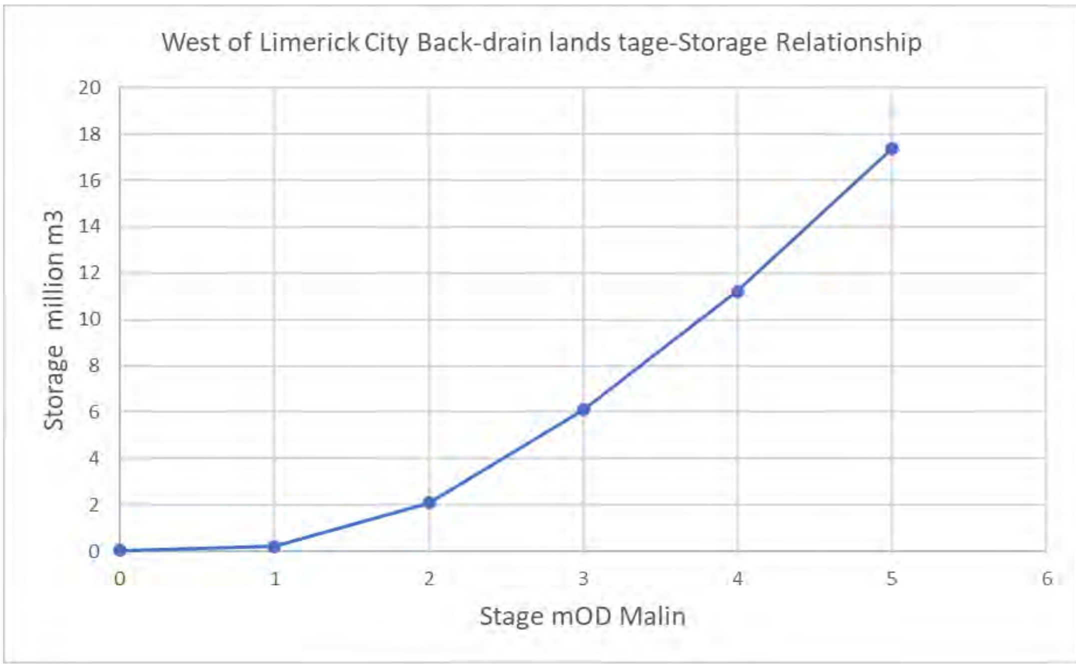


Figure 10 Stage-Storage relationship for Coonagh/Clonmacken Back-drain Catchment

The proposed clonmacken development on 6.53 ha total site area, if filled above 5m will remove the following potential flood storage volume from the Back-drain lands:

Stage m OD Malin	Site Storage m3	Reduction in back drain storage
0	0	0.000%
1	10	0.004%
2	2,330	0.111%
3	10,080	0.165%
4	23,370	0.208%
5	46,820	0.270%

The loss of potential back-drain storage as a result of infilling the entire site area is minor and will not result in any significant impact on flood levels or flood risk to the remaining backdrain lands. At 2m OD Stage height the area of back-drain land lower than this level is estimated to be 3.15km^2 and therefore the potential loss of 2,330m^3 from the site will increase the potential flood level by 0.07cm. At 5m OD the area of backdrain land inundated is 6.02km^2 and the impact on the flood level from the displacement of 46,820m^3 at the site is 0.78cm, which is an insignificant increase in relation to the overall flood level and flood extent at the 5mOD flood level. This also hold through for all other possible flood levels with potential increase consistently less than 1cm.

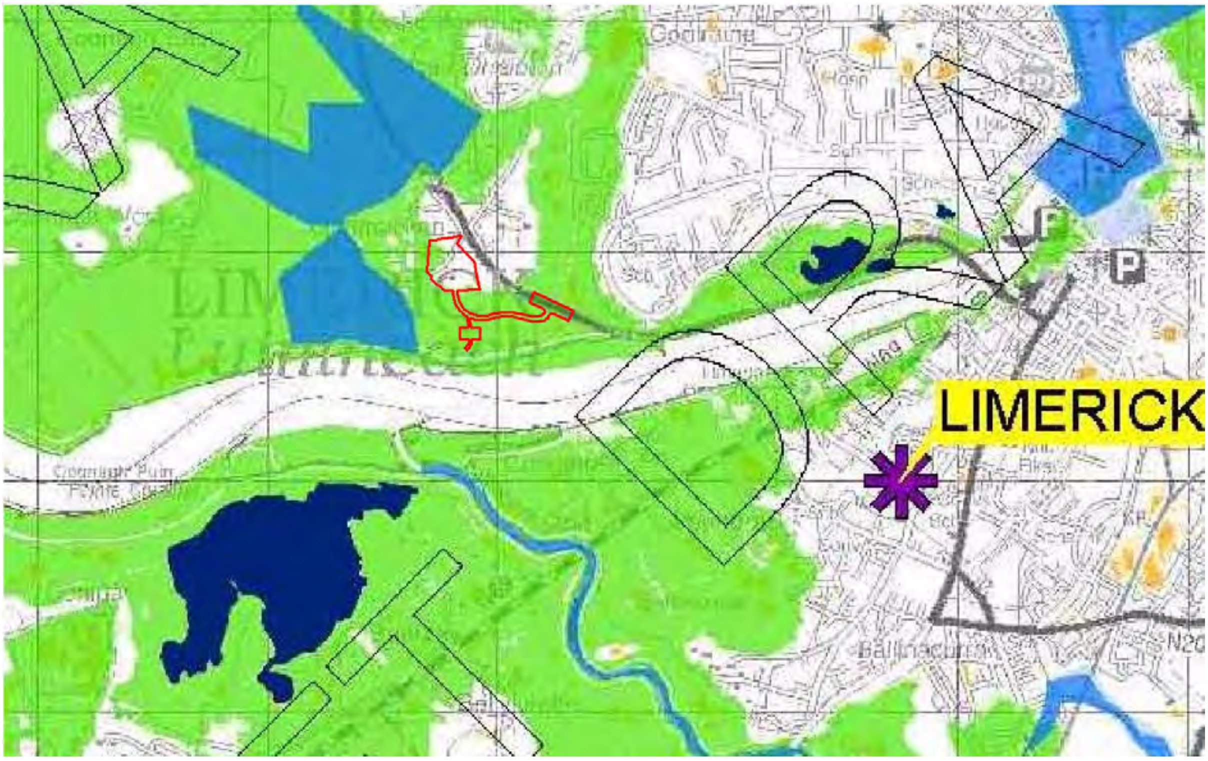


Figure 10 OPW pFRA map showing Coastal flood risk for proposed site

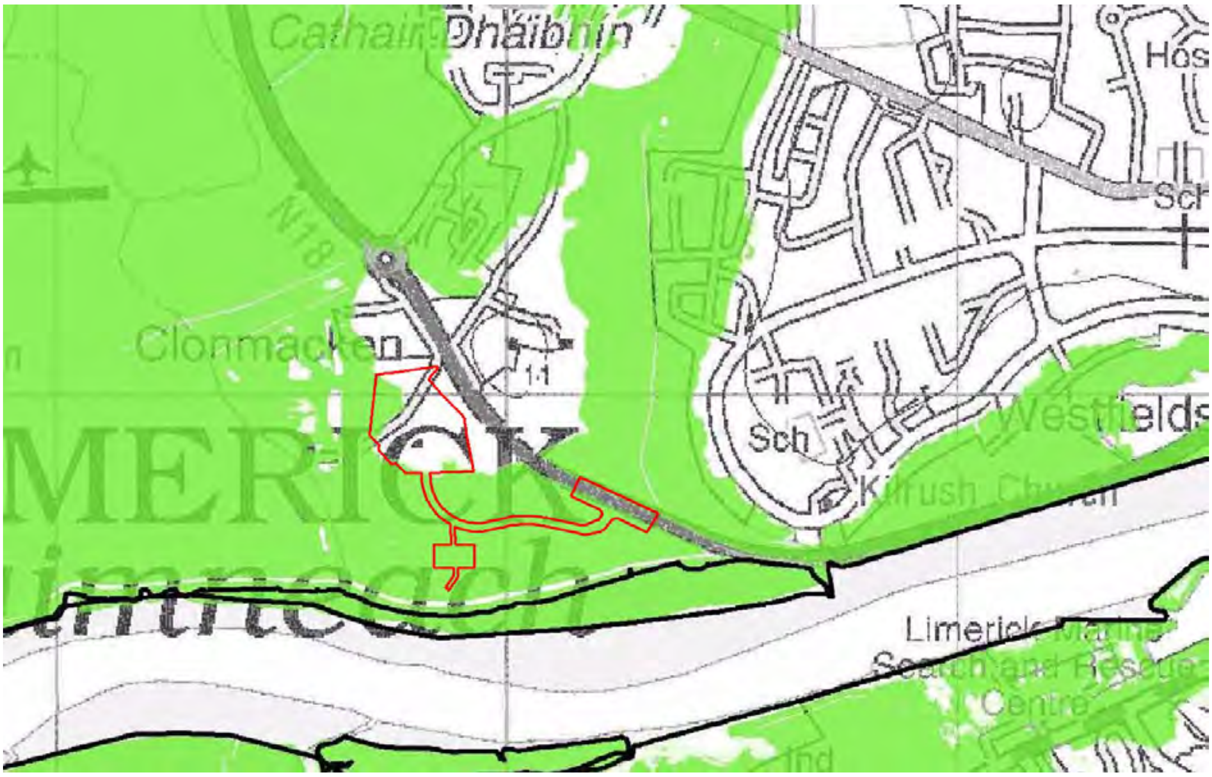


Figure 11 OPW - Irish Coastal Protection Strategic Study – Shannon Estuary

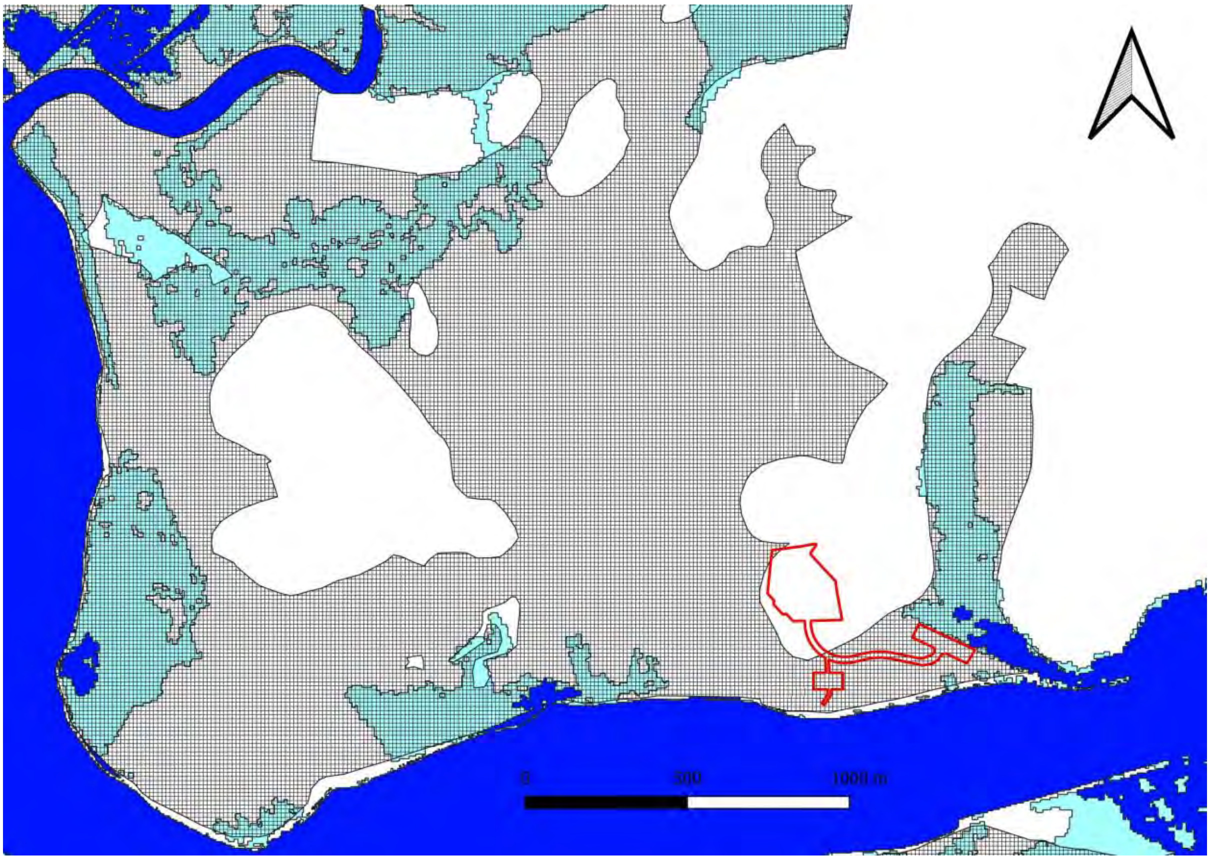


Figure 12 ***CFRAM Coastal Flood Risk mapping showing defended lands and predicted tidal flood inundation with present flood defences over a tidal surge event.***

Note: Blue is 200year and cyan is 1000year event and hashed area is defined by OPW as benefitting (defended) lands

7.4 Flood Risk Assessment of Proposed Clonmacken Development

The analysis presented earlier in Section 6 in respect to tidal storm surge levels in the estuary suggest, in terms of delineating flood risk zones on the site, that the critical flood event is the tidal storm surge event in the estuary as opposed to the local fluvial flood risk.

It is also important to note that the delineating of Flood Risk Zones as per the flood risk management planning guidelines (2009) one must neglect the presence of flood defences, which in this case include the OPW tidal embankments along the Shannon Estuary and the local Authority embankment along the Condell Road at Westfields. In any case this OPW defence is defined as having a minimum SOP of 1 in100year flood event and therefore not considered sufficient to protect against the 200year tide event or the 1000year tide event which are to be used to delineate Flood Risk Zones A, B and C. The CFRAM study shows no tidal flooding in the case of the existing defended situation with both the 200year and 1000year flood extents occupying the low-lying back-drain lands below 1.5m OD Malin.

The predicted undefended 200year and 1000year tidal Storm Surge with seiche and wind set-up for the Shannon Estuary adjacent to the Clonmacken Site at Condell Road give flood levels of 4.43m OD and 4.71mOD respectively. These undefended levels are used to establish the flood zones on the site as required by the flood risk management planning guidelines, refer to Figure 13.

The source of fluvial flood risk is runoff from the local streams of the Shannabooly and Clonmacken and the local back-drain areas that need to be stored behind the tidal defences during high tide periods which gravity outflow via the embankment sluices cannot take place. Combined these local runoff sources have an overall catchment area of c. 8.28km^2. Within the back-drain lands there is c. 3.1km^2 (310ha) of agricultural land below 2m OD Malin to provide strategic storage in the event of major overtopping event or to accommodate the local drainage from the 8.3km^2 drainage catchment.

The critical duration for fluvial flooding from the back-drain area and streams is of the order of 12 to 24hours. During this period the gravity outflow to the estuary via the sluices is likely to be restricted to 8 hours in a 24hour period (2 tidal cycles with 2hours either side of low water for outflow via gravity). Assuming a conservative runoff rate of 70% the 100year rainstorm event in a 24hour period (FSU prediction 86.4mm rainfall in 24hours) will generate less than 500,000m^3 of fluvial runoff in the back-drain lands assuming no outflow via the sluices. Such a volume is easily accommodated in the back-drain lands below the 2m OD level. The 1000year a rain depth over 24hours is estimated to be 138mm which would potentially generate a runoff volume into the back drain lands of just less than 800,000 m^3 which would also be accommodated in the back drain lands below the 2m OD level. Based on fluvial flooding not exceeding the 2m OD level the proposed development site is not at risk from fluvial flooding in the Back-drain lands and therefore not a critical source of flooding for the proposed development.

The loss of potential back-drain storage as a result of infilling the entire site area is minor and will not result in any significant impact on flood levels or flood risk to the remaining backdrain lands. At 2m OD Stage height the area of back-drain land lower than this level is estimated to be 3.15km^2 and therefore the potential loss of 2,330m^3 from the proposed development site will increase the potential flood level on the back-drain lands by only 0.07cm. At the 1000year 4.71m OD flood level the area of back-drain land inundated is estimated to be 5.9km^2 and the impact on the flood level from the displacement of 40,000m^3 at the development site is 0.72cm, which represents an insignificant increase (i.e. < 1cm) in relation to the overall flood level and flood extents.

It should be noted that the CFRAM study also shows inundation of the low-lying lands in the case of the defended simulation of the 1000year Tidal Storm Surge with flooding limited to the Low-lying lands at 1.5 to 2.5 mOD Malin, refer to Figure 12.

7.4 Flood Risk Mapping

The undefended 200year and 1000year flood level at the site is estimated to be 4.43m and 4.71mOD. Malin based on the most recent ICWWL (OPW, 2020) national tidal surge study. Note the historical maximum observed tide level which occurred in February 2014 produced a tidal surge flood level at Limerick Docks Gauge of 4.51m OD Malin which is statistically just slightly in excess of a 200year flood event.

Using these flood levels and combining them with recent topographical survey of the site by NCS (Nov 2019) a flood risk extent and zoning map was generated for the site and this mapping is presented in Figures 13 below. This Flood Risk Zoning map shows the location of Zones A (high probability of flooding with a probability greater than 0.5%), B (moderate probability of flooding with a probability of 0.1 to 0.5%) and C (low probability of Flooding with a probability of less than 0.1%) on the site. Generally the residential development area of the site is in flood zone C but some of the residential units do encroach flood zones A and B. It is not considered feasible or necessary to avoid these flood zone areas as the architectural aesthetics and design practicalities of the site dictate otherwise.

The proposal for these slightly lower sections will be to raise then above the 1000year flood level of 4.71m so as to be safe from flooding. This flood risk management approach applies both to the residential building footprint area, the green space areas and the internal roads.

Within the entire red line boundary of 6.44ha the land area associated with flood zones A, B, and C on the site is 3.92ha in flood zone C (i.e. at elevations above 4.71m OD Malin), and the remainder as OPW defended lands, with flood zone A (i.e. lands below 4.43mOD) having an of 2.27ha and flood zone B (lands with elevations at 4.43 to 4.71mOD) at 0.25ha. Within the 4ha residential development footprint (excluding the access road and attenuation area), flood zone A is 0.366ha, flood zone B is 0.215ha and flood zone C is 3.426ha.

7.5 Recommended Minimum Finish Level for Development

The proposed finish floor levels within the development should be set at 5.5m OD Malin and higher. This provides for the predicted 200year tidal surge event of 4.43m OD a medium range sea level rise of 0.55m (includes 500mm seal level rise and land isostatic adjustment of 50mm) and a freeboard for uncertainty of 500mm. This easily meets the requirements of the Flood Risk Management Planning Guidelines and the planning objectives and therefore the proposed development will have a suitably low flood risk.

The proposed minimum road levels within the development should be set above the 1000year tidal flood level with climate change allowance at 5m OD.

The finish floor levels of the all housing units should be set at least 300mm above adjoining road levels such that in the event of a blockage to a storm drain or gully the houses then selves will not be at risk with overflow along the road way eastward.

7.6 Emergency Access

The survey information shows that access to the development site off the Condell Road at the proposed access road entrance is within the low Flood Risk Zone C and therefore meets the requirements of the public access road to the site. The Condell road is connected to the M18 road and tunnel via the new link road which is embanked and out of the flood risk zones and therefore accessible in the 1000 year extreme event. All proposed internal roads on the site will be raised above 5m OD and out of the flood risk zones.

7.7 Residual Flood Risk

The residual flood Risk to the development is assessed as low as the roads and finish floor levels are all located well above the design flood level and future proofed with an allowance for climate change. The proposed development does not rely on the existing tidal flood defences with the recommended minimum finish floor level to be set above 5.5m OD Malin which is over 1m above the current 200year tidal flood level prediction and therefore provides a generous freeboard allowance to account for uncertainty and future climate change sea level increases.

7.8 Flood Risk Management Justification Test

The following point represent the justification for residential development of the proposed site at Clonmacken by The Clonmacken Partnership:

- The proposed Site is zoned for residential development in the current Limerick City Development plan. This plan carried a strategic Flood Risk Assessment to support the zoning of lands.

- The residential development footprint area is predominantly within Flood Zone C lands with only slight encroachment of Flood Zones A and B. The proposed access road to the development is on raised ground at c. 3.5 to 4m OD for the majority of it which still puts it in flood Zone A (lands below 4.43m OD). The location the road is set by a requirement of an entrance off the Condell road which has planning granted and which is used by the adjacent development currently under construction on the north side of the Condell road.

- The proposed development does interfere with the Flood Conveyance or strategic flood storage areas nor does it limit access to watercourses, active floodplains of flood defences for maintenance purposes.

- The proposed flood risk management for the development is to raise as necessary lands out of the flood risk zones and therefore not depend on the OPW tidal embankment protection. This is feasible for this particular site give the raised nature of a large portion of the site and the already infilled sections on the site granted under 2005 planning permission.

- Encroachment of Flood Zone A and B lands is necessary to provide an access road to the development and also for architectural design layout requirements. Compensation storage is not considered necessary as the loss of storage on the site only occurs at higher flood levels above 3m which are unlikely to ever be realised given the presence of the OPW tidal embankments and even in the event of such levels occurring the inundation area is vast at almost 6km^2 and subsequent effect of such storage loss is shown to be very minor at < 1cm increase.

- The impact of the raising of ground out of the flood zones (i.e. above 4.71m OD) is very minor with a potential flood storage loss estimated at 40,000m3 (conservative based on the full red line boundary area) and represent 0.25% of the flood storage area at the 1000year flood level of 4.71m OD. Such a 1000year flood level of 4.71m OD in the back-drain lands would only be achieved if the tidal embankment were removed / lowered or a substantial breach was allowed to develop which is unlikely given the extent of existing urban development in the Coonagh area that is within flood zone A at finish levels at 3 and 3.5m OD and currently protected by the Shannon tidal embankments.

- The critical flood storage in these back-drain lands is located at elevations between 1 and 2.5mOD which will not be impacted by the proposed development.

- Figure 2 presented earlier in this report shows that there is very limited undeveloped land available in the West Limerick City area of Coonagh and Clonmacken that is located in the low flood risk zone C lands and that this site represents the best opportunity being a relatively raised site and located predominantly in Flood Zone C and importantly accessible via a road network that is in Flood Zone C. Development as proposed will not result in any significant adverse flood risk to other third party lands. The site is considered to be strategic to the residential development on the west side of the River Shannon in Limerick city and is only 1.6km from the city centre and is serviced by cycle lanes and walking paths along the Condell road.

- There is an opportunity if required to compensate this storage loss by lowering flood zone B and C lands within land ownership immediately to the east of the development boundary, refer to Figure 13. However given the defended nature of the area, with the critical storage levels in the back-drain lands at between 1 and 2.5m OD such lowering of these lands would only serve as a cosmetic exercise and such raised lands to the east would better serve for future strategic residential development.

- Vehicular emergency access from the Condell road is from Flood Zone C and therefore the site will not be cut-off for any period during critical flood events.

Based on the above it is considered under the flood risk management planning guidelines (2009) that the proposed development passes the flood Risk management Justification Test and represents sustainable development in respect to flooding currently and in the future.

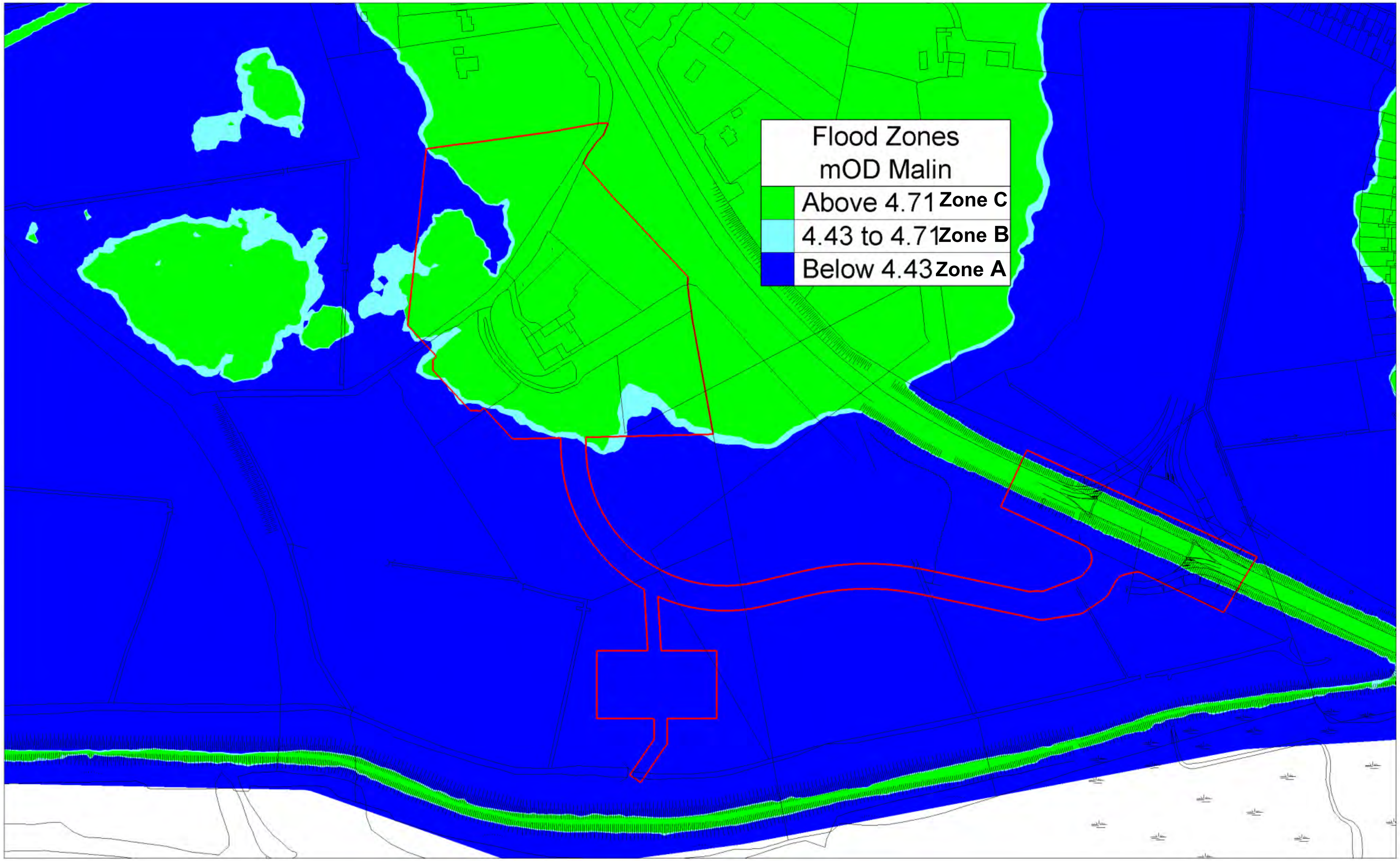


Figure 13 Flood Zone Map for Proposed Clonmacken Development Site (Blue – Zone A, Cyan – Zone B and Yellow – Zone C)

8. CONCLUSIONS

The source of flood risk to the proposed development site is identified as tidal flooding from storm surges and wind set-up. The fluvial assessment shows that the 100 and 1000year flood levels in the adjacent back-drain lands will not exceed the 2m O.D contour level and therefore will not inundate the proposed site and therefore do not represent a flood risk to the proposed development site. There are no watercourses discharging through the site.

The tidal storm surge assessment shows that in the Shannon Estuary reach adjacent to the Site that the 200year and 1000year flood levels are 4.43m OD and 4.71m OD respectively. These represent the undefended critical flood levels for the development site from which the Flood Risk Zones can be defined. The CFRAM tidal flood simulations examined the current defended case and the CFRAM flood inundation mapping show tidal inundation of the low-lying back-drain lands to flood levels of c. 1.5 to 2m OD Malin only and which does not reach the proposed development site.

The Flood Risk Zone C (low probability of flooding) for the site is all lands above 4.71m OD Malin, the moderate flood risk Zone B are lands between 4.43 and 4.71m OD and the high Flood Risk Zone A lands are all lands below 4.43m OD Malin. The flood zone mapping shows for the full 6.44 ha red line boundary area that flood Zone C occupies 3.92ha, flood zone B occupies 0.25ha and flood zone A occupies 2.27ha. Within the 4ha residential development footprint (excluding the access road and attenuation area), flood zone A is 0.366ha, flood zone B is 0.215ha and flood zone C is 3.426ha.

A flood risk justification test is applied to this development and passes the test as set out in section 7.8 of this report. In summary the proposed development site is currently zoned for residential development and is considered a strategic site located within 1.6km of the city centre area and representing the only greenfield zoned site within the West Limerick city area that is sufficiently elevated, with much of the site within Zone C and accessed by public roads from flood Zone C. It is feasible to infill this site in order to manage flood risk on the slightly lower lands that fall into flood zones A and B without causing significant displacement of back-drain storage or causing significant increase in flood levels or flood risk to other properties and lands..

Anthony Cawley

Anthony Cawley B.E. M.Eng.SC. (Hydrology), C.Eng M.I.E.I. 25th June 2021
Consulting Hydrologist
Hydro Environmental Ltd.

Ballykeeffe

LCC – C62 – 170




REPORT

Flood Risk Assessment for Lands at Ballykeeffe, Mungret, Co. Limerick

February 2022

GARLAND
Concepts Realised

CONTENTS

Description of change	Originator	Rev	Approval	Date
Initial Release	TM	1st	BL	14/02/22

1. INTRODUCTION

GARLAND Consulting Engineers has prepared this Site Specific Flood Risk Assessment (FRA) for lands in Ballykeeffe, Co. Limerick in accordance with the requirements of “The Planning System & Flood Management Guidelines” published by the Department of Environment, Heritage and Local Government in November 2009.

This lands are greenfield site located to the east of the Dock Road and are divided by the N18. The lands are adjacent to Ballykefffe Estate and the currently disused railway line to the East.

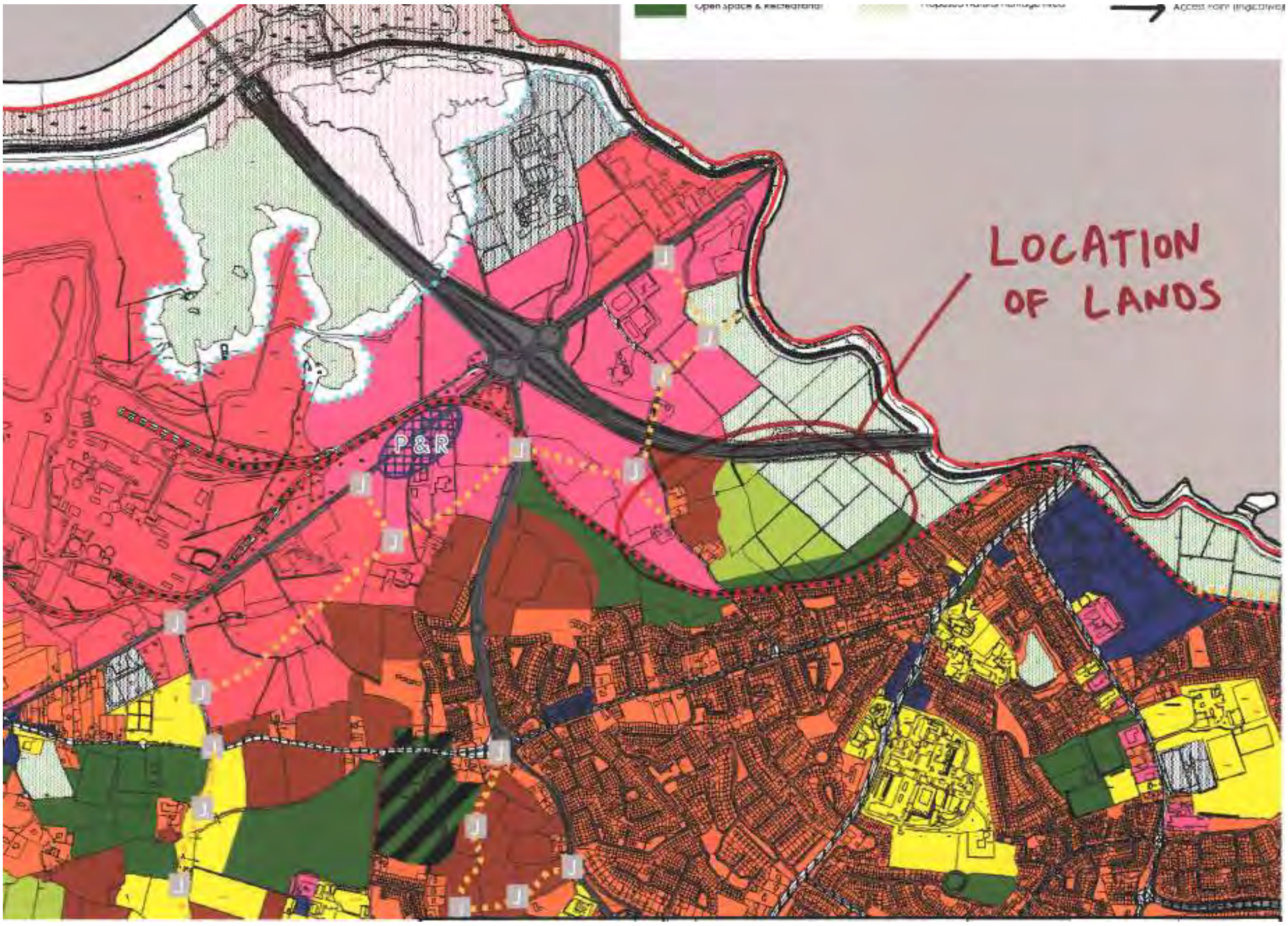


Figure 1 - Site Location Map

1.1. Flood Risk Management Guidelines

"The Planning System and Flood Risk Management Guidelines" (hereafter referred to as FRM Guidelines) was published in November 2009. The core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk.

1.2. Flood Risk Zoning

The guidelines set out the following description of flood risk zones;

1.2.1. Flood Zone A

- Lands with a high probability of flooding;
- Subject to flooding probability of 1 in 100 – rivers;
- Subject to flooding probability of 1 in 200 – coastal/ tidal areas.

1.2.2. Flood Zone B

- Lands with a moderate probability of flooding;
- Subject to flooding probability of 1 in 1000 – rivers;
- Subject to flooding probability of 1 in 1000 – coastal/ tidal areas.

1.2.3. Flood Zone C

- Lands with a low probability of flooding;
- Subject to flooding only with a probability greater than the 1 in 1000

2. HYDROLOGY

The lands are located adjacent to Ballynaclough River to the North East.

Figure 2 - Water Features

3. REVIEW OF POTENTIAL FLOODING SOURCES

All potential flood risks and sources of flood water at the site have been considered, as follows;

3.1. Fluvial Flood Risk

Fluvial flooding occurs when rivers and streams break their banks and water flows out onto the adjacent low-lying areas. This can arise where the runoff from heavy rain exceeds the natural capacity of the river channel, and can be exacerbated where a channel is blocked or constrained or, in estuarine areas, where high tide levels impede the flow of the river out into the sea.

Different rivers will respond differently to rainfall events, depending on a range of factors such as the size and slope of the catchment, the permeability of the soil and underlying rock, the degree of urbanisation of the catchment and the degree to which flood waters can be stored and slowly released into lakes and along the river's floodplains. A storm of a given rainfall depth and duration may cause flooding in one river, but not in another, and some catchments may be more prone than others to prolonged rainfall or a series of rain events. River flooding can occur rapidly in short, steep rivers or after some time, and some distance from where the rain fell, in larger or more gently flowing rivers. Changes in rainfall patterns, such as might be caused by climate change, will have different impacts on flood magnitudes and frequency in different catchments.

The CFRAMS maps show that the site is not at risk of fluvial flooding. Fluvial flooding is not therefore considered further in this report.

3.2. Coastal / Tidal Flood Risk

Coastal flooding occurs when sea levels along the coast or in estuaries exceed neighbouring land levels, or overcome coastal defences where these exist, or when waves overtop over the coast. Wind speed and direction and low pressure systems can force water into estuaries and harbours, cause surge effects, and create extreme wave conditions.

The CFRAMS maps show that the site has areas which are defended from coastal flooding by flood embankments along the Ballynaclough River which have a standard of protection of 0.5% AEP. There are some areas of the site where over topping of these embankments could occur at 0.1% AEP There are also some areas within the site that are not at risk of coastal flooding. Extracts from the CFRAM Study Tidal Flood are provided below.

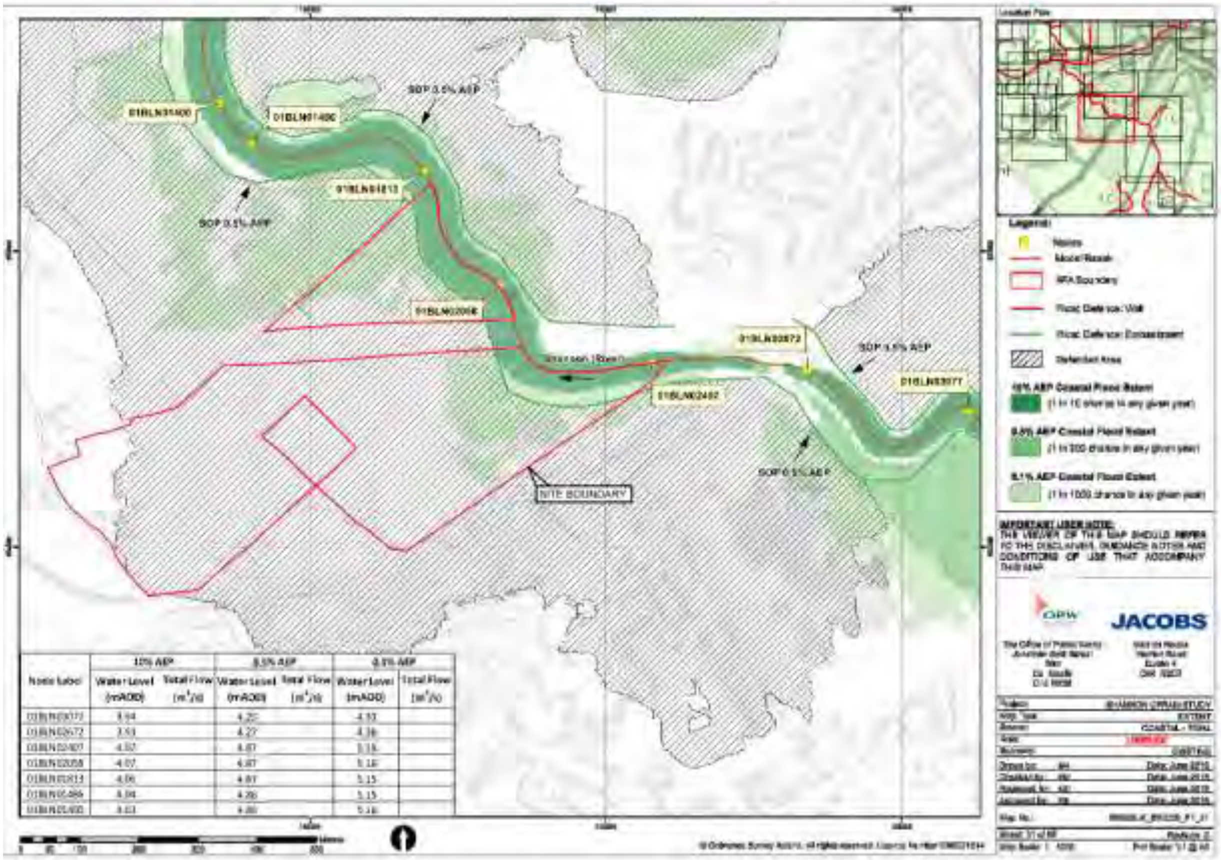


Figure 3 – Extract from CFRAMS Coastal Model

3.3. Pluvial Flood Risk

Pluvial flooding is defined 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. Pluvial flooding distinguishes itself from flooding associated with high river flows (fluvial) or high tidal surges (coastal). Any areas at risk from fluvial flooding will almost certainly be at risk from pluvial flooding. Pluvial flood risk can also occur in urban areas due to blockages of the urban drainage network.

There is no record of pluvial flooding at the site on the OPW flood mapping. Ponding of rainwater is not expected because of the topography of the site. Therefore it is not considered further in this report

3.4. Groundwater Flood Risk

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall, to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from the interaction of site-specific factors such as local geology and tidal variations. While water level may rise slowly, groundwater flooding can last for extended periods of time. Hence, such flooding may often result in significant damage to property and disruption.

In Ireland, groundwater flooding is most commonly related to turloughs in the karstic limestone areas prevalent particularly in the West of Ireland. Extensive groundwater flooding occurred around South Galway and areas of Mayo, Roscommon and neighbouring counties in 1995, November 2009 and December 2015/ January 2016 due to extended periods of heavy rain.

The OPW flood maps indicate the proposed site is not in an area exposed to flooding from groundwater and therefore is not an issue and is not considered further.

Therefore, the primary potential flood risk to the proposed site can be attributed to a fluvial flood event in the Inagh River.

4. REVIEW OF AVAILABLE INFORMATION

The site location is indicated within the figure below. In establishing the extent of the flood risk at this site, a number of sources of information have been considered, as follows;

- OPW / EPA / Local Authority Hydrometric Data
- Flood Info and OPW Flood Hazard website, flood records and online information
- OPW Benefitting Lands
- Ordnance Survey Historic Mapping
- CFRAMS Flood Risk Mapping
- CFRAM Study, a breach analysis
- Local Authority Development and Local Area Plans
- Site Visits / Walkover

5. FLOOD RISK ASSESSMENT

The purpose of the above available information review is to identify possible flood risks and to implement the necessary level of detail and assessment to assess these possible risks, and to ensure these can be adequately addressed in the flood risk assessment. The above screening assessment indicates that an assessment of fluvial flooding needs to be considered in further detail.

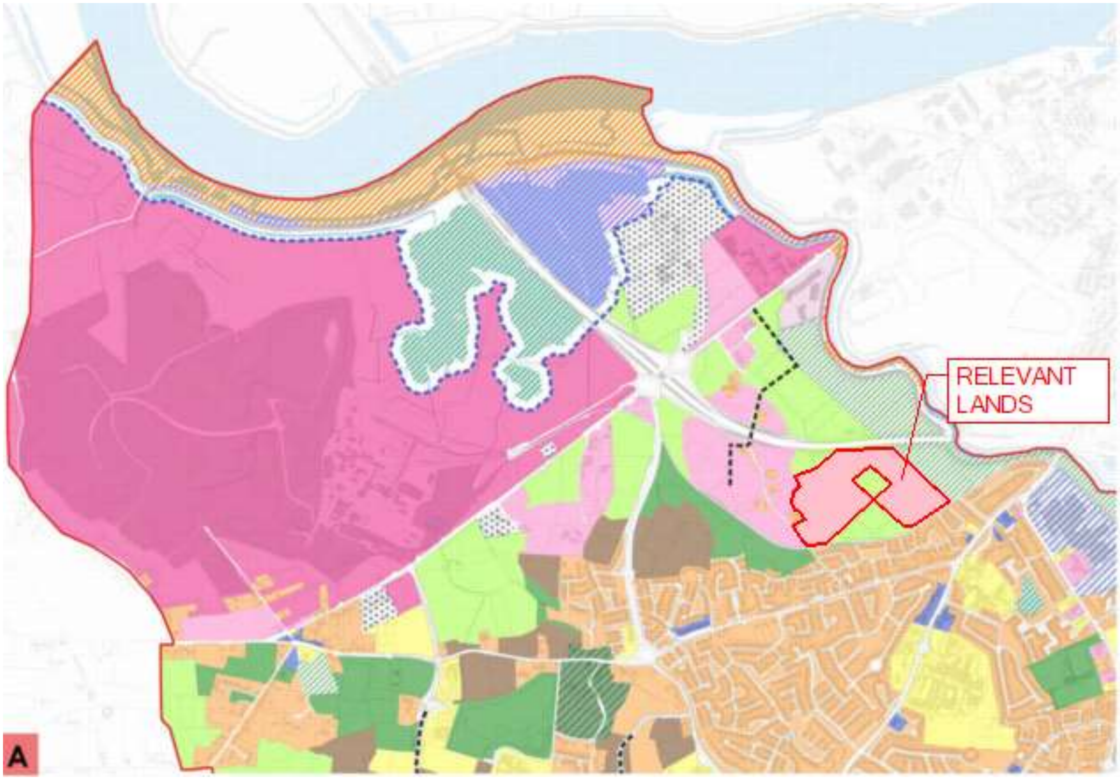
5.1. Coastal Flood Risk

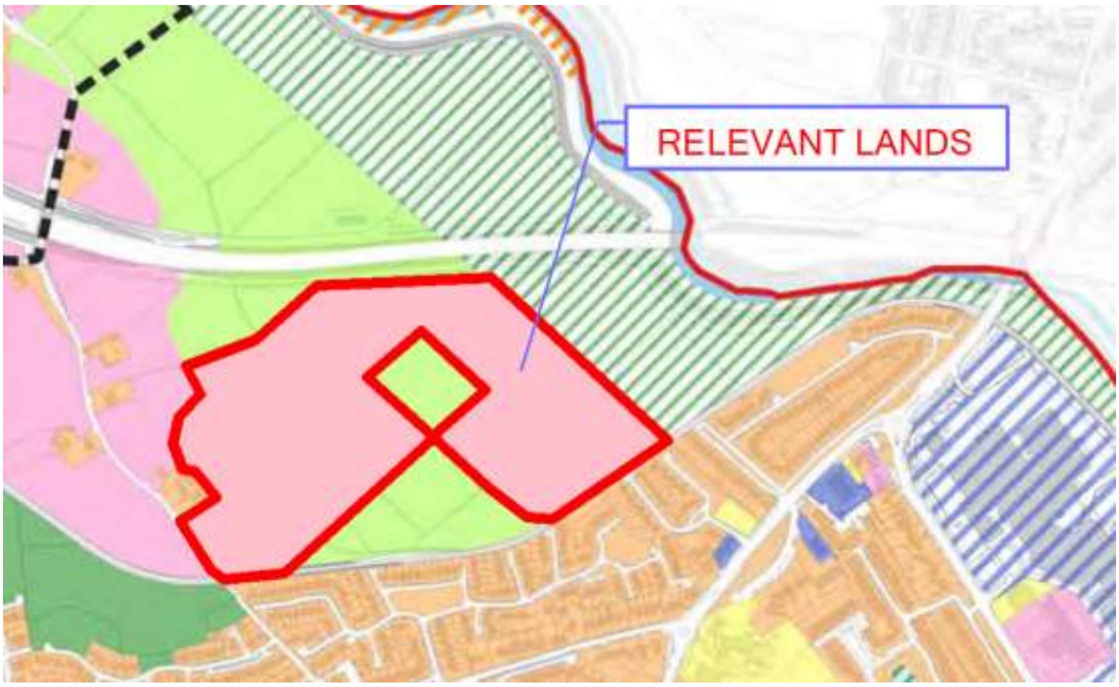
The CFRAMS maps show that the site has areas which are defended from coastal flooding by flood embankments along the Ballynaclough River which have a standard of protection of 0.5% AEP. There are some areas of the site where over topping of these embankments could occur at 0.1% AEP There are also some areas within the site that are not at risk of coastal flooding.

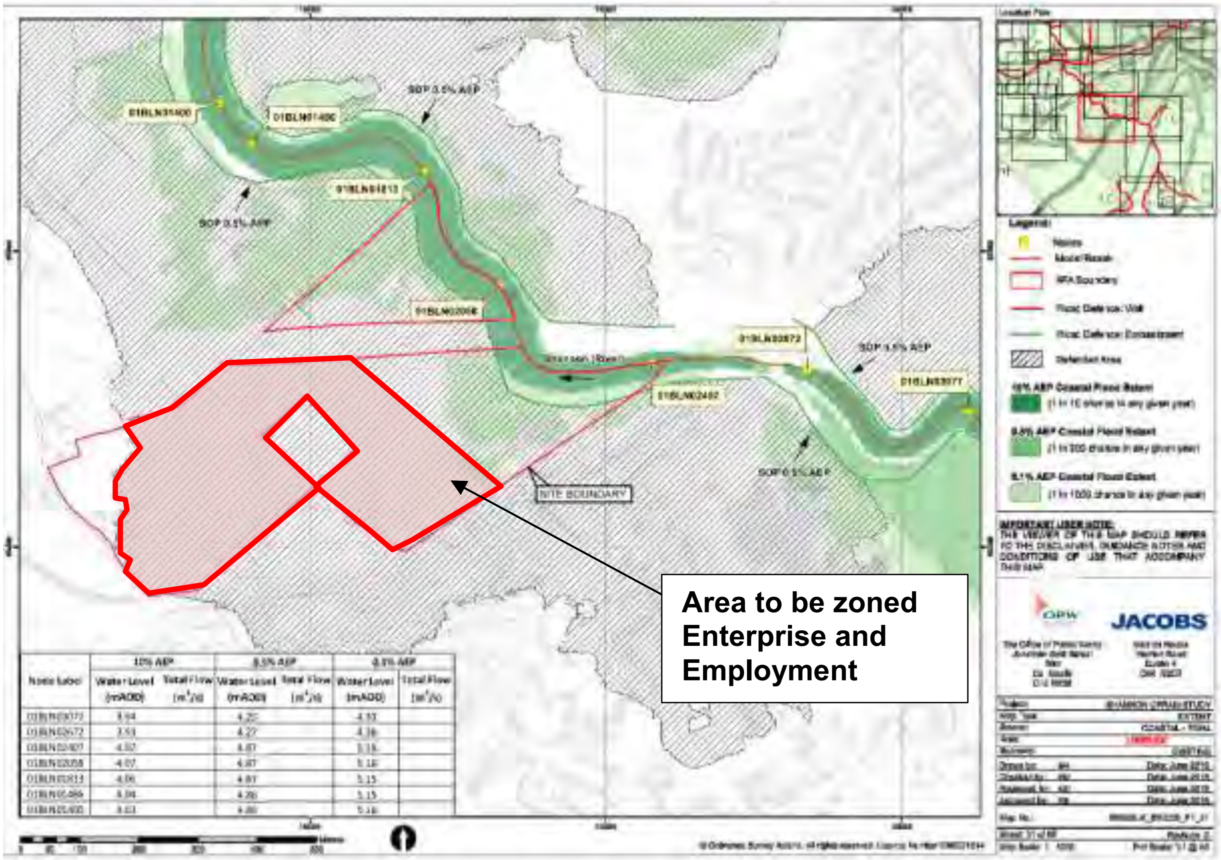
The defended site (and proposed development area) is not within the existing area of risk to flooding (although is largely within Flood Zone A) so risk is from residual risk of breach rather than direct inundation. The embankment defences are part of the OPW arterial drainage scheme and are of unknown condition and standard of protection, although the defence height (as modelled by CFRAM and RPS) provides protection to the site in the 0.5% tidal events with limited overtopping flooding at 0.1% tidal events.

6. PROPOSED ZONING

It is proposed to zone section of the lands Enterprise and Employment.







7. JUSTIFICATION TEST FOR THE PROPOSED ZONING

7.1. Vulnerability to Flooding

Table 3.1 of the Planning System and Flood Risk Management Guidelines (hereafter referred to as the FRM Guidelines) for Planning Authorities gives a detailed classification of vulnerability of different types of development.

In this zoning, enterprise and employment uses is proposed within Flood Zone A and must therefore must pass the justification test.

The Flood Risk Management Guidelines state that "*Having prepared a Strategic Flood Risk Assessment and mapped flood zones as part of its development plan review process and any more detailed flood risk assessments as necessary, situations can arise where a planning authority will need to consider the future development of areas at a high or moderate risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2. In such cases, the planning authority must be satisfied that it can clearly demonstrate on a solid evidence base that the zoning or designation for development will satisfy the Justification Test outlined in Box 4.1 opposite.*"

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

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) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];

   (ii) Comprises significant previously developed and/or under-utilised lands;

   (iii) Is within or adjoining the core[3] of an established or designated urban settlement;

   (iv) Will be essential in achieving compact and sustainable urban growth; and

   (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.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

   N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

7.2. Development Plan Justification Test

Box 4.1 - Item 1; The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended

The Limerick Shannon Metropolitan Area is targeted for growth under the National Planning Framework (NPF) and Regional Spatial and Economic Strategy (RSES) for the Southern Region.

The NPF envisages Limerick as the principal focus within the Mid-West Region, with the potential to generate and be the focus of significant employment and housing growth. The RSES includes a Metropolitan Area Strategic Plan (MASP) for the Limerick Shannon area. The MASP supports the NPF's ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to enhance its significant potential to become a City of scale.

Box 4.1 – Item 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:

(1) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement2 ;

(2) Comprises significant previously developed and/or under-utilised lands;

(3) Is within or adjoining the core3 of an established or designated urban settlement;

(4) Will be essential in achieving compact and sustainable urban growth; and

(5) 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.

Response; Limerick's Dock Road has been identified as a key employment and enterprise location under the MASP, which acknowledges the significant potential of this area of the City for economic development. The lands at Ballykeeffe in proximity to the Dock Road subject of Flood Zone A are essential for the provision of lands for employment uses which cannot be accommodated in the City Centre (warehousing, logistics etc.).

The lands are located adjacent to the City boundary line, within an urbanised area, are serviced by water and drainage infrastructure and are located within a 10 minute cycle of Limerick City centre. This makes these lands ideally suitable for infill development thereby reducing further urban sprawl away from the city centre.

The lands are also located adjacent to a disused rail line, which has the potential for sustainable mass travel from the lands to the city centre and other areas of the City and County. The lands are located in close proximity to the Dock Road, an area identified for growth of employment.

Suitable alternative lands are not available for development within and adjoining the core of the City for enterprise and employment uses which cannot be accommodated in the City Centre.

Box 4.1 Item 3 - A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the Development Plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

The defended site (and proposed development area) is not within the existing area of risk (although is largely within Flood Zone A) so risk is from residual risk of breach rather than direct inundation. The embankment defences are part of the OPW arterial drainage scheme and are of unknown condition and standard of protection, although the defence height (as modelled by CFRAM and RPS) provides protection to the site in the 0.5% and 0.1% tidal events.

Any detailed development proposals can address and manage flood risk with the site plans, typically through appropriate setting of finished floor levels, ground raising and use of the sequential approach within the development to ensure more vulnerable elements of the design are at a higher level. In the event of a defence's breach, emergency access to the lands can be provided directly from areas of higher ground from the South.

8. CONCLUSION

All available existing information has been reviewed regarding flood risk in the location of the proposed zoning change. These lands meet the requirements for sustainable development under the Flood Risk Management Guidelines, the aim of which is to ensure that sustainable development can proceed in towns and cities, despite the fact most are located in flood plains. As the lands are already defended these lands are not flood plains and any development of these lands will not unduly effect lands up or down stream of the river.

Signed: Tommy Morey

TOMMY MOREY
CHARTERED ENGINEER

Date: 14 February 2022

Consulting Engineers

Project Management

Safety Management

International

www.garlandconsultancy.com

GARLAND

Concepts Realised

Ballykeeffe,
Mungret,
Co. Limerick.
V94 YT93

6th September 2021

Planning and Environmental Services Department,
Limerick City & County Council,
County Hall,
Dooradoyle,
Limerick.

RE: DRAFT LIMERICK DEVELOPMENT PLAN 2022-2028

Dear Sir/Madam,

As owners (Laurence & Elizabeth Lahiff) of the land outlined in 'Red' on the proposed Local Area Plan 2021-2027, we are disappointed with the zoning proposed to our lands.

Our lands are some of the closest undeveloped lands to Limerick City Centre. Our lands extend to the Ballynaclogh River which form the boundary between Limerick City and County Limerick. It has been shown by two previous planning applications on our land, that the land is eminently serviceable with foul and surface water sewers and manholes are present within the North Eastern sections of our land.

Our land is 200m from a current and active bus route. From our lands it is already possible to walk and/or cycle to Raheen Industrial Estate, University Hospital Limerick, Crescent Shopping Centre and the City Centre. Our son and our nephews walked and cycled to school from these lands. Therefore, the use of our lands for residential use have the huge potential to increase sustainable and green modes of transport as an alternative to the use of car. Our land is adjacent to well established housing developments and close to all associated amenities including a significant number of schools. Our land also borders a disused railway line which has huge potential for the mass sustainable transport of people from any development on our lands to the city centre, the existing transport hub and other employment areas within the surrounding areas.

We note from the draft plan that zoning has been applied to Greenpark, which is on the opposite is of Ballynaclogh River to us and is subject to the same flooding risk. It also appears that lands to the West in Mungret which are further from the City Centre have proposed zoning of residential. We cannot determine what positives the lands to the West further away from the city have over our lands which are closer to the city with established infrastructure already present.

The current use of the lands is agricultural. We are past retirement age. Our landholding in this area is too small to sustain a modern farm, therefore the next generation of our family will not be able to farm this land into the future. We have always relied on the use of third party lands to make our farm sustainable. Connecting these isolated farm lands through a predominately residential area has become more and more difficult, if not impossible. Therefore, after we decide to discontinue farm activities on our lands, which will be within the life of the proposed plan 2022 to 2028, we do not see how the agricultural land use can be continued here.

Some of our lands are protected from potential flooding by embankments to the Ballynaclogh River. The embankments were constructed following a flood event during the construction of Ballykeeffe Estate so they we not created for the purpose of protecting agricultural land alone. Since the creation of these embankments, over 60 years ago, our lands have not flooded. We note these embankments protect existing residential developments including as Ballykeeffe Estate and Russell Court. There are a number of measures that could be employed to further protect any developments within our lands. As our lands are already defended, any measures used will not impact on upstream or downstream lands. Other third party lands do not and cannot rely on our lands being a flood plain as it does not flood given the existing defences present.

As a result of the above we seek that the draft plan be revised as follows:

- Retain at least the 2 hectares of residential lands within Flood Zone C as indicated on the 2011-2017 Southern Environs plan. These lands are located close to the border with the City and have established infrastructure present within and surrounding them. The 2 hectares does not relay on flood protection from existing flood defences.

- As we have noted above, the continued use of agricultural zoning on our lands is not viable and an alternative zoning needs to be applied here. The currently zoned agricultural land could be zoned as residential or mixed use to allow for a suitable transition between residential lands and enterprise and employment lands.

- As the lands are already defenced from flooding, the agricultural zones lands should be reconsidered for development zoning. We believe the draft plan has been prepared on the basis that our lands be sacrificed to form some sort of flood plain which simply cannot happen due to the elevation and topography of the surrounding areas. Given the lands are already defended, we see no value in retaining a large portion of land at the City Border which are higher in elevation than areas of land that are already developed adjoining our lands. We ask that the flood mapping and zoning is considered in the overall context of the lands and also the surrounding development that has already occurred in this area around our lands.

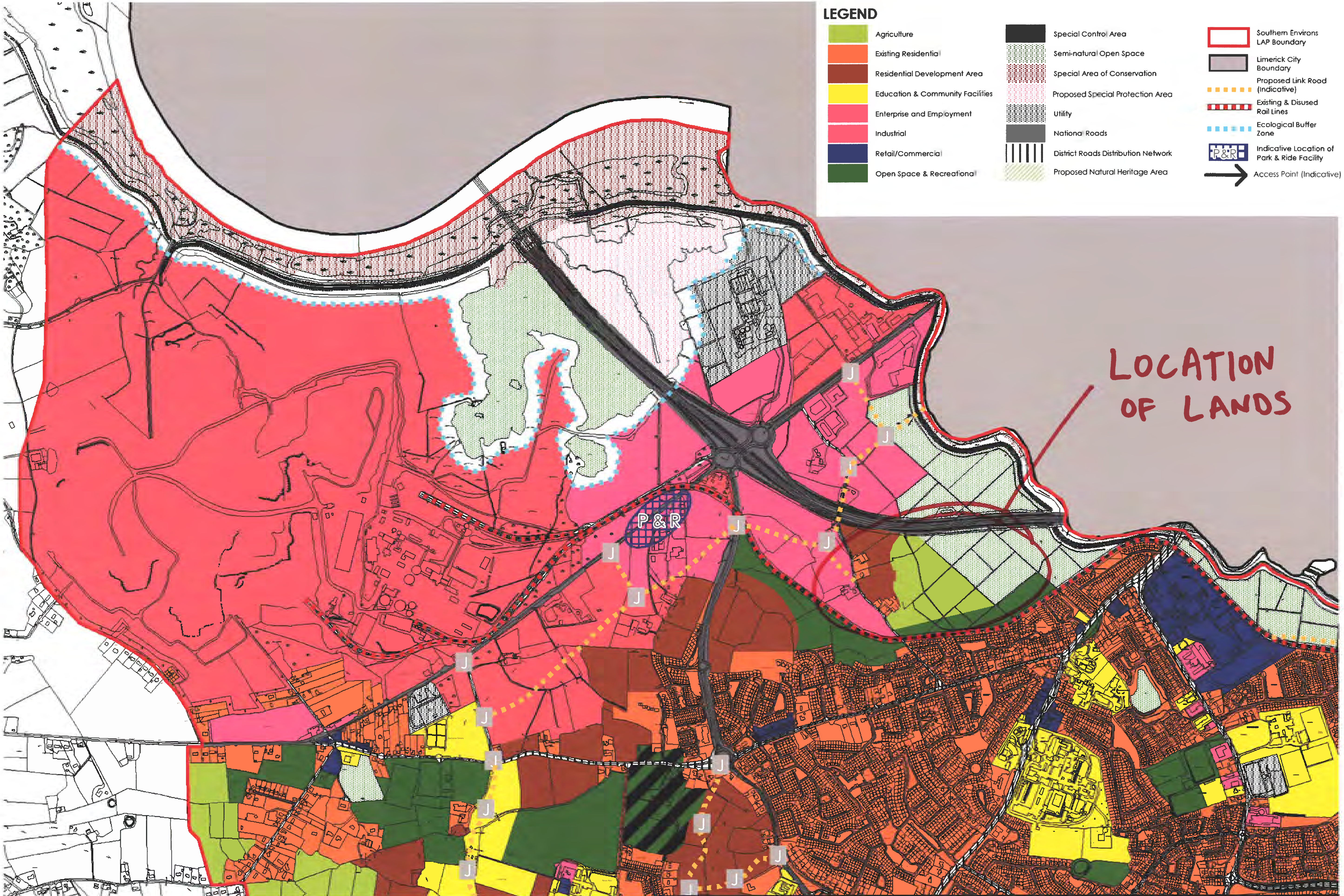
Also, Garland will be submitting a report on my behalf, which is enclosed herewith.

Yours faithfully,

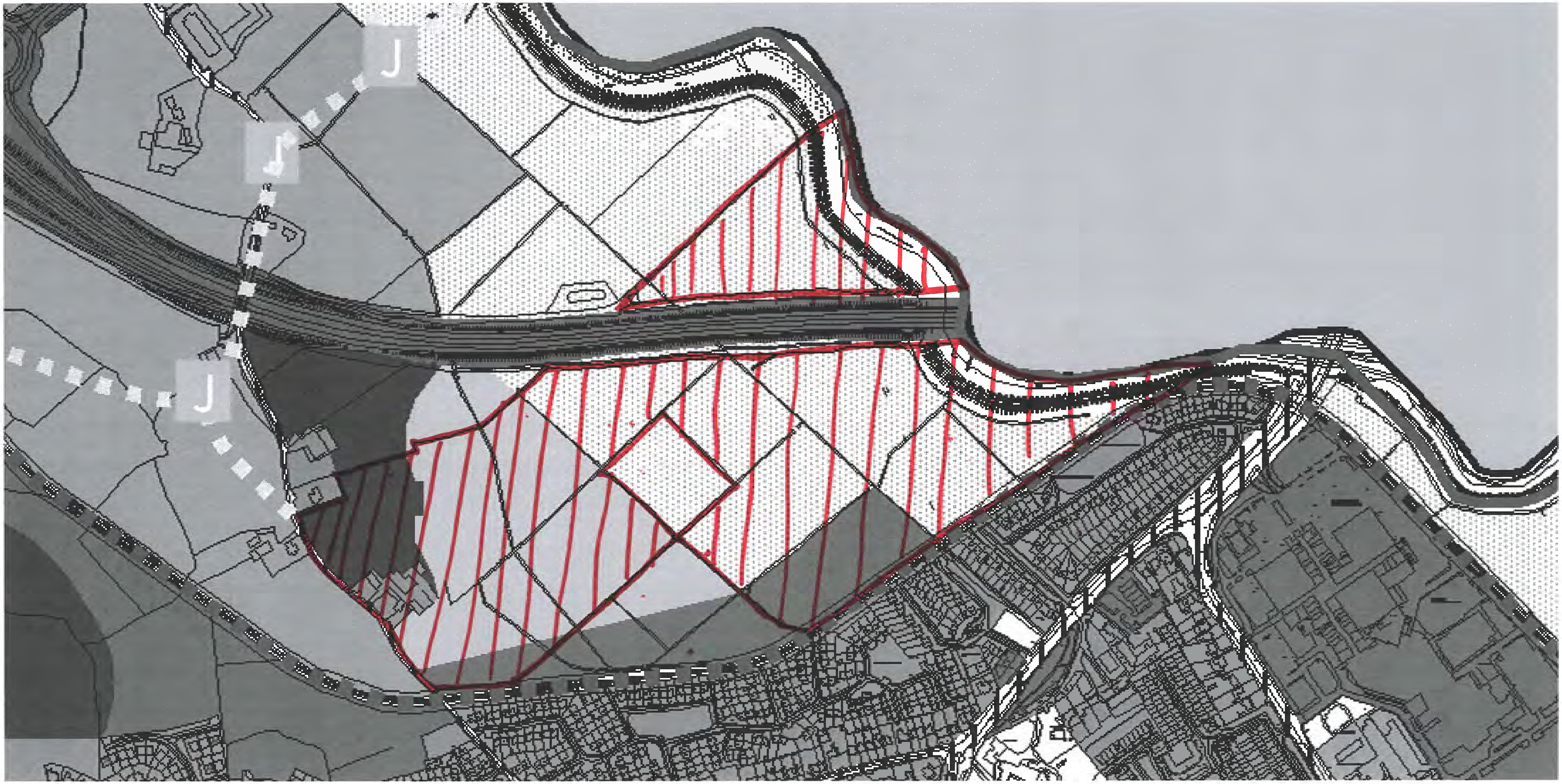
Laurence Lahiff

LAURENCE & ELIZABETH LAHIFF.

Elizabeth Lahiff



Limerick City & County Council Southern Environs Local Area Plan 2011-2017	N	Southern Environs Zoning Map Ordnance Survey Ireland CCMA Limerick City & County Council	May 2016	Map No. 1A



SITE OWNERSHIP BOUNDARY

SITE OWNERSHIP AREA

Our Ref: BL/L0431-Misc-003

Date: 6 September 2021

Planning and Environmental Services Department
Limerick City and County Council,
Dooradoyle,
Co. Limerick
V94 XF67

Re: Draft Limerick Development Plan 2022-2028
Zoning of Lands at Ballykeeffe, Mungret Co. Limerick

Dear Sir / Madam,

We hereby make a submission on behalf of Laurence and Elizabeth Lahiff of Ballykeeffe, Mungret, Co. Limerick in relation to the zoning of lands in the Draft Limerick Development Plan 2022-2028. We have attached a drawing indicating the extent of the lands in their ownership to which this submission refers (see Appendix A).

There are detailed Shannon CFRAMS maps available for the area of this site which were published in June 2016, attached in Appendix B for reference. These CFRAMS maps indicate that the Lahiff's lands are in a "defended area" up to the 1/200 year event [0.5%AEP]. As shown on the extended CFRAMS maps, these existing defences (embankments and sluices) protect hundreds of existing houses in the Ballykeeffe area, as well as the Crescent Shopping Centre. These defences are comprehensively maintained by the OPW under the Arterial Drainage Act. Given the extent of defended lands, there can be no question of them being allowed to fall into disrepair, as any breach would potentially cause flooding of vast parts of the city and county and affect the economy of Limerick.

We also understand that these aforementioned defences were constructed at a time when it was known that the housing development at Ballykeeffe Estate was either completed or under construction. Therefore, the embankments constructed in the knowledge that they were not solely protecting agricultural lands. Since the construction of the embankments over 60 years ago, Lahiff lands have not flooded.

We note that the draft Strategic Flood Risk Assessment has provided successful justification test to four areas within the City Suburbs and Southern Environs as follows:

- Industry and Enterprise and Employment lands at the Dock Road (A.1.1)
- Enterprise and Employment lands at Greenpark (A.1.2)
- High Tech/ Manufacturing zoned lands within Raheen Business Park (A.2.1)
- Enterprise and Employment zoned lands at Dock Road (A.2.3)

The lands subject to this review are not dissimilar to Enterprise and Employment lands at Greenpark

(A.1.2). The Lahifff Lands are located on the opposite side of the River to the Greenpark Lands. The Greenpark lands are similarly protected by the same existing embankment and are not known to flood as a result of same.

We therefore request that those parts of Lahiff's lands which are protected by these same flood defences be subject of a Justification Test within the Strategic Flood Risk Assessment and be zoned for development. The lands are located adjacent to the City boundary line, within an urbanised area, are serviced by water and drainage infrastructure and are located within a 10 minute cycle of Limerick City centre. This makes these lands ideally suitable for infill development thereby reducing further urban sprawl away from the city centre. The lands are also located adjacent to a disused rail line, which has the potential for sustainable mass travel from the lands to the city centre and other areas of the City and County. The lands are located in close proximity to the Dock Road, an area identified for growth of employment.

It is noted within Page 26 of the "The Planning System and Flood Risk Management - Guidelines for Planning Authorities" under the heading "Justification Text" that "…strategically located urban centres and particularly city and town centre areas whose continued growth and development is being encouraged in order to bring about compact and sustainable urban development and more balanced regional development." We therefore believe these lands on the city boundary adjacent to established residential and industrial developments can contribute to the compact development of the City, avoid urban sprawl and therefore the use of justification text when assessing flood risk is appropriate.

These lands meet the requirements for sustainable development under the Flood Risk Management Guidelines, the aim of which is to ensure that sustainable development can proceed in towns and cities, despite the fact most are located in flood plains. As the lands are already defended these lands are not flood plains and any development of these lands will not unduly effect lands up or down stream of the river.

A detailed Flood Risk Assessment would accompany any future planning application for development on the lands. This Flood Risk Assessment would include a justification test for the proposed development outlining in detail how the proposals would achieve full compliance with the Flood Risk Management Guidelines 2009.

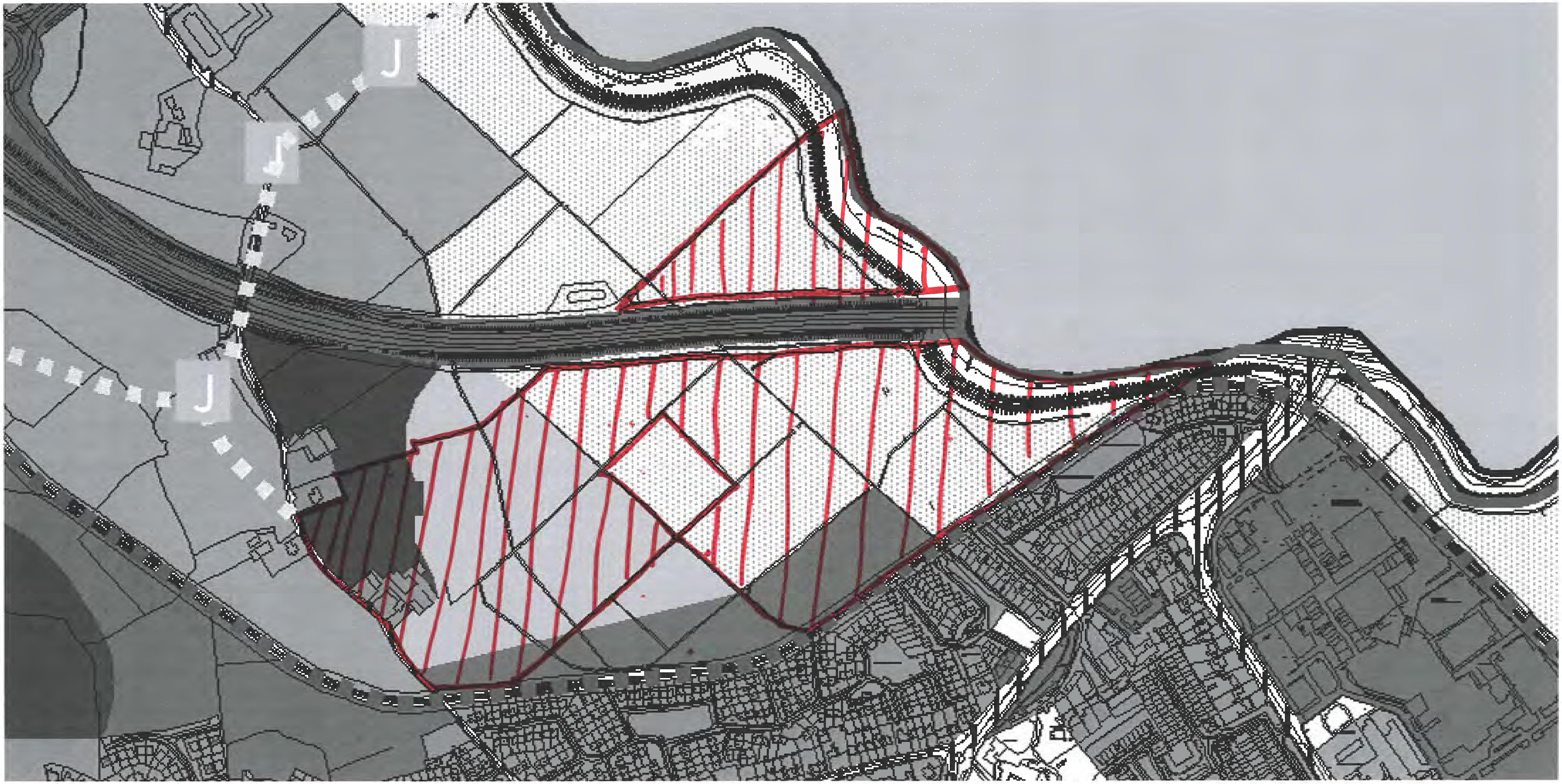
We trust the above and enclosed meets with your requirements and on behalf of our client, we look forward to a favourable outcome when considering these lands for a change to development zoning when the final version of the Southern Environs Local Area Plan is published. If you need any further information when considering this application, please do not hesitate to contact us.

Yours sincerely,

Tommy Morey

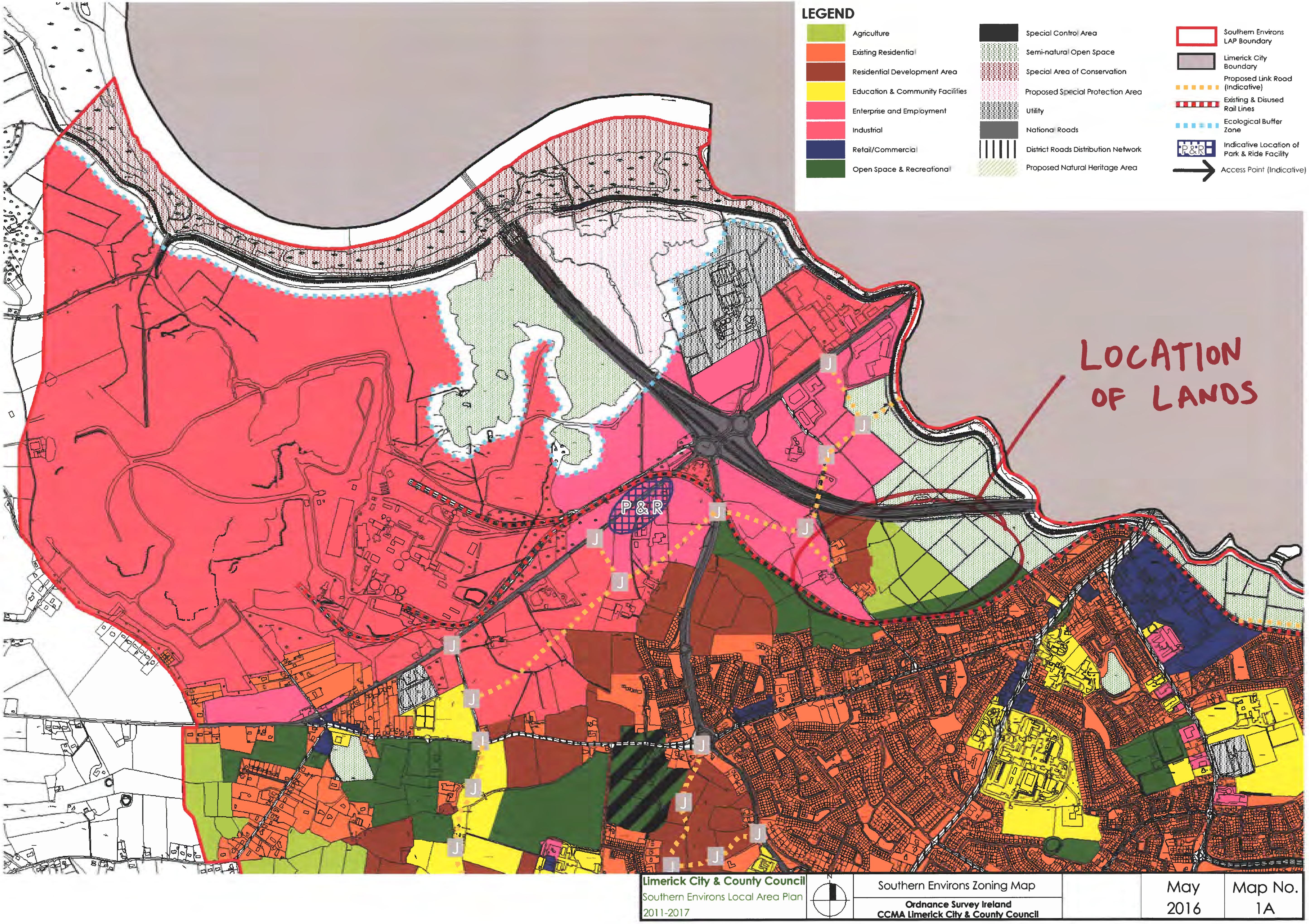
Tommy Morey
Chartered Engineer

Appendix A
Land Ownership

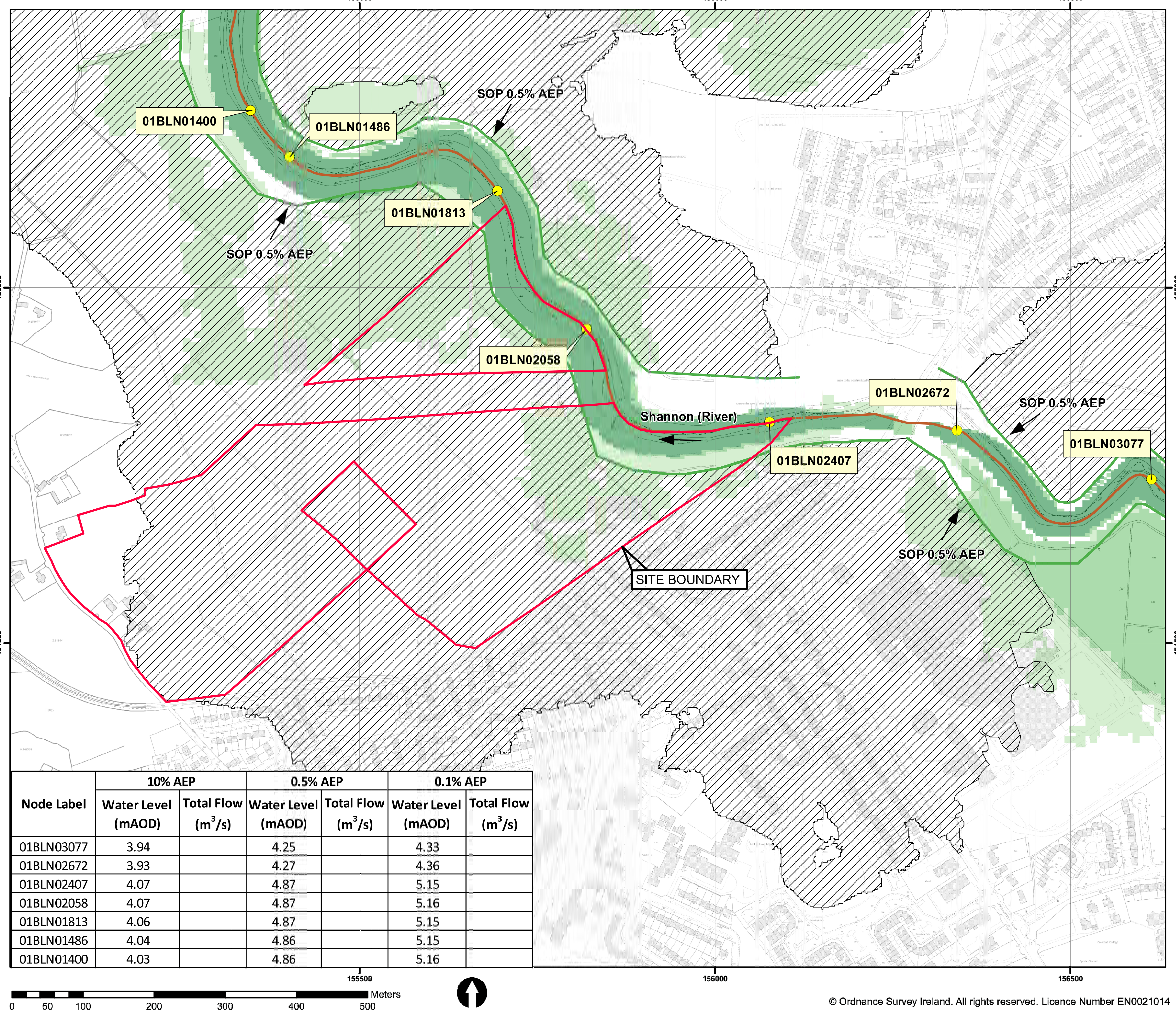


SITE OWNERSHIP BOUNDARY

SITE OWNERSHIP AREA

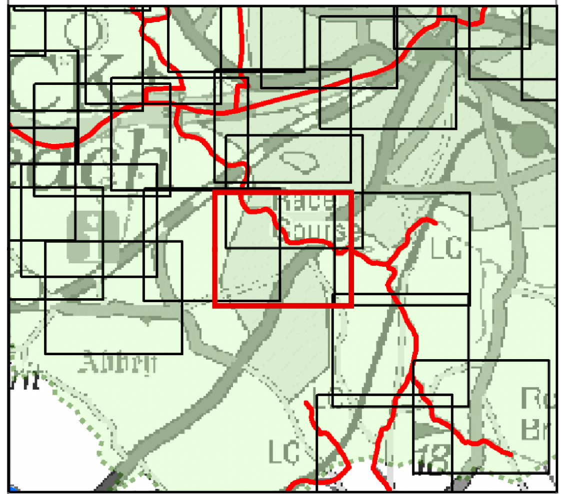

LEGEND
Agriculture
Existing Residential
Residential Development Area
Education & Community Facilities
Enterprise and Employment
Industrial
Retail/Commercial
Open Space & Recreational
Special Control Area
Semi-natural Open Space
Special Area of Conservation
Proposed Special Protection Area
Utility
National Roads
District Roads Distribution Network
Proposed Natural Heritage Area
Southern Environs LAP Boundary
Limerick City Boundary
Proposed Link Road (Indicative)
Existing & Disused Rail Lines
Ecological Buffer Zone
Indicative Location of Park & Ride Facility
Access Point (Indicative)
P&R
LOCATION OF LANDS
Limerick City & County Council
Southern Environs Local Area Plan
2011-2017
Southern Environs Zoning Map
Ordnance Survey Ireland
CCMA Limerick City & County Council
May
2016
Map No.
1A

Appendix B
CFRAMS Maps



Node Label	10% AEP		0.5% AEP		0.1% AEP	
	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)
01BLN03077	3.94		4.25		4.33	
01BLN02672	3.93		4.27		4.36	
01BLN02407	4.07		4.87		5.15	
01BLN02058	4.07		4.87		5.16	
01BLN01813	4.06		4.87		5.15	
01BLN01486	4.04		4.86		5.15	
01BLN01400	4.03		4.86		5.16	

Location Plan:



Legend:

- Nodes
- Model Reach
- AFA Boundary
- Flood Defence: Wall
- Flood Defence: Embankment
- Defended Area

10% AEP Coastal Flood Extent
(1 in 10 chance in any given year)

0.5% AEP Coastal Flood Extent
(1 in 200 chance in any given year)

0.1% AEP Coastal Flood Extent
(1 in 1000 chance in any given year)

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

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
C15 NX36

JACOBS
Merrion House
Merrion Road
Dublin 4
D04 R2C5

Project:	SHANNON CFRAM STUDY
Map Type:	EXTENT
Source:	COASTAL - TIDAL
Area:	LIMERICK
Scenario:	EXISTING
Drawn by: EH	Date: June 2016
Checked by: KM	Date: June 2016
Reviewed by: MC	Date: June 2016
Approved by: PS	Date: June 2016
Map No.:	S2526LIK_EXCCD_F1_31
Sheet: 31 of 65	Revision: 0
Map Scale: 1: 5000	Plot Scale: 1:1 @ A3

Ballykeeffe, Mungret
LCC – C62 – 206

HRA PLANNING
Chartered Town Planning Consultants

Submission on

Draft Limerick Development Plan 2022 - 2028

On behalf of:

Mr. Michael Gabbett

HRA | PLANNING
chartered town planning consultants

DEVELOPMENT PLANNING | ENVIRONMENTAL PLANNING | MASTERPLANNING

Limerick | Dublin | t: 061 435000 | e:info@hraplanning.ie | w:www.hraplanning.ie

Title:	21062 Development Plan Submission	
Project:		
Prepared by:		
Signed:	Gary Rowan MIPI MRTPI Director	Approved by: Mary Hughes MIPI (Director)
Date:	September 2021	
Issue:	Issue01final	

Table of Contents

1.0 INTRODUCTION & PURPOSE OF SUBMISSION

HRA PLANNING Chartered Town Planning Consultants has been retained by Mr. Michael Gabbett, Ballykeefe, C. Limerick (‘**the property owner’**) to prepare the following submission to Limerick City and County Council in respect of the Draft Limerick Development Plan 2022-2028.

This submission relates to 4 plots of land in the Mungret area of the ‘Southern Environs’ suburb of Limerick City and metropolitan area as illustrated in Figure 1 and 2 enclosed at the end.

The property owner respectfully requests that the proposed landuse zoning provisions of the draft Limerick Development Plan (‘**the Draft Plan’**) are reviewed and subsequently amended to reflect the site circumstances and opportunities of the subject lands vis-à-vis their strategic location, and, having regard to the commitment by the property owner heretofore, in facilitating the compulsory acquisition and subsequent dissection of his property for the construction of strategic national roads through its property.

The property owner respectfully submits that the proposed agricultural landuse zoning applied to portions of the subject site, are inappropriate to this location, and represents an underutilisation of serviced land within the Limerick City Metropolitan area which is planned for growth, and would contrary to the approach in the National Planning guidelines, which seeks to achieve efficiencies in the use of serviced land within cities and urban areas designated for growth.

This submission sets out the material planning reasons why the subject lands should be zoned for **‘enterprise and employment’** corresponding to that use which has been applied on some parts of the subject property in the draft plan.

This submission is accompanied by a site-specific flood risk assessment report[1], and the conclusions drawn in that assessment which have informed some aspects of this submission.

2.0 BACKGROUND

2.1 Site Location and Context

The subject property comprises a number of separate plots located between the village of Mungret and the (junction 2) intersection on/off ramps between the N18 / N69 national roads and the ‘Dock Road’ which serve as the Limerick city bypass within the western environs of the city area. The location of each plot of land is illustrated in Figure 1 and comprises Plot A (5.57ha), Plot B (4.25ha), Plot C (5.57ha) and Plot D (10.22ha).

Plot A is situated on the N69 generally opposite the Irish Cement factory. Plots B-D are situated immediately adjacent to the previously mentioned intersection and whilst subdivided by the N18 National road, they are connected to, and accessible via the Ballykeefe Boreen from the Dock Road.

[1] *Flood Risk Assessment prepares by PUNCH Consulting Engineers*

Figure 1 illustrates the location of each plot, and illustrates also, the extent to which the construction of the Limerick N18 bypass route has subdivided the overall landholding.

Plots B-D are currently undeveloped and of improved agricultural greenfield character.

The Dock Road (R510) accommodates several commercial and industrial landuse activities including the Blackberry Business Park situated immediately adjacent to the north of the subject lands and which accesses the Dock Road by the upgraded Ballykeefe Boreen road. The majority of the Dock Road frontage, as it extends westward from the city centre up to the N18 intersection, is developed with residual and rear lands identified for similar urban development.

Plots B-D represent an unrivalled location, positioned at a pivotal gateway intersection between the National transportation network, and the edge of city. This location offers immediate accessibility to routes to/from the city, to Ennis/Galway to the north, Dublin to the east, and to designated 'Tier 1' port installation The Shannon Foynes Port Company which has operational facilities at Foynes via the N69 and on the Dock Road.

2.2 Draft Landuse Zoning Provisions

The Draft Plan allocates a number of different zoning objectives to the subject plots. Plots B and C comprise of both 'enterprise and employment' and 'Agriculture' land use zoning objectives. Plot D is comprised predominantly of 'agriculture' and 'semi-natural open space' with a very small portion of 'enterprise and employment'. The 'semi-natural open space' on Plot D extends back for a distance of in excess of 100m from the edge of the Ballinacurra Creek.

The purpose and extent of these zoning objectives, as they apply to the subject plots of land, and, their purpose within the wider city environs, and to this strategic location are unclear.

3.0 GROUNDS OF SUBMISSION

The grounds for submission are based on the following material considerations:

3.1 Inappropriateness of draft zoning objectives: '**Agriculture'** and '**Semi-Natural Open Space'**

3.1.1 Inappropriateness of draft 'Agriculture' zoning objectives: and 'Semi-Natural Open Space'

The preparation of the Draft Plan results in the coming together, for the first time under one plan, the combined spatial development and landuse zoning objectives for the Limerick city urban area, and the Southern Environs which previously, were set out under the Limerick City Development Plan 2010 As amended and varied), and, the Southern Environs Local Area Plan 2021-2027.

In the morphing together of these two Plans, the collective spatial development objectives and landuse zoning provisions has resulted in a mosaic of development and non-development landuse zoning objectives which extend between the Dock Road and the village of Mungret and adjacent to a strategic intersection where access to and from the city centre meets the Limerick Southern ring-road and the national road network which extends to other major urban centres and regions.

In effect, this mosaic approach to this agriculture land zoning is likely to create instances where ‘enterprise and employment’ will occur on backlands, behind ‘agriculture’ zoned land, and functionally appear piecemeal, disjointed and require greater road construction and extended provision of services to reach those ‘development’ areas.

Examining these differing zoning objectives in a wider metropolitan city context, presents a scenario of potential under-utilisation of serviced land located at a critical gateway access point to the urban city centre and at a location with immediate access to strategic national road network.

In considering the function and suitability of ‘agriculture’ zoning to this location, reference is made in the first instance to the zoning objectives set out in the draft plan Chapter 12 (Landuse Zoning Strategy) which state that the Objective of the ‘Agriculture’ zoning objective is to;

> *“To protect and improve rural amenity and provide for the development of agricultural uses”.*

The purpose of the zoning is stated;

> *“To protect rural amenity and agricultural lands from urban sprawl and ribbon development and provide a clear demarcation to the adjoining built up areas”.*

In the first instance, the property owner seeks to confirm that the agricultural use of the property, in the manner prescribed and provided for in the landuse zoning ovbjecive, is neither feasibility nor practical. The agricultural landholding has been eroded from its original 69 hectares in its operational prime to circa 16 hectares for a variety of reasons including, land take for public road building, the consequent effects of severance by road construction, and residual effects of a mosaic of different landuse zoning types ibn the last local area plan including ‘enterprise and employment’. Thus, in the first instance, the landholder can confirm that there is no necessity to protect and/or provide for agricultural use of the subject lands for ‘agriculture’ use because it is commercially unviable to do so.

Secondly, the use of an ‘Agriculture’ zoning objective for the purpose of protecting rural amenity, to prevent urban spawl or to provide a clear demarcation between built up areas is incongruous to the preferential and the optimal sequential use of serviced urban land at this location. The Limerick Southern Ring Road has to an extent, been a controlling feature in preventing ‘urban sprawl’ and making a distinction in urban areas between the Dock Road City core area to the east, and the suburban centre of Mungret to the west. Furthermore, the provision of sporadic agricultural zoning, around a major gateway to a metropolitan city area, which is planned for significant settlement growth in Limerick is, is somewhat counterintuitive to sustainable integrated landuse and transport planning, and National and Regional spatial development objectives, when in fact other urban uses may well be appropriate on the site and developed sufficiently responsive to flood risk management requirements (discussed later).

Figure 3 and 4 illustrates the spatial location of the property within the context of strategic road network and illustrates that the potential opportunities of its immediate accessibility to the national roads network.

In effect, the proposed piecemeal nature of the agriculture zoning, provides no feasibility for agriculture use or for the purpose of controlling settlement sprawl and thus, is considered an inappropriate landuse allocation to the subject property.

3.1.2 Inappropriateness of draft 'Semi-Natural Open Space' zoning objectives

The 'semi-natural open space' designated within Plot D appears to be without logical justification other than its position adjacent to the Ballinacurra Creek. The extent of that zoning encroaches for a significant distance from the Ballinacurra Creek, into Plot D for a distance of circa 100m following and follows an arbitrary line of an internal field boundary.

The stated objective and purpose of this zoning objective (as stated in Chapter 12 of the draft plan) is to prohibit development in order to maintain the integrity of Natura 2000 sites and flood plains for wildlife habitat flora and fauna and floodwater storage. Furthermore, it is noted that Objective SCSI O18 (Protection of lands zoned for public open space) which states that It is an objective of the Council to:…."(b) *Protect semi-natural open space areas from inappropriate development in the interest of recreational enjoyment, community health and well-being, flood protection and biodiversity".*

The consideration of 'flood protection' is considered in detail, under separate section later in this submission. That aside, the property owner submits that there is no current or planned openspace, recreational enjoyment, or community health function of Plot D that requires 'protection' by way of allocation of 'semi-natural open space zoning as provided for in Objective SCSI O18. Secondly, the property owner is not aware of any scientific evidence that demonstrates how this allocation of 'semi-natural open space' is necessary, from a landuse planning perspective, to protect biodiversity as provided for in Objective SCSI O18. Furthermore, the property owner is not aware of any scientific evidence which confirms a necessity to sterilize in excess of 100m of land extending back from the creek for the purpose of prohibiting development in order to maintain the integrity of the SAC specifically, for the purpose of protecting a specific habitat type, a specific feature, or habitat of feature which is of conservation value and protected under the EU Habitats Directive.

The consequential effect of this zoning is that it sterilises a significant portion of Plot D from potentially suitable development uses that might be consistent with National, Regional and Local planning policy, and, which might have no effect to the ecological amenity of the Ballinacurra Creek or the SAC.

The provisions of 'Part XAB' of the Planning and Development Act 2000 (as amended) provides the statutory test ('appropriate assessment') for ensuring that the integrity of the SAC designation is maintained. With that statutory provision in place (which is transposed into specific policy objectives contained in the draft Plan), and, without any scientific evidence to the contrary, the applicant submits that there is no necessity for the draft Plan to apply the 'semi-natural open space' landuse zoning objective in such an extensive manner in Plot D for the purpose of protecting the SAC.

The property owner is mindful that the local authority can rely on the full provisions of the Part XAB 'appropriate assessment' mechanism and the provisions of the EU Habitats Directive for the purpose of protecting designated Natura 2000 sites, irrespective to whatever land use zoning applies.

That said, and mindful of the principles of biodiversity, the property owner submits that any such amenity buffer from the Ballinacurra Creek (if it is the Council's intention to provide an amenity buffer), could be practically and reasonably applied to a distance back from the creek of circa 20m. This could be applied by way of modified semi-natural open space landuse zoning objective restricted to that extent, or, otherwise, delivered as part of any urban development landuse activity by way of express development management policy objective without necessarily requiring to sterilize a large swath without apparent reason.

3.2 Suitability of Location for 'Enterprise and Employment Uses'

The suitability of the subject sites for urban landuse activities has been confirmed by virtue of the existing 'enterprise and employment' landuse zoning objectives which have been applied to portions of those lands by the Planning Authority.

The site is sufficiently serviced by existing road infrastructure with direct accessibility from Ballinacurra Boreen / Dock road and is situated adjacent to the Dock Road and the significant area of commercial and enterprise activities that occur there, to justify the principle of 'enterprise and employment' use of the subject site.

3.3 Suitability of Infrastructure to support enterprise and employment use

Plot A has direct access from the N69 road. Plots B-D have direct access from the Dock Road, via the Ballykeefe Boreen. The Ballykeefe Boreen has been upgraded in recent years and this has included road widening extending for some 520m in form the Dock Road including the a 'flyover' bridge over the N18 and specific road junction access points on both sides of that flyover bridge which provides dedicated future access points into the subject lands. The intersection of the Dock Road and the Ballykeefe Boreen includes a (circa) 30m splayed 'T-junction' offering clear lines of sight to oncoming traffic travelling in both directions.

The road width from the Dock Road is generally in the order of 8m in width. Whilst a narrower section does occur between 215m and 335m back from the Dock Road, that section is within the property owner's ownership and any infrastructural deficiency at that point can be addressed through the detailed development management process.

3.4 Strategic Objectives Supporting Urban Employment Growth

Strategic and local Planning for urban and employment growth is set within the context of the National Planning Framework ('**NPF'**), and the Southern Regional Spatial and Economic Strategy ('**RSES'**).

and the draft plan. The following observations are considered pertinent in the context of recognises the relevance and importance of the subject site and its location.

The National Planning Framework

Section 4.4 of the NPF ('Planning for Urban Employment Growth') recommends that locations for expansion of existing enterprises should be dependent on the availability of different types of infrastructure including for example, **communications, power, water, roads ports and airports.** (emphasis added).

*The Southern Regional Spatial Economic Strategy ('**RSES'**)*

The RSES acknowledges that the Limerick Shannon Metropolitan Area with its high capacity transport corridors is a global gateway with a number of dynamic relations including: international connectivity through the Ports and Airport, its connections to the Dublin, Galway, Cork and Waterford metropolitan areas, connection to Key Towns in the Mid-West and its relationship to surrounding towns, villages and rural areas.

The RSES advocates the compact sustainable growth and the development of brownfield and infill lands to achieve growth targets and Integrated transport and landuse – the target growth along high quality public transport corridors. The RSES **Limerick Shannon MASP Policy Objective 9** promotes greater collaboration between the metropolitan areas of Galway and Limerick Shannon and the Key Town of Ennis (GESL) Economic Network to drive economic growth and innovation on a sub-regional basis. This potential network is underpinned by the presence of public transport and motorway infrastructure that connects the two cities on the West coast of Ireland and promotes the effective development and excellent inter-regional transport connections.

Draft Limerick Development Plan

Section 2.2 of the draft Development Plan reinforces the strategy recognition (contained in the NPF) that Limerick City region as a key asset, that will play a major role in both driving and accommodating a significant proportion of the proposed national population growth and will act as an effective complement to the economic strength of Dublin, and, that future growth will be based on leveraging national, regional and international connectivity, higher education capacity and quality of life to secure strategic investment. In tandem, regional population projections for the Plan period suggest an additional population of circa 49,200[2], two-thirds of which is planned with the Limerick City and environs area which includes **Mungret** (as well as Annacottty).

The 'Core Strategy' contained in the Draft Plan, expressly states that the Limerick City Metropolitan Area, including Mungret and Annacotty is designated for significant growth under the National Planning (NPF) and Regional Planning (RSES) spatial development objectives. Section 2.6 of the Core Strategy recognises also, the obligation on planning authorities to ensure sufficiency of land identified at suitable locations for employment purposes and suggests that the such zoning should have regard to the Draft Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) and the availability of infrastructure. Draft development plan objectives which support economic development are set out in Chapter 4 and which include inter-alia;

[2] *Draft Development Plan, Chapter 2 'Core Strategy' Table 2.1 and Table 2.2*

Objective ECON O13 Strategic Employment Locations City and Environs
It is an objective of the Council to:
a) Promote, facilitate and enable a diverse range of employment opportunities by facilitating appropriate development, improvement and expansion of enterprise and industry on appropriately zoned lands, accessible by public and sustainable modes of transport,

Objective ECON O19 Clustering and Innovation
It is an objective of the Council to encourage and facilitate the sustainable development and clustering of knowledge-based and high tech industries/businesses at appropriate locations in Limerick

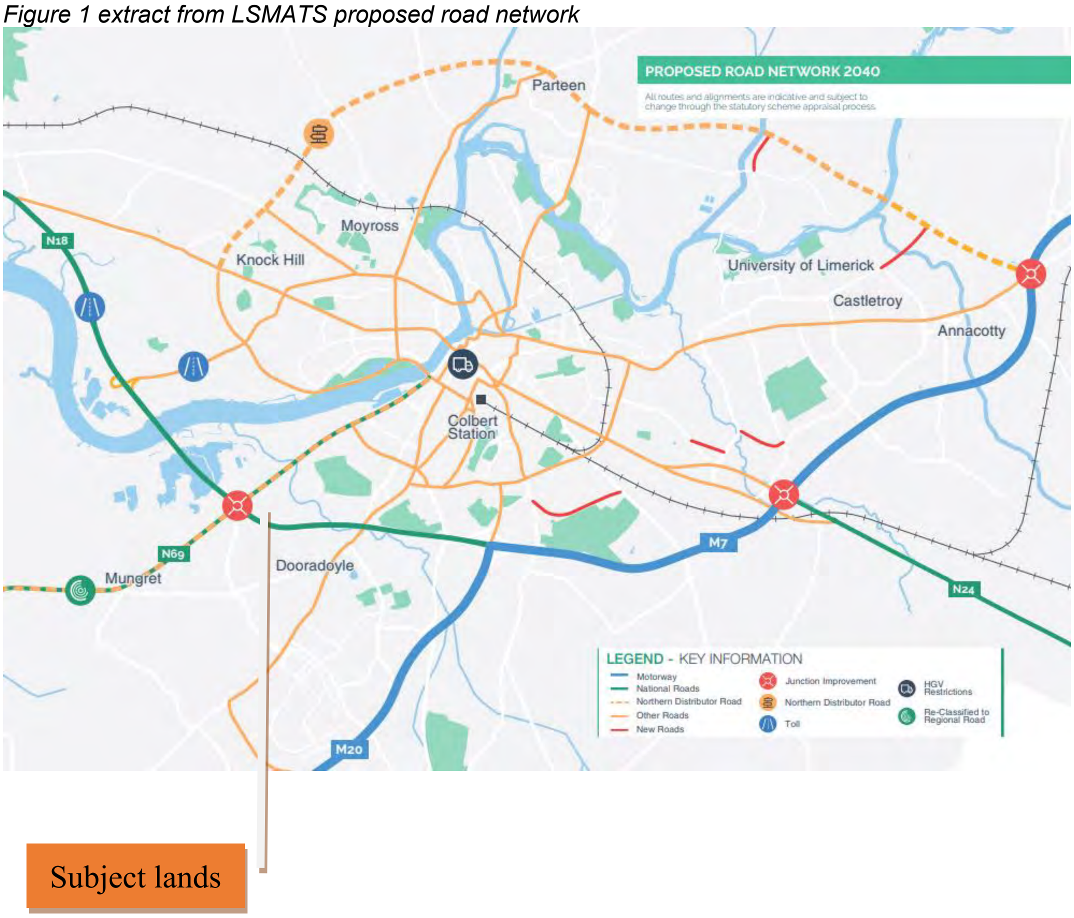
Objective ECON O24 Data Centres
It is an objective of the Council to:
a) Facilitate the development of Data Centres on lands appropriately zoned for such purposes, subject to normal planning, development and environmental controls and the assessment of the potential impact on such development on adjacent land uses.
b) Promote co-location of data centres with renewable energy sources at appropriate locations subject to proper planning and sustainable development considerations.

Objective ECON O35 Limerick Food Strategy
It is an objective of the Council to support Limerick's food and drink producers in accordance with the aims/gaols established under the Food Strategy for Limerick 2016–2018 and any update thereto.

Limerick Shannnon Metropolitan Area Transport Strategy ('LSMATS')

The LSMATS states that "the M7/N18 Limerick City Bypass is of key strategic important to the Strategy as it provides strategic linkage between the M7 Dublin, N24 Waterford, N/M20 Cork, N21 Tralee, N69 Port of Foynes, N18 Galway and N19 Shannon. Further to that, the LSMATS confirms that the mainline carriageway of the M7/N18 operates within capacity throughout the day, however, there is recognition of localised congestion on the grade separated junctions with this road, which includes the Dock Road Interchange. The LSMATS provides for improvements to this junction (in the immediate short-term) to ensure that this localised junction congestion does not impact on the strategic function of the M7/N18 road. The LSMATS illustrates (As per the extract below), how connected the subject site is by public road and public transport to and within the Limerick Metropolitan urban area as well as future objectives to enhance that urban mobility.

Figure 1 extract from LSMATS proposed road network



Policy Summary

The spatial development objectives for the Limerick City Metropolitan area therefore need to identify and allocate appropriate locations and landuse types within the urban area which can contribute to the most efficient and effective use of serviced urban land for this planned period of urban growth and development.

It is clear from collective consideration of national, regional and local planning policy objectives, that connectivity between Limerick and other large urban centres and transport nodes is critically important for the economic development of the region and the metropolitan city area. The subject plots are situated on a decisive gateway position between the city and the surrounding urban and rural hinterland, and existing transport corridor between Limerick and other major urban centres.

Whilst a portion of the subject site has been identified for 'enterprise and employment' landuse, it is considered that the the pivotal position of the subject site on the southern edge of the city environment, with accessibility to the inter-regional transport network and other transport modes (air and sea), and which has been identified for infrastructural upgrade, supports greater optimisation of land use at this location to support economic development in the manner envisaged in policy objectives ECON O13, ECON O19 ECON O24, and ECON O35 for example. The location on the periphery of the city centre with access to strategic and interregional network and transport nodes is an obvious location for enterprise and urban landuse which would benefit from high levels of accessibility and connectivity.

3.5 Flood Risk is not an impediment to provision of development of the Property

Mindful that the subject property, particularly Plots B, C and D appear to be situated within areas of potential flood risk (floodzones A and B), a detailed Site-Specific Flood Risk Assessment (SSFRA) has been undertaken by Punch Consulting in order to assess potential flood risk to each plot and a copy enclosed with this submission. Each plot has been assessed for flood risk in accordance with 'The Planning System and Flood Risk Management Guidelines – DoEHLG-2009'.

Taking into account the hydrological and urban circumstances, the SSFRA establishes that part of the plots are located within Flood Zone C when flood defences are taken into consideration but, are within Floodzone A in an undefended scenario due to coastal flood risk. The extent of that predicted Floodzone A appears to match the 'Agriculture' and 'semi-natural openspace landuse zonings as they applies to each plot. Whilst this is the current situation, it must be noted also that Limerick City and County Council has appointed RPS Consulting Engineers to work on the Limerick City and Environs Flood Relief Scheme (FRS). Although the delivery of this project is unlikely to be completed in the short term, the completed FRS will offer more reliable flood defence for the site in the future.

The SSFRA suggests that, given the low probability of flooding on the Flood Zone A as it occurs to the subject plots, it is highly likely that less vulnerable uses such as 'Enterprise and Employment' could be justified subject to justification test carried out in accordance with Flood Risk Management Guidelines for Planning Authorities[3] (**'the flood risk guidelines')**. The FRA suggests that the residual risk of flooding thereafter (after consideration of the justification test) can be addressed by flood mitigation measures appropriate to each site and landuse circumstance.

In the context of 'the flood risk guidelines', the property owner is mindful that the explanation of the 'Principles and Key Mechanisms' to flood risk management as set out in those guidelines, sets out various "*less vulnerable development*" uses which might be appropriate landuse activities within areas at flood risk, subject to tests and/or best practice flood protection and prevention measures. This includes *inter-alia;* buildings used for retail, leisure, warehousing, commercial, industrial and non-residential institutions; waste treatment, processing, and local transport infrastructure as expressly identified in the flood risk management guidelines.

There is nothing in the flood risk management guidelines which directs that that the only suitable landuse, within areas at potential risk to flood, must be non-development – agriculture, or semi-natural open-space or other amenity function. The less vulnerable uses referenced above from the flood risk guidelines, are commensurate with uses permissible under 'enterprise and employment' in the draft Limerick Plan.

In this regard, it is pertinent to refer to section 3.7 of the flood risk guidelines which states:

> *"it is recognised that the existing urban structure of the country contains many well established cities and urban centres, which will continue to be at risk of flooding. At the same time such centres may also have been targeted for growth in the National Spatial Strategy, regional planning guidelines and the various city and county development plans taking account of historical patterns of development and their national and strategic value"*

[3] *Published by the Department of Environment Heritage and Local Government, 2009*

In accordance with the flood risk management guidelines, landuse objectives which would support 'less vulnerable'[4] development activity, can be provided within areas defined as 'Floodzone A' subject to a Development Management justification test.

In this instance, the Plan-making Justification Test (Box 4.1) is the relevant test to be used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Table 1 below details why zoning must be considered on the subject lands and demonstrates why zoning of the site for 'enterprise and employment' use would be in compliance with the Justification Test and the Planning System and Flood Risk Management Guidelines.

3.6 Flood Risk (Development Management) Justification Test

Table 1	
'Box 4.1' Justification Test Criteria to be addressed	***Response***
1. The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.	*Limerick has been identified in the National Planning Framework (NPF) as one of the five cities in the country which is the subject of a Metropolitan Area Strategic Plan. This emphasises the Metropolitan Area's national importance, for significant additional growth. This is echoed in the Regional Spatial and Economic Strategy for the Southern Region, which mentions that the Limerick Shannon Metropolitan area is "a key economic driver for the region and Ireland". Limerick has been identified for significant population growth in the NPF along with an objective that 50% of that future growth be located within the city and its suburbs. (NPO2a).* *Limerick City is located at a pivotal point on the Atlantic Economic Corridor. The NPF and RSES confirms that Limerick has the potential to generate and be the focus of significant employment and housing 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:	
a Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement	*Zoning of the subject would assist achieving proper planning and sustainable development of the metropolitan city centre given that the intended function of the lands – to facilitate 'enterprise and employment' at a pivotal location adjacent to the city centre, at a strategic intersection with the national road and transportation corridors will assist in consolidating urban expansion within the defined urban city core supporting economic growth and employment for the metropolitan area.*
b. Comprises significant previously developed and/or under-utilised	*The land is greenfield in nature and is significantly underutilised in that capacity. Given its strategic gateway position with*

[4] 'Less vulnerable' in the context of flood risk management

land.	*immediate access to both the city centre and the transport corridor accessing the western seaboard, and other major intra urban cities, zoning of the subject site for enterprise and employment would contribute to effective utilisation of serviced urban land within the settlement.*
c. Is within or adjoining the core of an established or designated urban settlement.	*The subject site is located adjacent to the core Limerick city metropolitan area – a settlement designated for growth.*
d. Will be essential in achieving compact and sustainable urban growth.	*Use of the subject site for the purpose of enterprise and employment uses can contribute to compact and sustainable growth by consolidating such uses within the built envelope of the existing city urban area and create synergies and opportunities with uses which are less suited to core centre locations, but which still need access to the city cente (which is in close proximity) and access to the national transport corridors extending north to Clare/Galway, south to Cork, East to Dublin and southwest to Kerry.*
e. 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	*There is no other alternative site at lower risk to flooding which present an equal or better degree of location, accessibility and proximity to the city core, situated at the western gateway location and adjacent to the strategic transport corridors. Whilst the property owner's lands do have some aspects of enterprise and employment landuse zoning objectives designated to them in the draft plan, they are of insufficient size and of isolated formation to warrant investment in development of those or to be marketable for such uses. It is only the collective consideration of the lands at this location which become commercially viable, and the development of areas which are at risk to flooding will still be required to undergo a development management 'justification test' pending consideration of site specific considerations, and development specific uses and development arrangements.*
A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere. N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment	*Not only has a SFRA been carried out as part of the SEA, but so too has a SSFRA which examines the specific characteristics of each plot of land and which confirms that site specific and development specific flood risk measures can be considered at detailed development management stage to ensure that development will not cause unacceptable adverse impacts elsewhere.*

Therefore, in principle, and subject to compliance with a manged approach to flood risk as set out in the aforementioned guidelines, there is sufficient justification to support the zoning of all of the subject properties for 'enterprise and employment' in accordance with the food risk management guidelines, and that the potential flood risk, does not dismiss the principle of suitable development uses.

4.0 CONCLUSION

For the material reasons stated herein, including; the suitability of the subject sites and supporting infrastructure; National, Regional and local planning objectives which support settlement and employment growth in the limerick city metropolitan area; having regard to the strategic gateway and highly accessible location; and the ability of the proposed enterprise and employment use to comply with the flood risk management guidelines, the property owner respectfully requests that the land use zoning objective in the Development Plan is amended to provide for 'enterprise and employment' landuses.

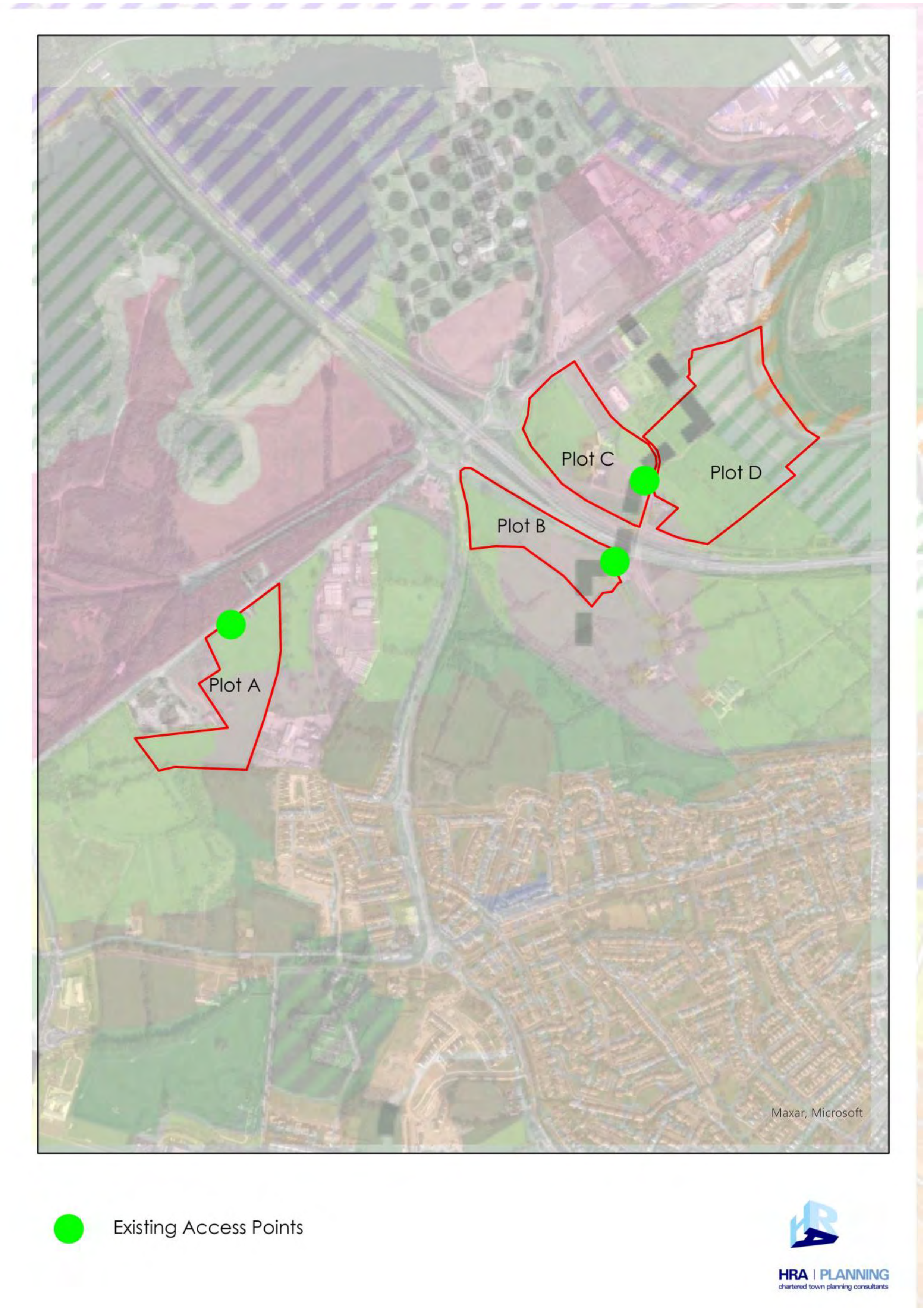


Figure 1 Site Location with zoning (and existing access points)

Site Locations

Special Areas of Conservation (SAC)

HRA | PLANNING
chartered town planning consultants

Figure 2 Sites within SAC context

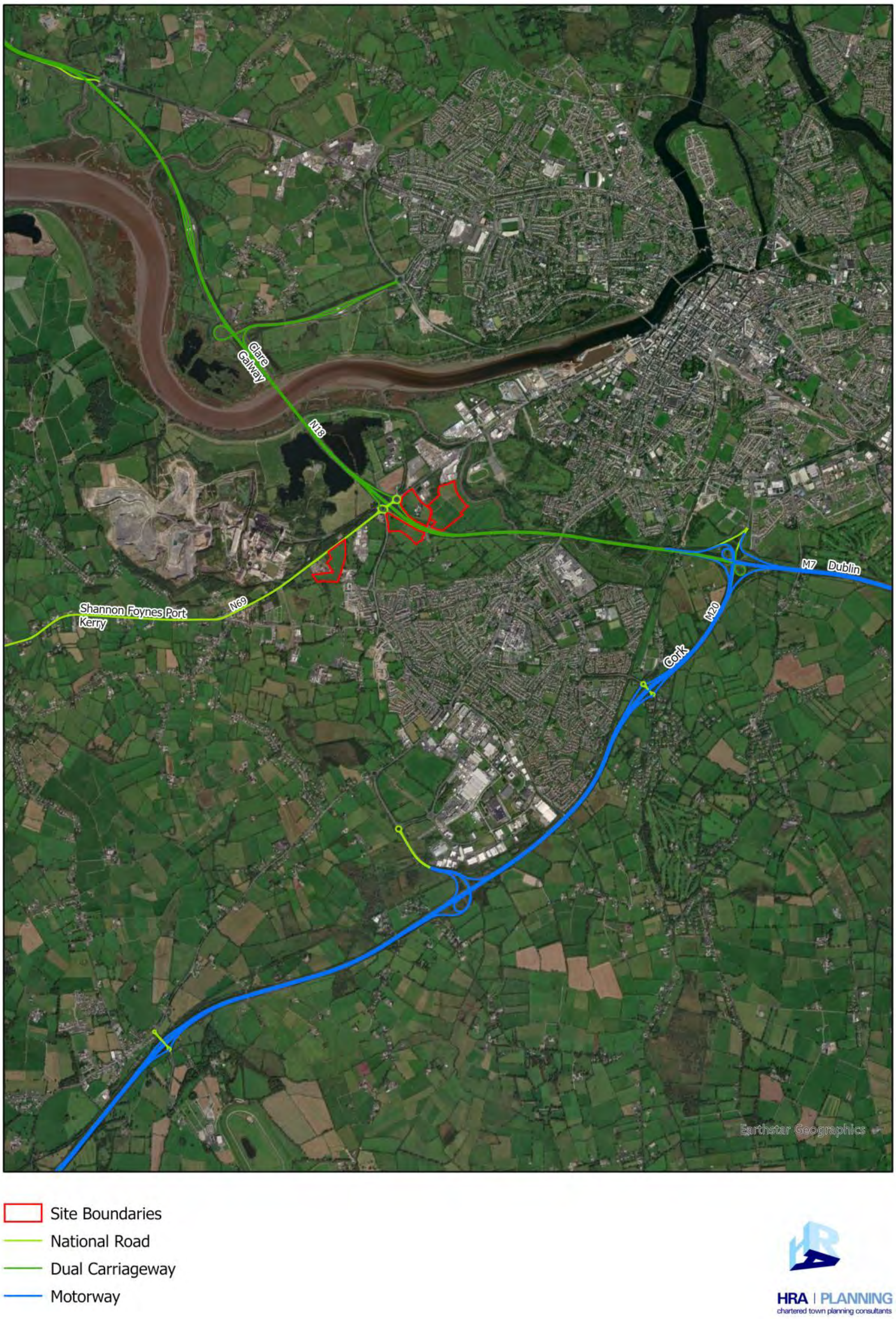
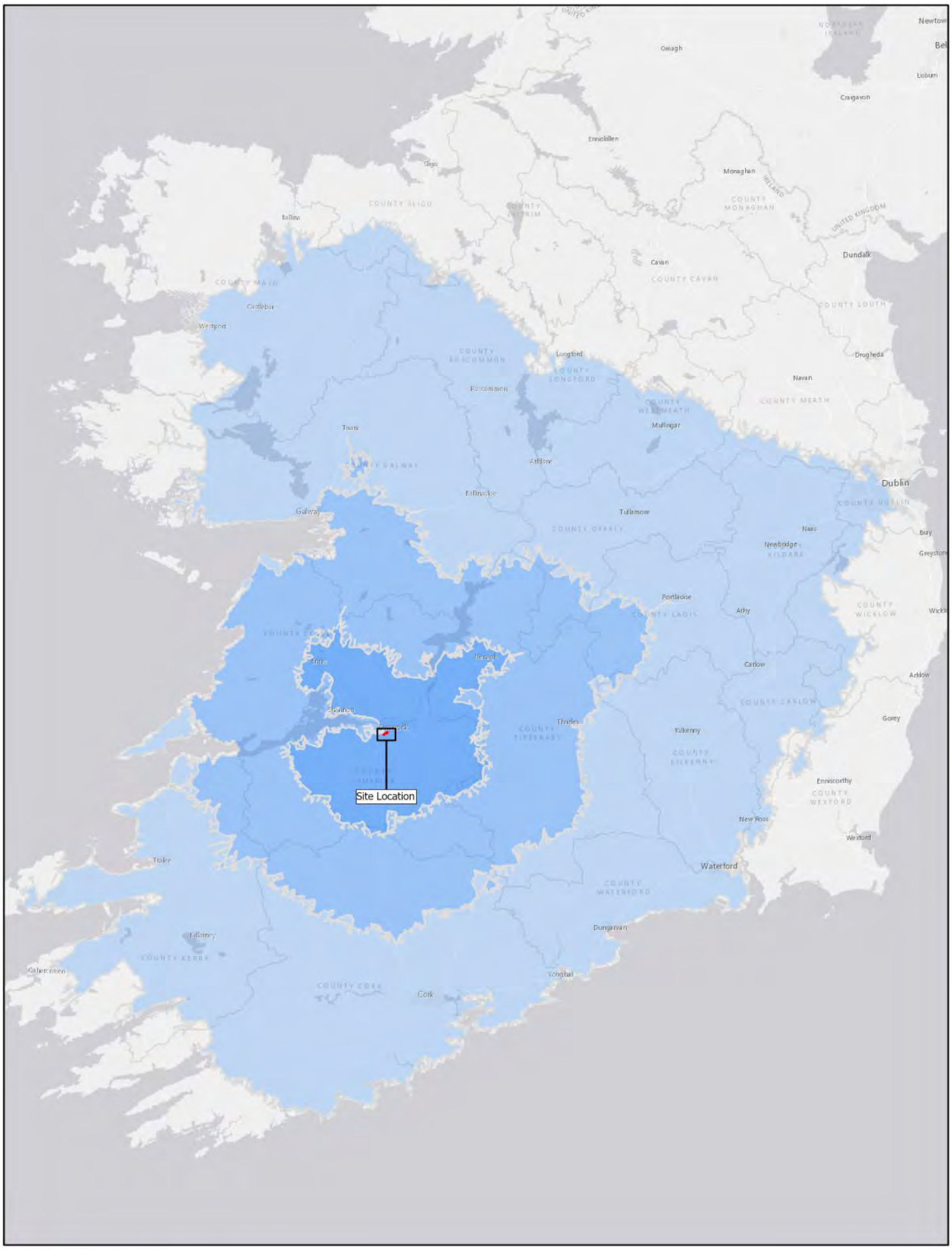


Figure 3 Strategic location on the local and national road network and edge of Metropolitan City area



Site Boundaries
30 Minute Drivetime from Sites
60 Minute Drivetime from Sites
120 Minute Drivetime from Sites

HRA | PLANNING
chartered town planning consultants

Figure 4 National Catchment proximity from the subject site by drivetime

Appendix: Flood Risk Assessment

PUNCH consulting engineers

Michael Gabbett Sites, Dock Road, Limerick

Site Specific Flood Risk Assessment

211262-PUNCH-XX-XX-RP-C-001

September 2021

Document Control

Document Number: **211262-PUNCH-XX-XX-RP-C-001**

Status	Rev	Description	Date	Prepared	Checked	Approved
S3	P01	Final Issue	3 September 2021	T. O'Connell	D. Egan	J. Tiernan

Table of Contents

Executive Summary

PUNCH Consulting Engineers carried out a Site-Specific Flood Risk Assessment in accordance with *"The Planning System & Flood Risk Management Guidelines*" published by the Department of the Environment, Heritage and Local Government in November 2009 for three sites located on the Dock Road.

The sites have all recently had portions of their lands rezoned in the Draft Limerick Development Plan as a result of the Flood Zone A designation in the Draft Strategic Flood Risk Assessment carried out by JBA Consulting on behalf of Limerick City and County Council. The sites zoning has changed from 'Enterprise and Employment' or 'Industrial' to new designations of 'Agriculture'.

Various potential sources of flooding specific to each site were assessed and relevant mapping and online portals were visited in order to define the flood risk at the site. The site was visited by PUNCH Consulting Engineers which verified the findings of the desktop study.

It was determined that all three sites are currently protected by existing flood defences on the River Shannon and Ballinacurra Creek to a varying degree and the actual flood risk to the site is currently low due to the protection that these flood defences currently offer.

However, the FRMG advise that food zones ignore the presence of defences. Therefore, it must be concluded that each site has an area designated Flood Zone A for coastal flooding as per the JBA mapping presented in the Draft SFRA.

If these flood defences could be accounted for, parts of the sites could be classified as Flood Zone C and Flood Zone B but the residual risk of flooding would still need to be accounted for.

Potential development options are discussed in the report based on the relevant flood zoning designation. Given the defended Flood Zone A areas noted on part of each site, development other than 'water compatible use' will be subject to a Justification Test in accordance with The Planning System and Flood Risk Management Guidelines dependent.

Given the low probability of flooding on the defended Flood Zone A designated site areas, it is highly likely that a 'less vulnerable use' such as 'Enterprise and Employment' could be justified. The sites are all well serviced in regard drainage and access requirements and would therefore benefit from a 'less vulnerable' use zoning. Further planning advice is required for the Planning Justification (Box 4-1).

As part of each site is located in a defended flood zone, the residual risk of flooding must be addressed. Potential flood mitigation measures appropriate for the sites were discussed and based on an appropriate site development proposal they can be explored further.

Appropriately zoned development on the defended Flood Zone A portions of the site can be delivered at low risk of flooding and not increase the risk of flooding to adjacent or nearby areas through the implementation of standard flood mitigation measures and specifically engineered development flood mitigation measures.

1 Introduction

1.1 Background

PUNCH Consulting Engineers were appointed by Mr Michael Gabbett to carry out a Site-Specific Flood Risk Assessment for a number of sites in the vicinity of the Dock Road, Limerick.

The assessment is carried out in full compliance with the requirements of "The Planning System & Flood Risk Management Guidelines" published by the Department of the Environment, Heritage and Local Government in November 2009.

1.2 Existing Site

The site locations are shown in Figure 1-1 below. The land is generally low-lying flat land.

Site 1: The site is a greenfield site located furthest from the city is approximately 5.9 hectares and is bound by the N69 to the north with Mungret Civic Amenity Centre and Dog Shelter to the northwest. The OPW Arterial Drainage Maintenance office is located outside the southeast corner of the site.

Site 2: This site is a greenfield site located to the east of the Dock Road East and West Roundabouts and is divided by the N18. The portion of the site to the south of the N18 is 3.9 hectares with no existing buildings or structures located within the site boundary. The portion to the north is 5.65 hectares with a farm and dwelling located centrally on the site.

Site 3: This site appears to be used for agriculture at present. It is located closest to the city and is bounded by Ballinacurra Creek to the northeast and N18 to the south. The site is approximately 11.9 hectares with Riverside Park and Blackberry Business Park to the west. The land is generally flat.

Figure 1-1: Location of the Proposed development (site boundary indicated in red)

2 Relevant Guidance

2.1 The Planning System and Flood Risk Management Guidelines

In September 2008, "The Planning System and Flood Risk Management" Guidelines were published by the Department of the Environment, Heritage and Local Government in Draft Format. In November 2009, the adopted version of the document was published.

The Flood Risk Management Guidelines give guidance on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management in the planning system. The core principle of the guidelines is to adopt a flood risk sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for river and coastal flooding. The guidelines include definitions of Flood Zones A, B and C, as noted in Table 2-1 below. It should be noted that these do not take into account the presence of flood defences, as there remain risks of overtopping and breach of the defences.

Table 2-1: Flood Zone Designation

Flood Zone	Type of Flooding	Annual Exceedance Probability (AEP)
Flood Zone A	Coastal	Less than a 1:200 (0.5% AEP) year event
	Fluvial	Less than a 1:100 (1% AEP) year event
Flood Zone B	Coastal	Greater than a 1:200 (0.5% AEP) and less than a 1:1000 (0.1% AEP) year event
	Fluvial	Greater than a 1:100 (1% AEP) and less than a 1:1000 (0.1% AEP) year event
Flood Zone C	Coastal	Greater than a 1:1000 (0.1% AEP) year event
	Fluvial	Greater than a 1:1000 (0.1% AEP) year event

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

A three staged approach to undertaking an FRA is recommended:

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

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

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

This report addresses the requirements for Stage 2.

2.2 Local Area Plan

The proposed site is covered by the Southern Environs Local Area Plan 2011-2017 which states the flowing with regards to flood risk:

Objective IN 5: Flood risk assessment

It is an objective of the Council to require a comprehensive flood risk assessment for proposals in zoned areas at risk of flooding or areas adjoining same. The effects up and down stream shall be considered as should the cumulative effects of these developments. Flood risk assessment shall be carried out to the appropriate level of detail to demonstrate that flood risk to and from the development can and will be adequately managed. Such assessment will have to be guided by the contents of the The Planning Systems and Flood Risk Management (November 2009) guidelines and any subsequent guidance on the topic. Where development is permitted in areas subject to flooding, flood mitigation requirements will be required by the Council in terms of design, both internal and external and in layout and in the provision of appropriate Sustainable Urban Drainage Infrastructure (SUDS).

Objective IN 6: Flood risk and the Shannon CFRAM report

It is an objective of the Council to be guided by the measures proposed by the forthcoming Shannon CFRAM report.

2.3 DRAFT LCCC Development Plan

The Draft Limerick Development Plan dated 2022 to 2028 is now available and states the following regarding flood risk:

Policy CAF P5: Managing Flood Risk

It is a policy of the Council to protect Flood Zone A and Flood Zone B from inappropriate development and direct developments/land uses into the appropriate lands, in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009' (or any superseding document) and the guidance contained in Development Management Standards. Where a development/land use is proposed that is inappropriate within the Flood Zone, then the development proposal will need to be accompanied by a Development Management Justification Test and site specific Flood Risk Assessment in accordance with the criteria set out under 'The Planning System and Flood Risk Management Guidelines for Planning Authorities 2009' and Circular PL2/2014 (as updated/ superseded). In Flood Zone C, the developer should satisfy themselves that the probability of flooding is appropriate to the development being proposed and should consider the implications of climate change.

Objective CAF O20: Flood Risk Assessments

It is an objective of the Council to require a Site-specific Flood Risk Assessment (FRA) for all planning applications in areas at risk of flooding (coastal/tidal, fluvial, pluvial or groundwater), where deemed necessary. The detail of these Site-specific FRAs (or commensurate assessments of flood risk for minor developments) will depend on the level of risk and scale of development. A detailed Site-specific FRA should quantify the risks, the effects of selected mitigation and the management of any residual risks. The assessments shall consider and provide information on the implications of climate change with regard to flood risk in relevant locations.

Objective CAF O22: Cooperation with Other Agencies

It is an objective of the Council to work with other bodies and organisations, as appropriate, to help protect critical infrastructure, including water and wastewater, within Limerick, from risk of flooding. Any subsequent plans shall consider, as appropriate any new and/or emerging data, including, when *available, any relevant information contained in the CFRAM Flood Risk Management Plans and as recommended in the SFRA for the Draft Plan.*

Objective CAF O23: Flood Relief Schemes

It is an objective of the Council to support and facilitate the development of Flood Relief Schemes as identified in the CFRAM 10 Year Investment Programme.

Objective CAF O24: Minor Flood and Mitigation Works and Coastal Protections Schemes

It is an objective of the Council to support and facilitate the Office of Public Works Minor Flood and Mitigation Works and Coastal Protections Schemes.

Objective CAF O25: Strategic Flood Risk Assessment

It is an objective of the Council to have regard to the recommendations set out in the Draft Strategic Flood Risk Assessment prepared to support the Draft Plan.

2.4 Land Zoning

The proposed sites are currently zoned in the Southern Environs Local Area Plan 2011-2017. See extract below in Figure 2-1 from Map 1A of the Southern Environs Local Area Plan 2011-2017.

Site 1 is predominantly 'Industrial' with the north eastern corner zoned as 'Enterprise and Employment'. The location of the new link road is proposed to run diagonally through the site, from the southern boundary to the eastern. There is also a road proposed to connect the existing N69 to the proposed link road which runs from the northern point of the site to the eastern.

Site 2 is fully zoned as 'Enterprise and Employment' with the proposed link road running along and adjacent to the southern and southeastern site boundaries.

Approximately two thirds of Site 3 is also zoned as 'Enterprise and Employment'. The remaining third on the eastern end of the site is zoned as 'Semi-natural Open Space', taking into account that Ballinacurra Creek is running along the eastern border.

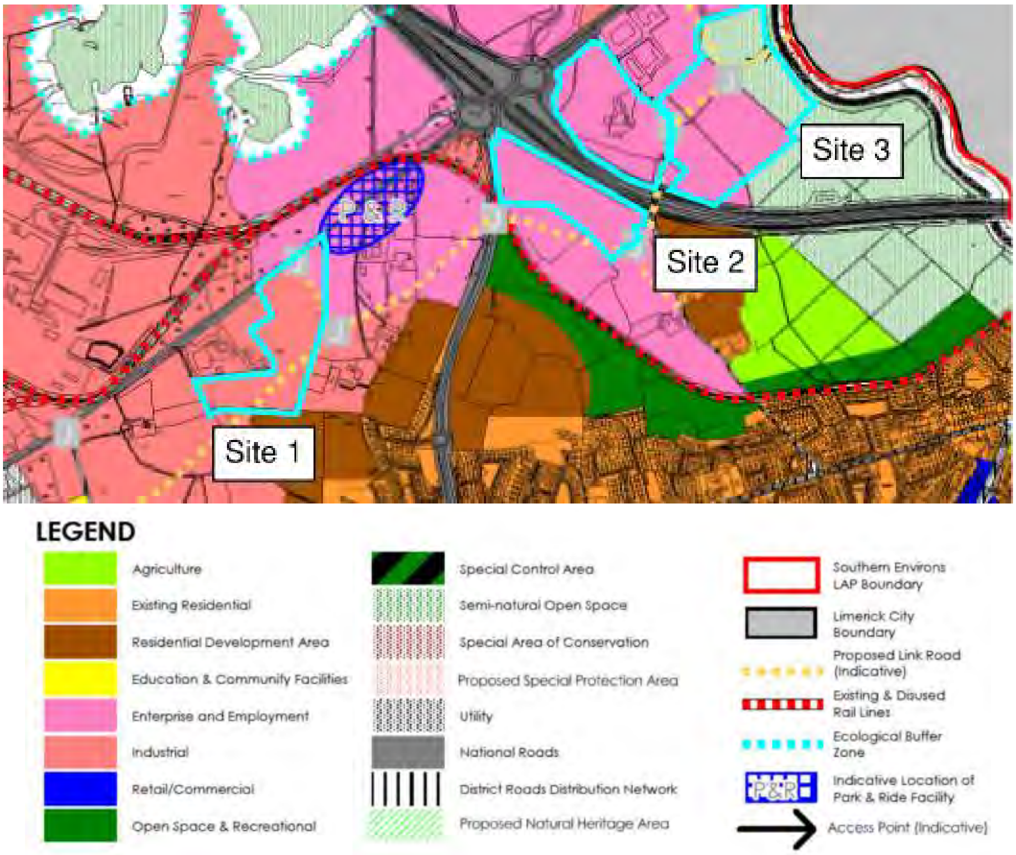


Figure 2-1: Southern Environs Zoning Map - Southern Environs Local Area Plan 2011-2017

The Draft Limerick Development Plan dated 2022-2028 is proposing to change the zoning of these sites to a mix of 'Enterprise and Employment' and 'Agriculture' with the area adjacent to Ballinacurra Creek remaining as 'Semi-natural Open Space'.

Approximately 50% of Site 1 is zoned as 'Enterprise and Employment' with the most northern and western areas zoned for 'Agriculture'. Unlike the existing Development Plan for the area, there is no proposed link road within the site boundary.

Similar to Site 1 above, approximately 50% of Site 2 is zoned as 'Enterprise and Employment' with the remaining site zoned for 'Agriculture'. There is also an 'Existing Residential' zone shown in the middle of the site to the east of the N18. The proposed link road is shown along the southern boundary of the site.

Only a small section of the southwestern corner of Site 3 remains zoned for 'Enterprise and Employment' with the remainder changing to 'Agriculture' in the draft Limerick Development Plan. The eastern area of the site, adjacent to Ballinacurra Creek, is to remain zoned as 'Semi-natural Open Space'.

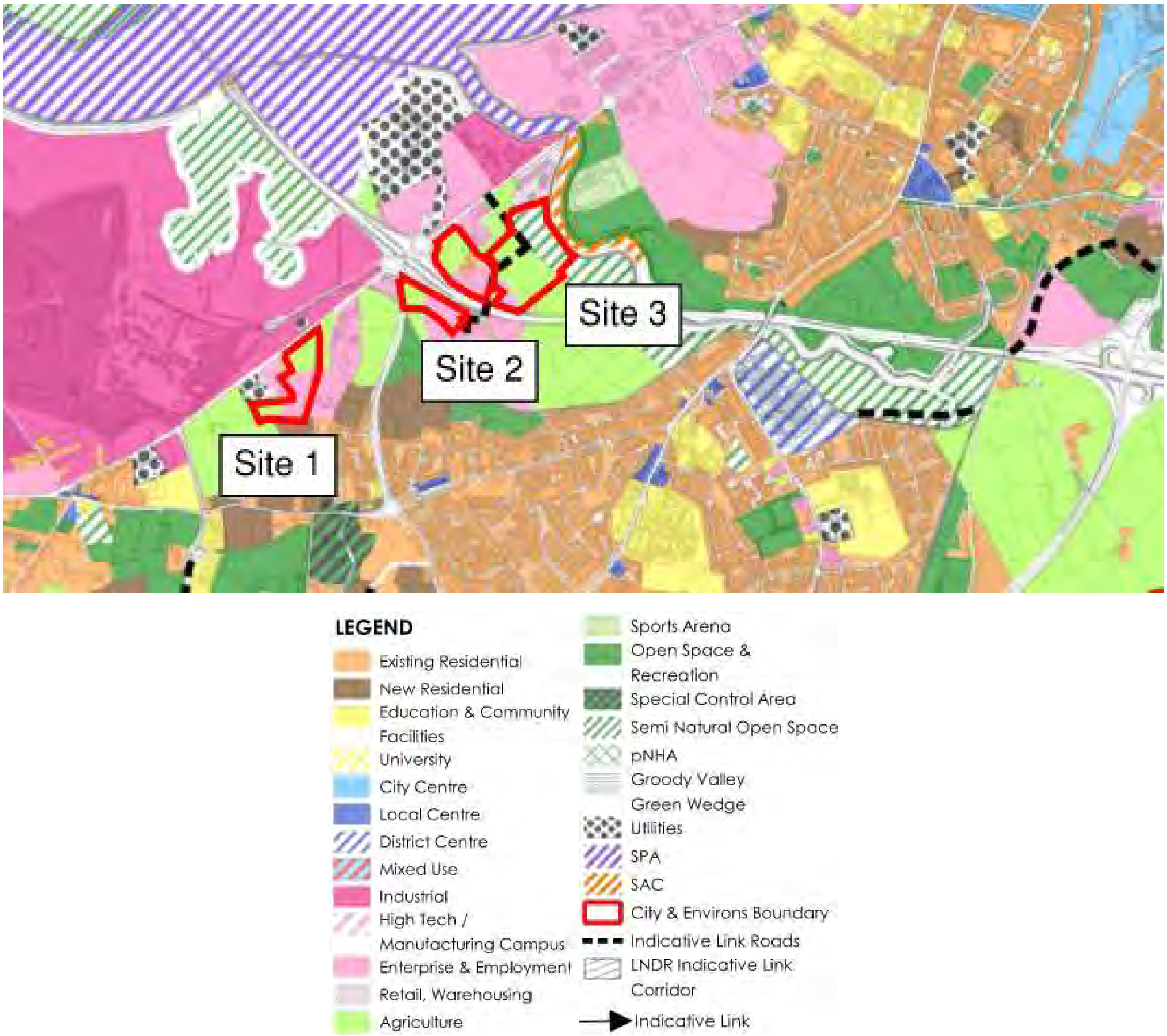


Figure 2-2: Extract from Land Use Zoning Map – Draft Limerick Development Plan 2022-2028

2.5 Flood Risk Management Plan

The OPW publish Flood Risk Management Plans detailing the feasible range of flood risk management measures proposed for their respective river basins. The Flood Risk Management Plan for the Shannon Estuary South River Basin was published by the OPW in 19/02/2018 and is valid for the period 2018-2021. The plan lists current flood management measures in place and potentially viable Flood Relief Works.

3 Flood Risk Identification

3.1 Existing Hydrogeological Environment

The existing hydrological environment is characterised primarily by the presence of the Shannon Estuary which is located approximately 1.2km north of the Dock Road.

Sites 1 & 2 are located approximately 500m south of Bunlicky Lake.

Running adjacent to the eastern boundary of Site 3 is Ballinacurra Creek which flows from southeast to northwest.

The hydrological environment around the site is shown in Figure 3-1 below.

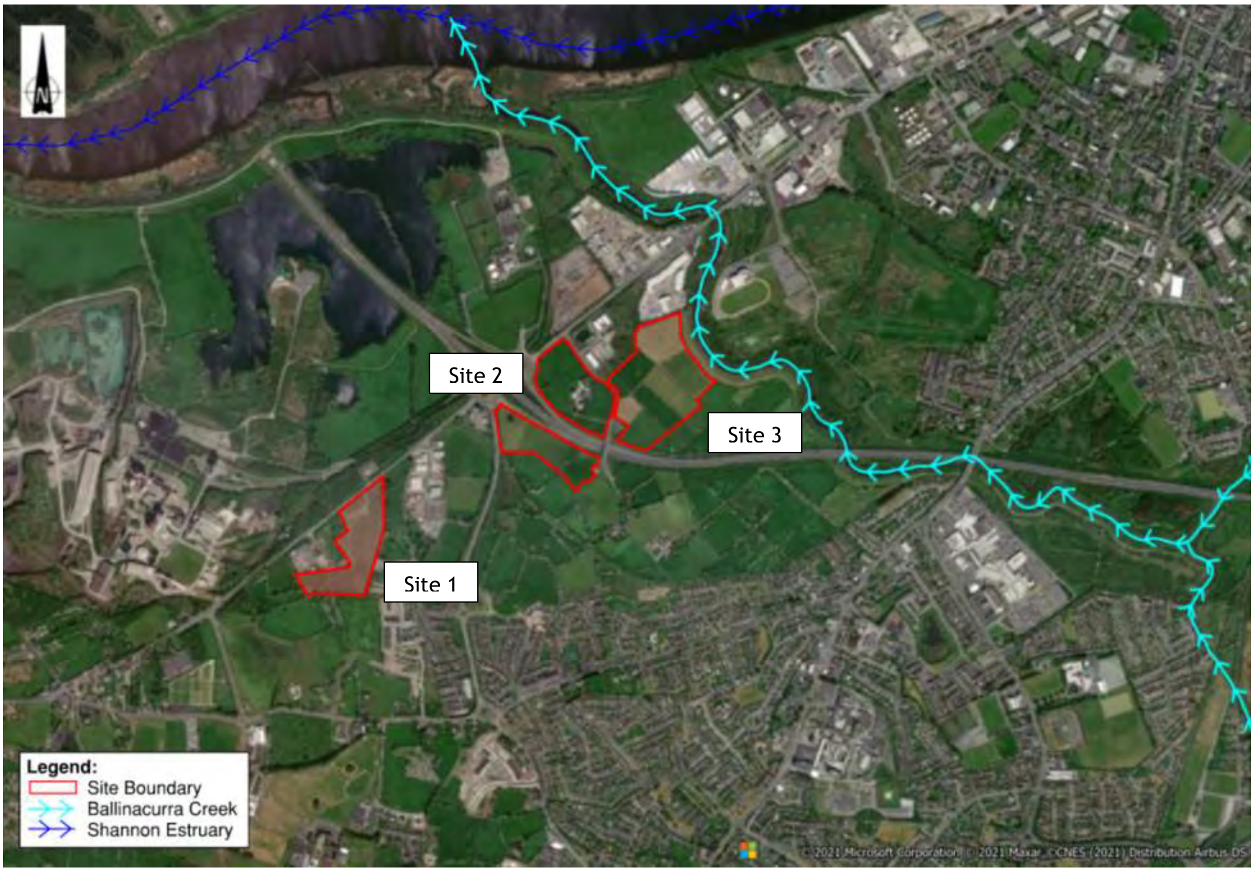


Figure 3-1: Hydrological Environment around the site

All three sites are located within the lands benefitted by the Shannon Embankments South Scheme. The land is also located within the OPW Ballynaclogh Arterial Drainage Scheme which drains into the Shannon Estuary. Refer to Figure 3-12 below.

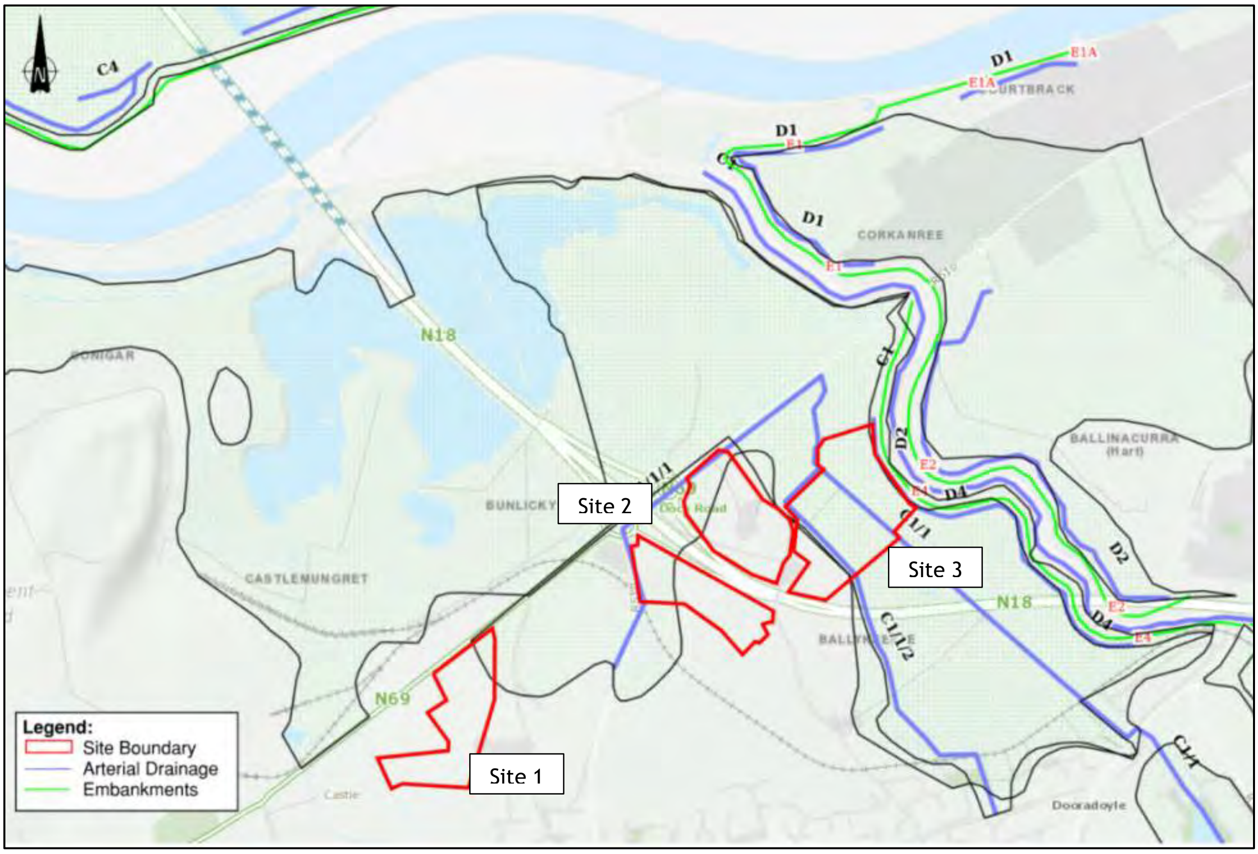


Figure 3-2: Extract from OPW Arterial Drainage Mapping

3.2 Topographical Survey

Topographical surveys of the sites and their environs were reviewed as well as available online contour mapping for each site. The information showed that Sites 1 & the western side of Site 2 are generally higher to the south and fall towards the N69. Site 3 and the eastern section of Site 2 are generally higher on the western side near the N18 and both fall eastwards.

3.3 Site Walkover

PUNCH Consulting Engineers visited the site on the 25th of August 2021 to assess the conditions and key features of the site, to establish any potential sources of flooding and to identify the likely routes of flood waters. Appendix A contains a selection of key images taken during the site visits.

The following was established from the site visit. Site 2 is split between 2 sections either side of the motorway. The comments below are therefore split into Site to east and west respectively for clarity:

a) Site 1
   i. Site 1 is currently accessed from the south side of the N69.
   ii. The site is existing farmland and was recently cut for silage.
   iii. The site is subdivided into a number of fields separated by electric fencing
   iv. There is an existing ruined house located in the middle of the site. The house is abandoned and in a state of significant disrepair.
   v. There was a spot of wet ground observed in the south-west corner. The ground in this area was wet with water visible in spots.
   vi. The majority of the site was dry with good ground conditions
   vii. The site is highest in the south with levels falling from south to north across the site

b) Site 2 West
   i. Site 2 West is currently accessed from a small local road to the south. The access is gated.
   ii. The site is farmland and is used for grazing livestock.
   iii. There is an existing drain along the southern portion of the western boundary of the site. This appears to tie in with the OPW channel noted in Section 3.1 above.
   iv. Ground conditions on site were observed to be dry at the time of the visit
   v. Levels on the site are highest to the south and fall away from south to north across the site.

c) Site 2 East
   i. There is an existing farmyard and residential property in the middle of the site with the rest of the site is farmland.
   ii. There is an existing drainage ditch along the southern boundary of the site. The ditch was dry at the time of the visit. Ditch depth approximately 1.5m.
   iii. Ground conditions were dry at the time of the visit.
   iv. There are 3 no access points to the site. from the existing road to the south which lead to the farmland and farmyard respectively and a 3rd entrance from the road to the east which accesses the existing property.
   v. The site is generally flat on the northern portion of the site with falls from the southeast towards the northwest.

d) Site 3
   i. The site is generally flat with a fall from the existing road to the west before levelling off across the rest of the site.
   ii. The site is accessed from the existing road to the west.
   iii. The site is currently used for grazing animals
   iv. There are 3 no drainage ditches crossing the site as shown in Section 3.1. Two of the ditches cross the site from south to north and the third flows from south to north along the eastern boundary of the site.
   v. The 3 ditches are crossed by existing culverted crossings
   vi. All channels were observed to be approximately 2.1m deep.
   vii. There are existing flood embankments just outside the eastern boundary of the site along Ballinacurra Creek.

3.4 Site Geology

The geology of the sites were reviewed using data from the Geological Survey of Ireland (available at www.gsi.ie). The soil type at the location of the proposed development is identified as predominately marine/ estuarine sediments and deep well drained mineral (mainly basic) as seen in Figure 3-3.

Site 1 is predominately deep well drained mineral with some areas of marine/ estuarine, mineral poorly drained, peat and shallow well drained mineral.

Site 2 is composed of marine/ estuarine with some areas of mineral poorly drained, deep well drained mineral and shallow well drained mineral.

Site 3 is mainly marine/ estuarine with some areas of made ground, mineral poorly drained and deep well drained mineral.

The surrounding areas comprise mainly of deep well drained mineral (mainly basic), marine/ estuarine and made ground.

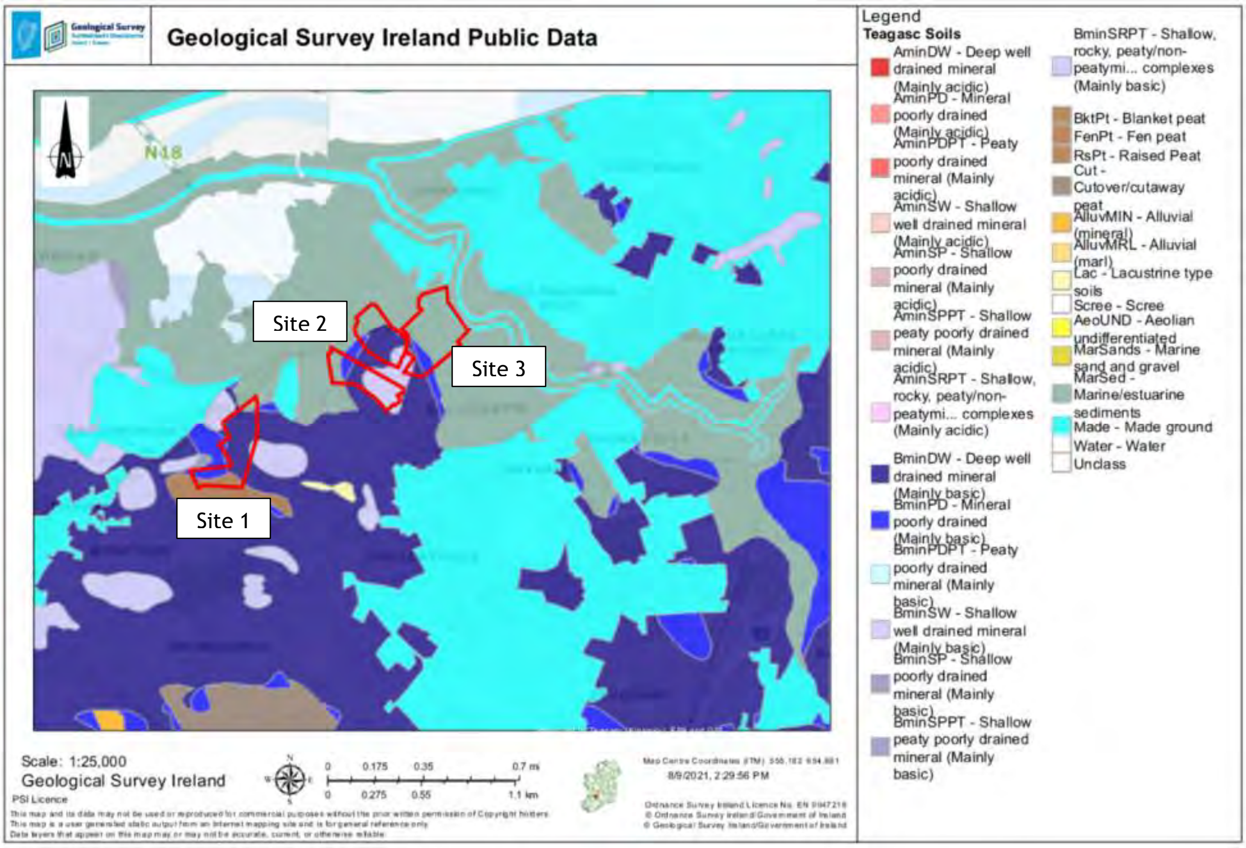


Figure 3-3: Geology of the surrounding area (source: Geological Survey of Ireland (www.gsi.ie))

3.5 Groundwater Flooding

A review of the groundwater mapping shows that there is no groundwater flooding risk in this area.

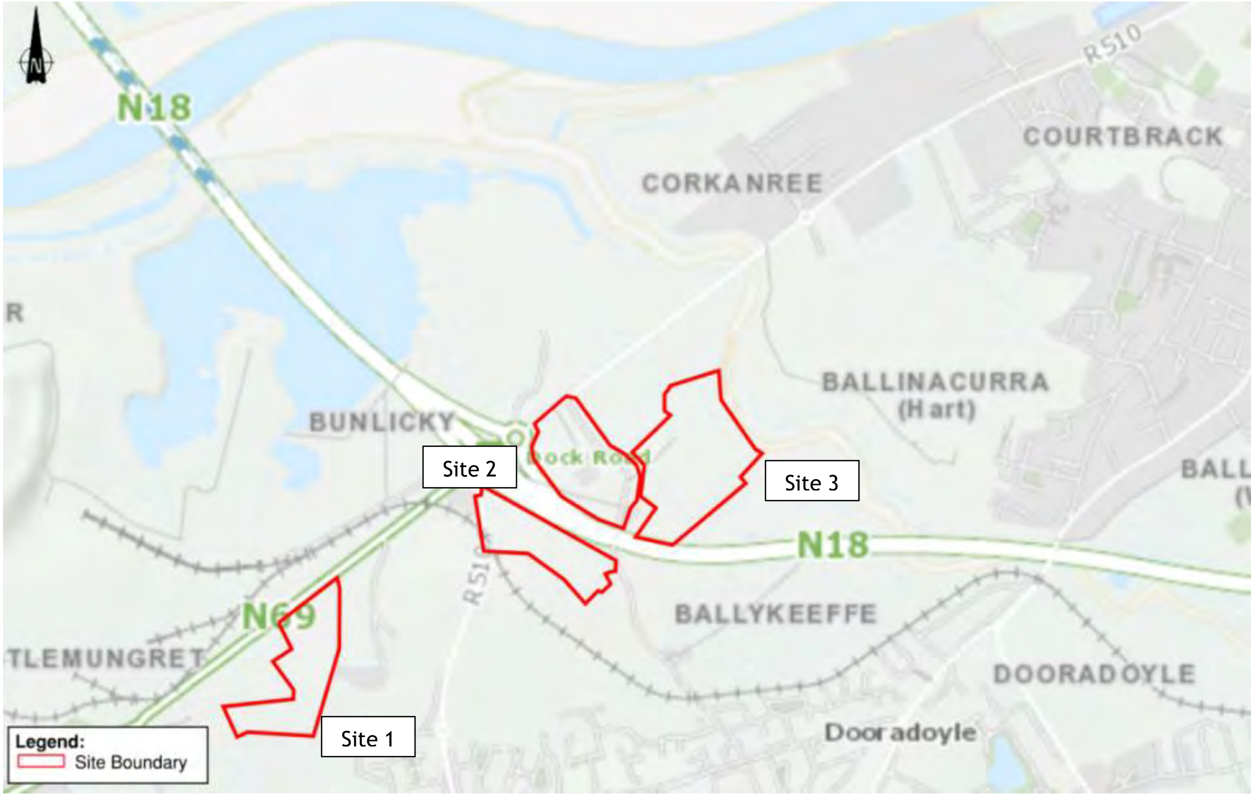


Figure 3-4: Groundwater Flooding Mapping

https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc

3.6 Review of Historic Mapping

A review of the OSI Historical maps[1] was carried out. Figure 3-5 shows an extract from the 25-inch historic map for the site. None of the sites are not indicated as "liable to flood" in the available historic OSI maps.

Figure 3-5: Extract from OSI historical 25-inch map

[1] Maps available: http://map.geohive.ie/mapviewer.html

3.7 History of Flooding

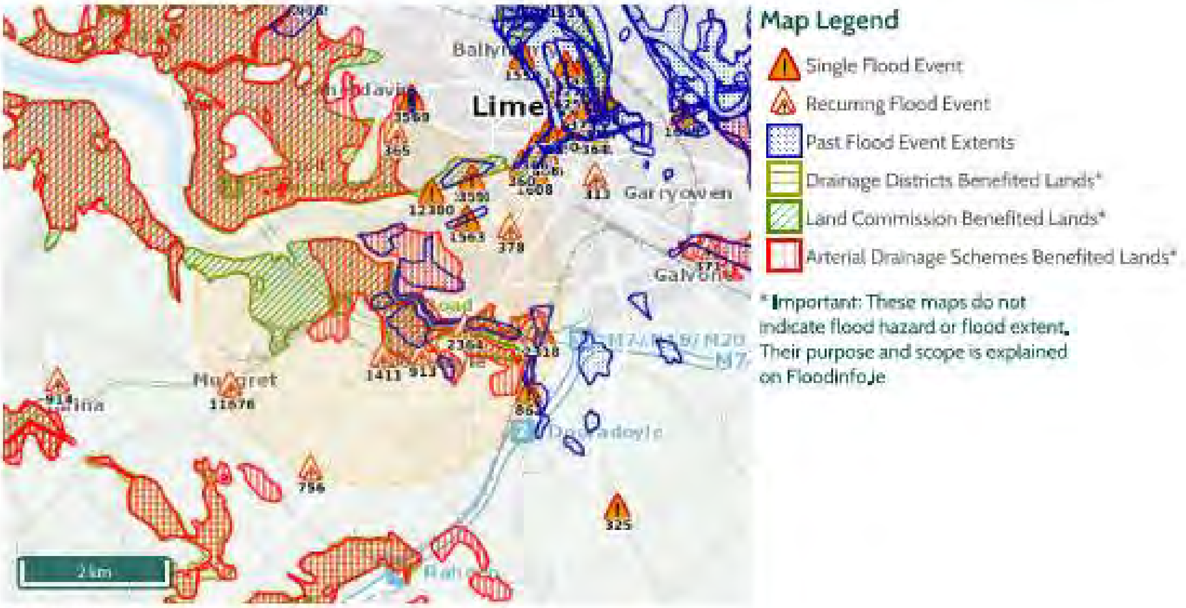
The Office of Public Works (OPW) Flood Hazard Mapping website holds a record of historic flood events. A review of the database indicated that there have been historical instances of flooding on Site 3 which is bounded by the Ballinacurra Creek, as shown in Figure 3-6**Error! Reference source not found.**, see Appendix B for full report. Please note that this is not a guaranteed record of all flood events.

Past Flood Event Local Area Summary Report OPW

Report Produced: 5/8/2021 16:48

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the "Website"). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



21 Results

Figure 3-6: Extract from OPW Floodmaps Database Report (see Appendix B for full report)
http://www.floodmaps.ie/index.aspx?ReturnUrl=%2fView%2fDefault.aspx

There is only a single flooding occurrence recorded on the proposed sites relating specifically to Site 3as outlined below:

Raheen Dooradoyle, Limerick February 1990:

Flooding to some extent or other has been a fairly regular event in certain area of the catchment for a number of years. In early February 1990, following a period of extreme rainfall and high tides, widespread flooding occurred in the catchment. See Figure 3-7 below for areas affected by the event.

Figure 3-7: Flooding experienced in 1990

3.8 Preliminary Flood Risk Assessment Mapping

The Catchment Flood Risk Assessment and Management Study (CFRAMS) is a national programme which to date has produced both a series of Preliminary Flood Risk Assessments (PFRA) which cover the entire country, as well as more detailed flood maps in certain catchments across the country.

Prior to the publication of the detailed CFRAMS flood mapping, a series of Preliminary Flood Risk Assessment (PFRA) maps were published. The PFRA flood zones are shown in Figure 3-3 below.

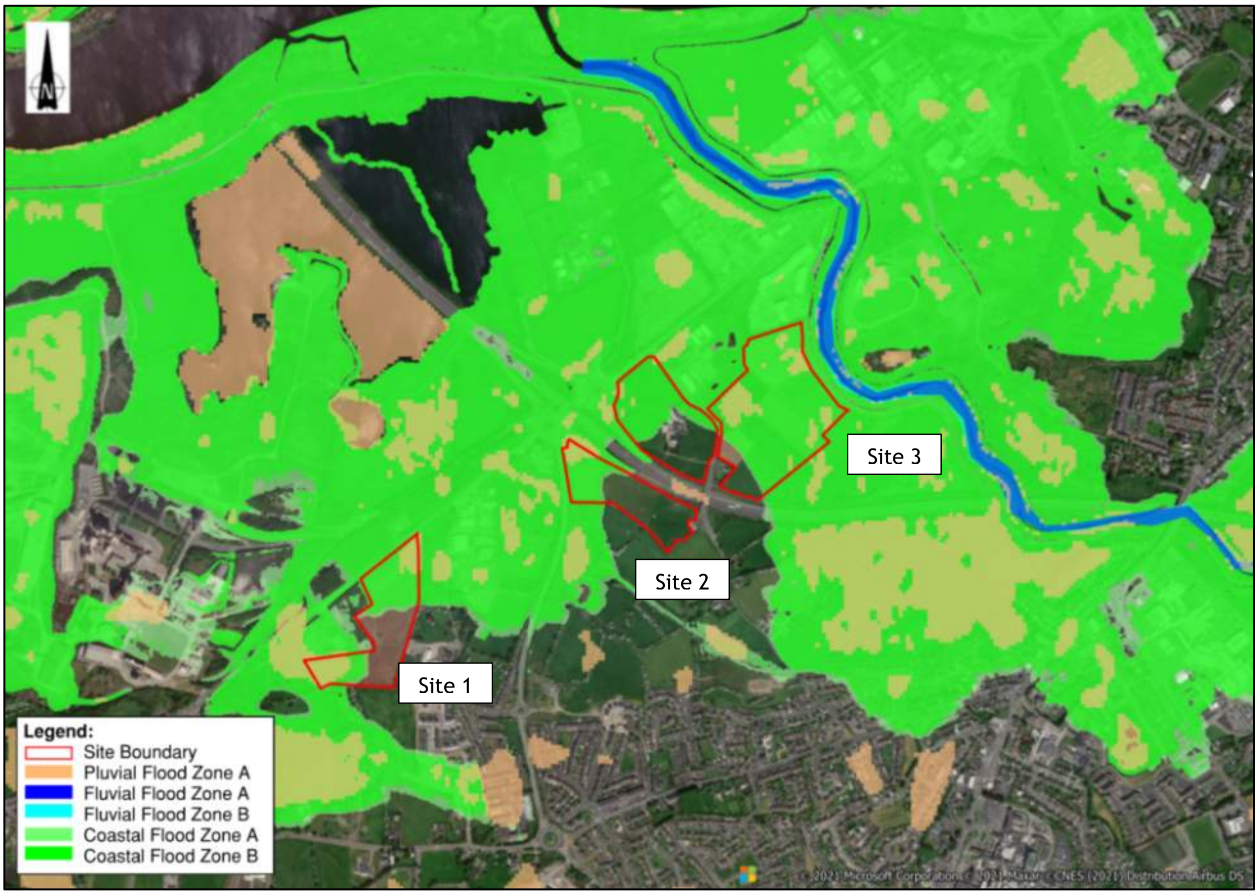


Figure 3-3: PFRA flood zone map indicating extents of preliminary flood zones

The PFRA mapping shown above indicates the sites are each partially located in Preliminary Coastal & Pluvial Flood Zone A.

It is noted that the PFRA modelling is a high-level study which uses a coarse ground to represent the topography of the country and does not take existing flood defences into account. As such PFRA fluvial, pluvial and coastal flood extents are to be utilised as an initial assessment only.

3.9 CFRAMS Mapping

As part of the CFRAMS programme, mapping is available online for public viewing, and the local area has been assessed as part of the Shannon CFRAMS. The OPW has published detailed flood hazard mapping for the area based on results from the CFRAMS. This includes flood extent and flood depth mapping for a number of return periods for fluvial and coastal flood events. The CFRAMS assessment in this area is based on hydraulic modelling of the River Shannon and its tributaries.

Figure 3-4 below is an extract from the relevant Shannon CFRAMS fluvial flood map and Figure 3-5 overleaf is an extract from the relevant Shannon CFRAMS coastal flood map for the area surrounding the proposed development site. Full CFRAMS maps for the area are included in Appendix C of this report.

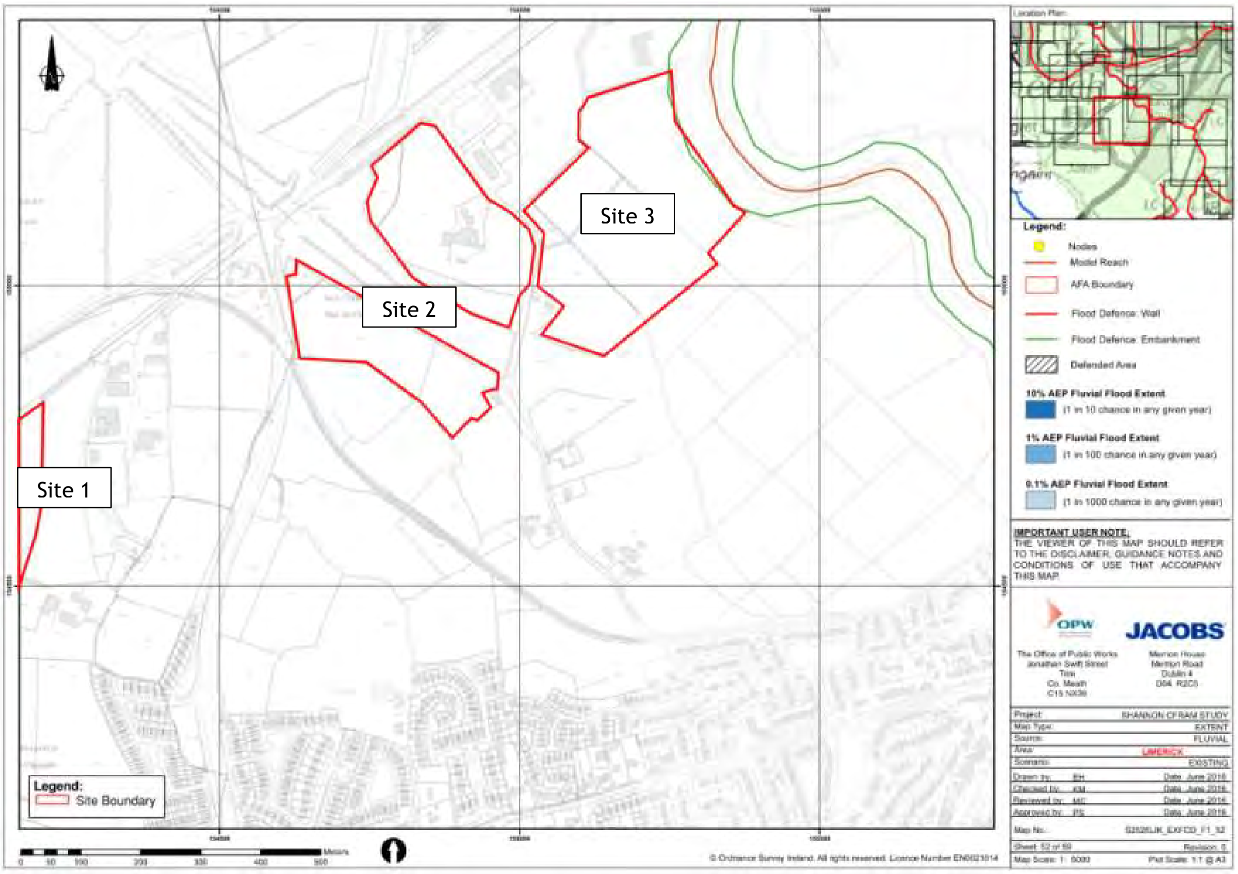


Figure 3-4: Extract from the CFRAMS fluvial map for the area (site indicated in red)

[1] **Maps available:** http:// http://www.floodinfo.ie/map/floodmaps/?X=6919597.223688143&Y=-959644.9352880842&Z=15

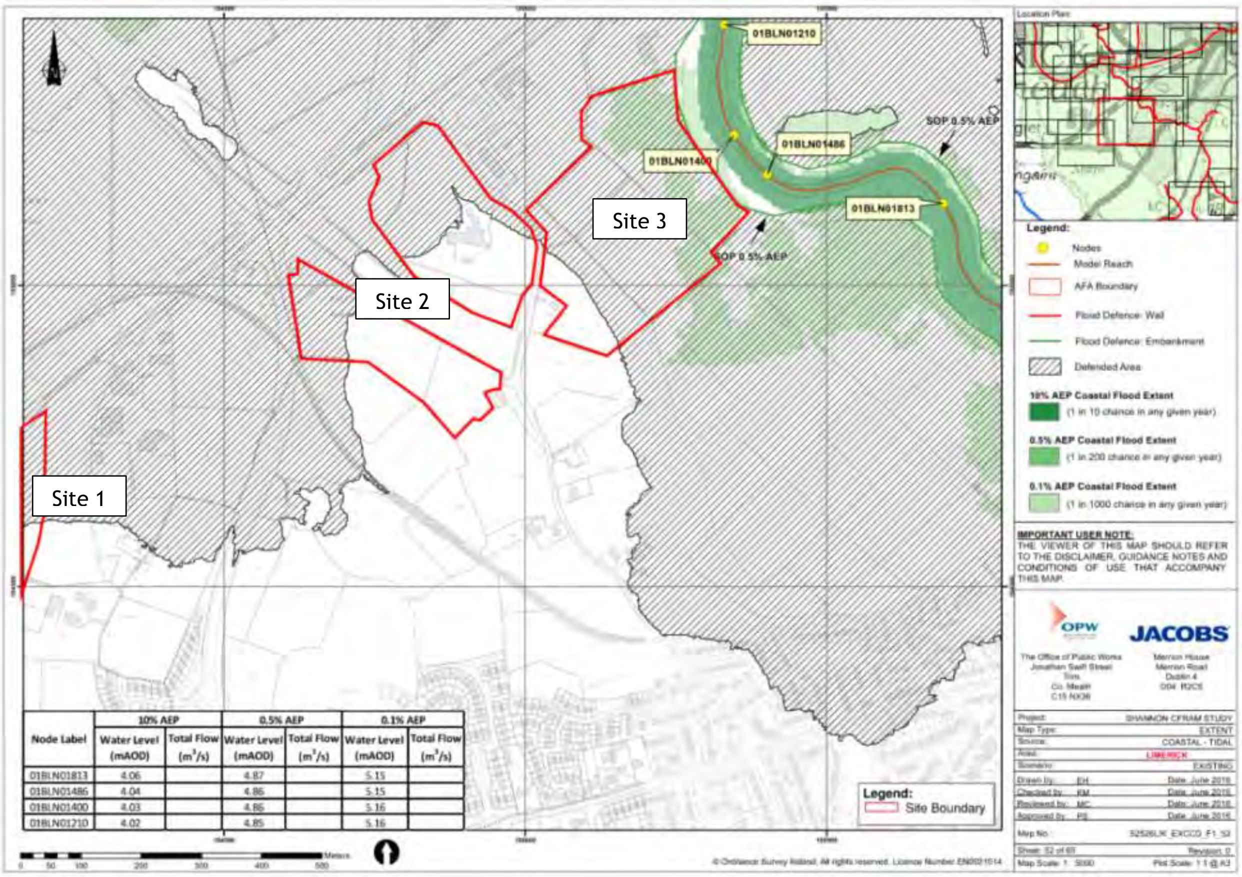


Figure 3-5: Extract from the CFRAMS coastal map for the area (site indicated in red)

The CFRAM mapping indicates that there is a 0.1% AEP Coastal Flood Extent partially noted on Site 3 (green hatch) and that each of the sites is partially noted as located in a 'Defended Area'.

LCCC has advised that the 0.1% AEP Coastal Flood Extent shown is the predicted flood level at the site during a breach of the flood defences when fully functional.

The closest node to the site notes flood levels in the Ballinacurra Creek as per Table 3-1 below. This level ignores the presence of flood defences altogether and also corresponds to the extent of the Defended Area noted on the mapping.

Table 3-1: CFRAM Coastal Predicted Flood Levels in Ballinacurra Creek in Vicinity of Site

Node	0.5% AEP (mAOD)	0.1% AEP (mAOD)
01BLN01400	4.86	5.16

3.10 Existing Flood Defences

The CFRAM maps shown in Figure 3-49 and Figure 3-5 identify a flood defence embankment located on the eastern boundary of Site 3. There are flood defence embankments located along both banks of Ballinacurra Creek in the vicinity of the site. These defences are noted as providing a standard of protection of 0.5% AEP. Flood mapping presented in the CFRAMS study ignores the presence of flood defences.

3.11 Breach Analysis

As part of the CFRAM Study, a breach analysis was carried out to assess the potential flood extents in the event of a breach failure as part of the Preliminary Options Report for the Unit of Management (UoM) 25 and 26 (2016). In May 2018 the OPW released the Flood Risk Management Plan for the Shannon Upper & Lower, River Basin 25/26. A number of locations on the tidal reaches of the Shannon and the Ballinacurra Rivers were analysed as part of this to assess the effect of a failure in flood defences on the surrounding area. Upon a review of this analysis, PUNCH identified three of these locations which impacted upon the site of the proposed development. It appeared that the embankment for the N18 National Primary Route behaved as an effective barrier to large tidal inundations from both sides. Of the three breach locations which impacted the site, one breach location is located to the west of the N18 and the two further locations that impacted the site were on the east. The locations of the breaches which impacted the study site are identified in Figure 3-6 below.

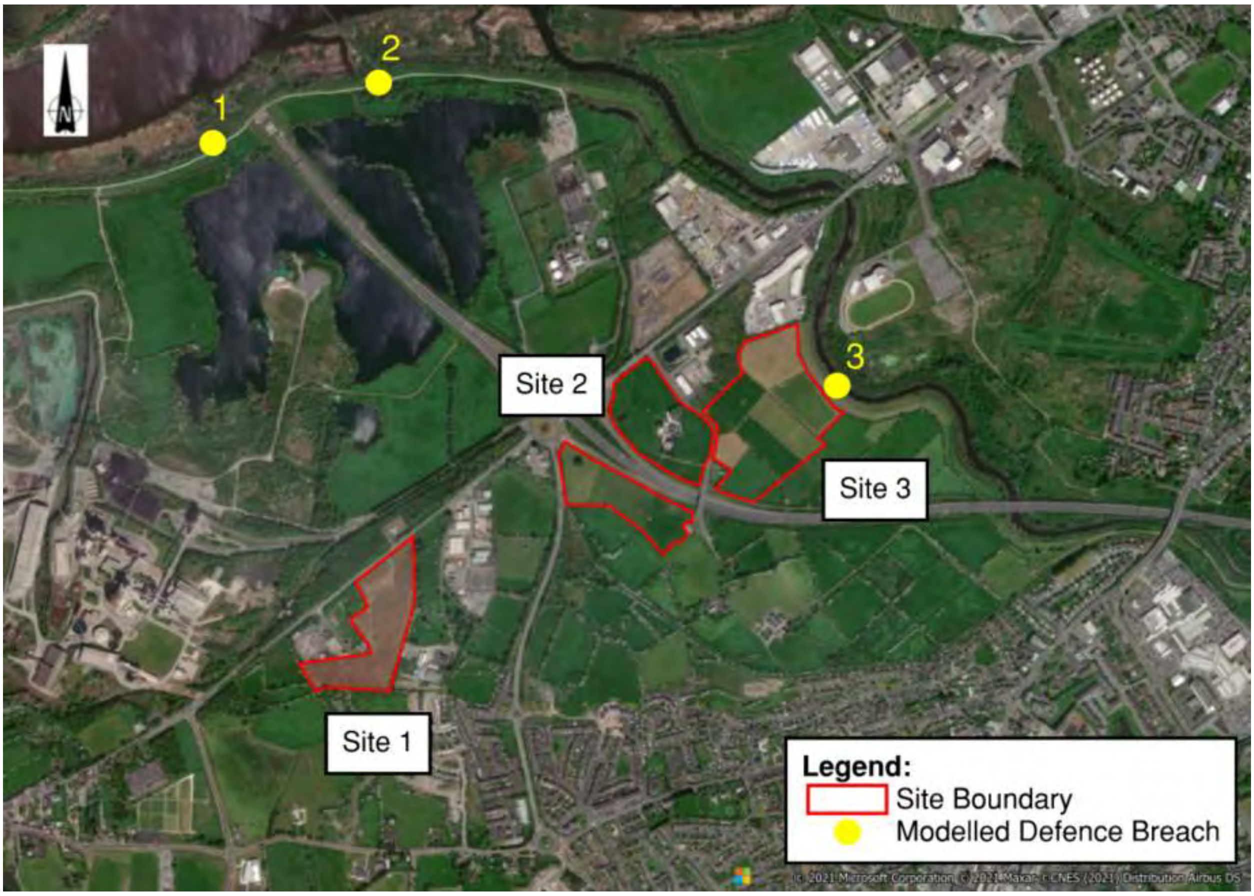


Figure 3-6: Locations of modelled CFRAMS defence breaches which impacted upon the site

The modelled breach which had the largest impact on the sites were location 2 for Site 2 and 3 for Site 3 as shown in Figure 3-6 above.

An extract from these maps, with the site boundary overlain, shows the flood extents and the flood depths at the site.

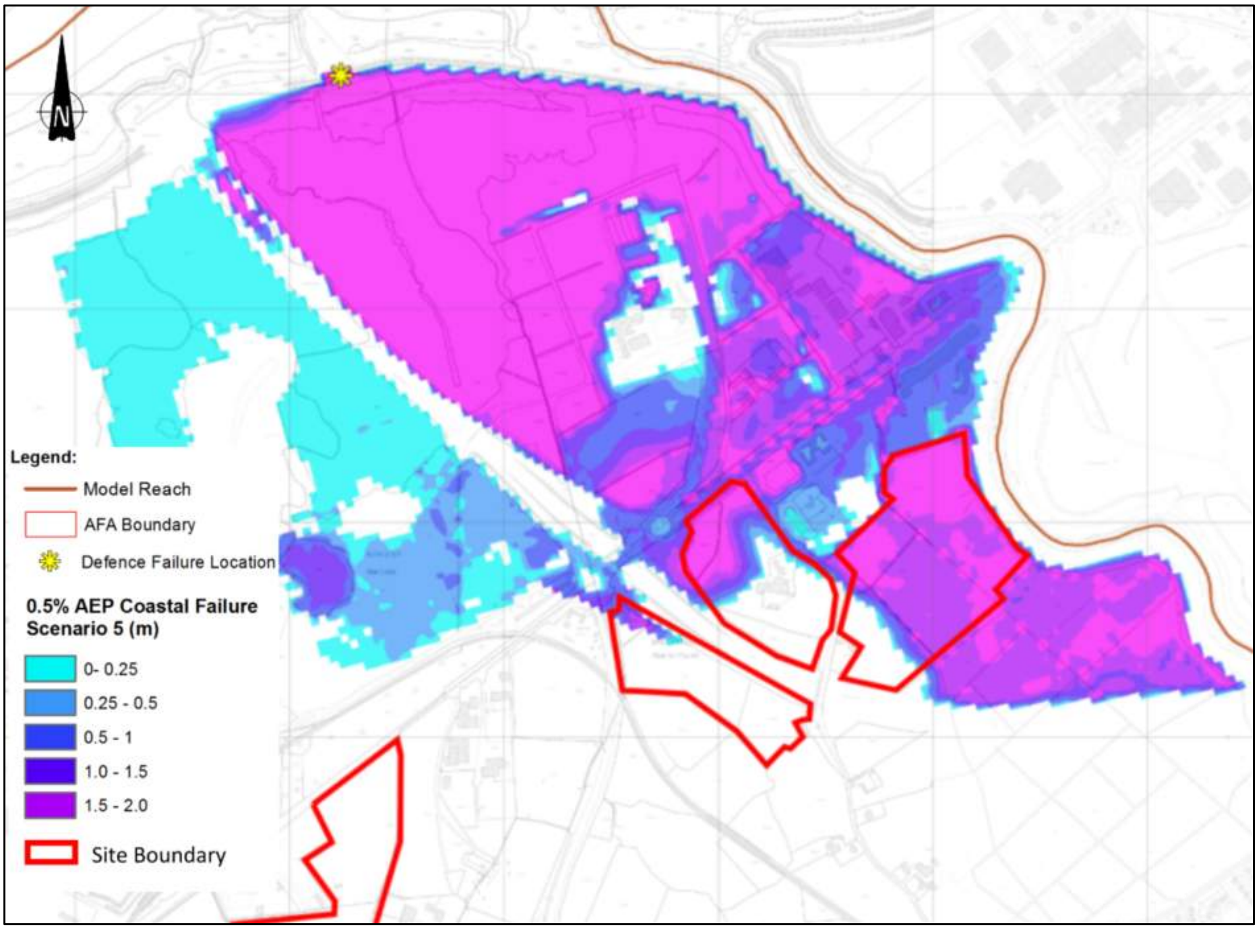


Figure 3-7: Point 2 0.5% AEP Flood extents from breach on River Shannon flood embankments

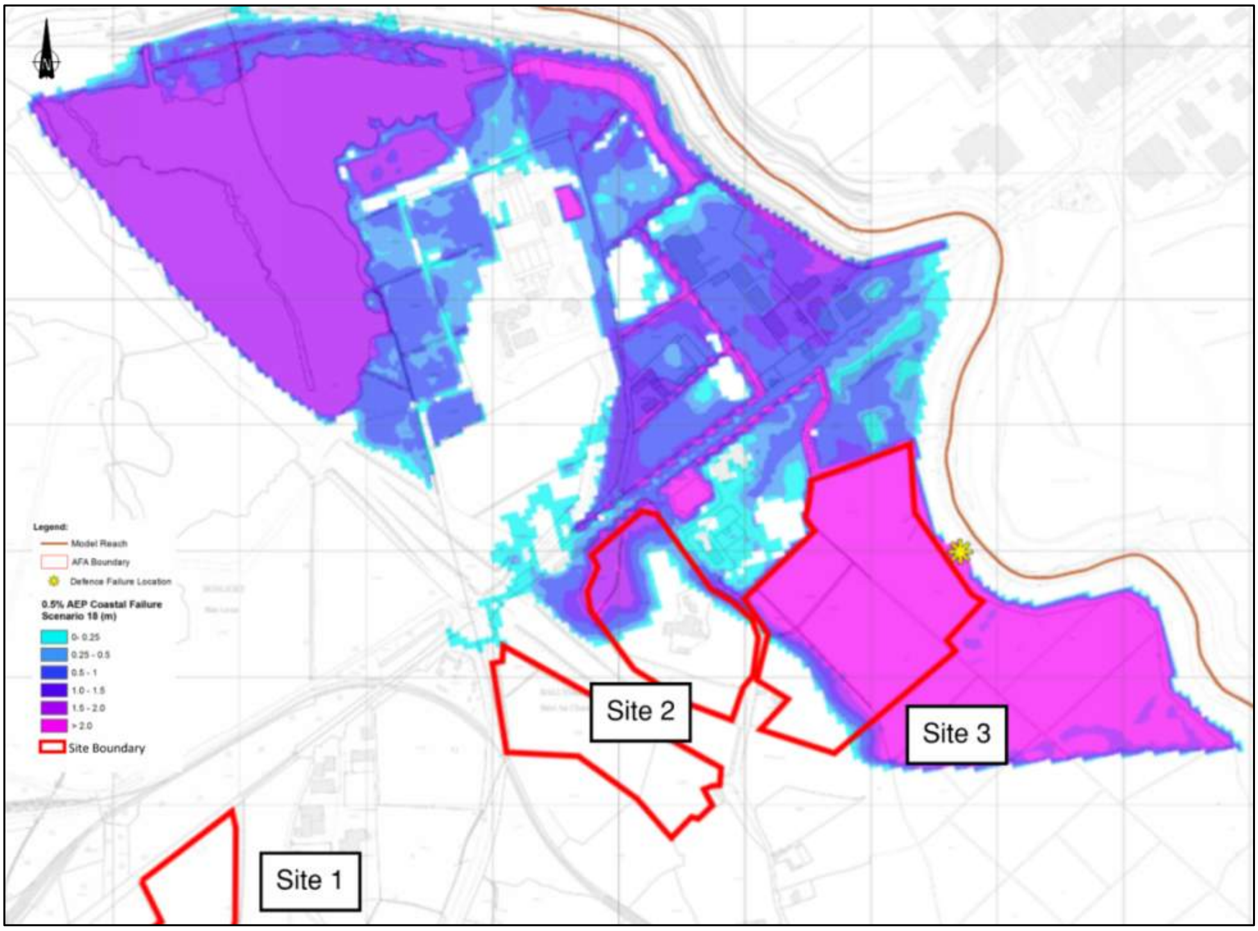


Figure 3-8: Point 3 0.5% AEP Flood extents from breach on River Shannon flood embankments

Based on the analysis carried out, Site 1 and the western side of Site 2 experienced no flooding for all three defence breach points.

Site 2, as shown in Figure 3-7, is expected to experience flooding of 2m or greater in approximately a third of the eastern side of the site. This area of the site is proposed to be rezoned to 'Agriculture' in the Draft Limerick Development Plan.

The results of the analysis from point 3 show flooding of 2m or greater for the majority of Site 3, as shown in Figure 3-82 & Figure 3-13 above. Similar to Site 2 this land is predominately zoned for 'Agriculture' with approximately a third of the site to the east zoned for 'Semi-Natural Open Space'.

3.12 Draft Strategic Flood Risk Assessment

The Draft Strategic Flood Risk Assessment dated 26th June 2021 and prepared by JBA Consulting as a part of the Draft Limerick Development Plan 2022-2028 provides guidance for the integration of flood risk management into the development strategy for Limerick City and County.

In the report, flooding maps are provided for Limerick City and other settlements in Limerick County as shown below in Figure 3-9.

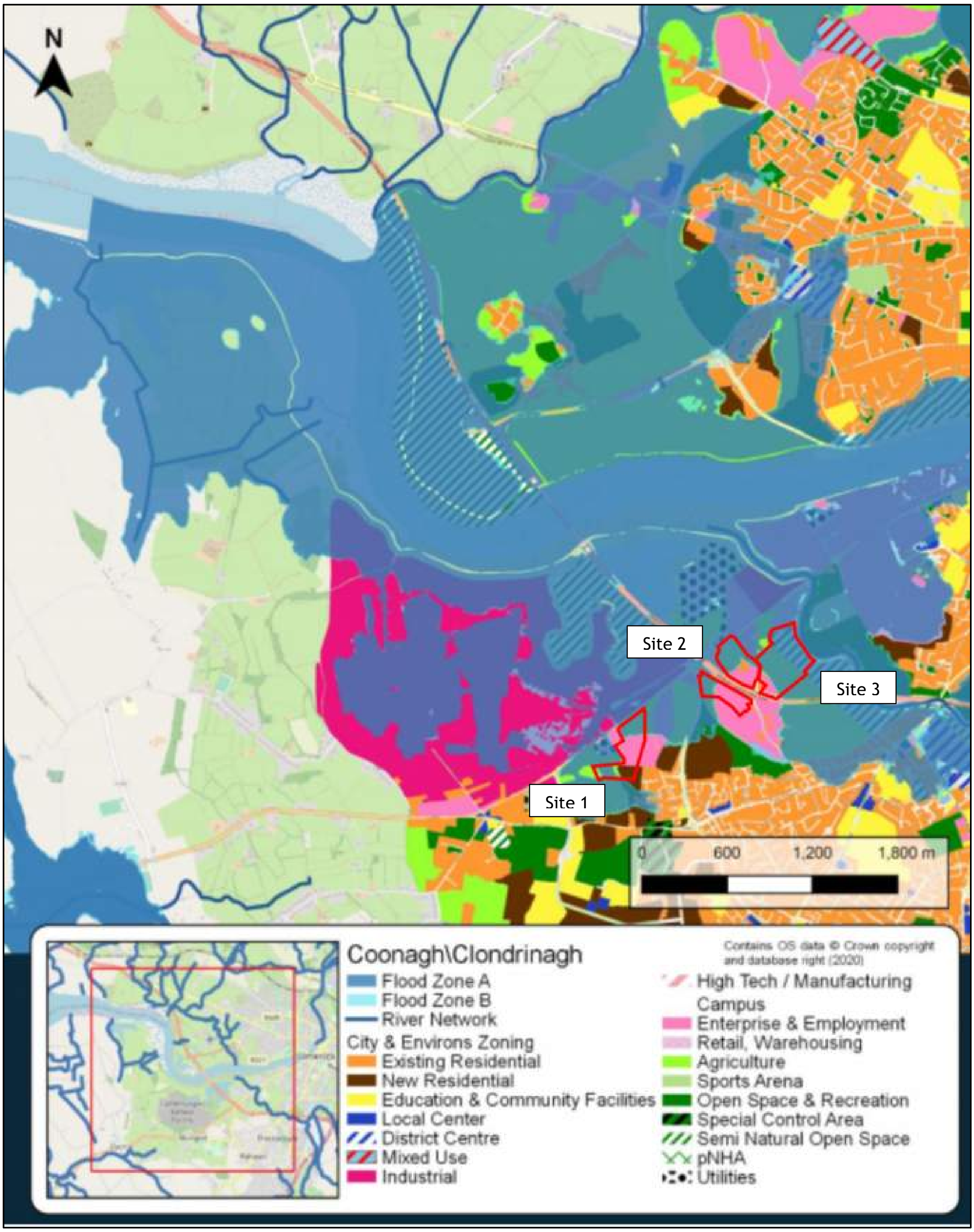


Figure 3-9: JBA Draft Strategic Flood Risk Assessment

According to the SFRA mapping in Figure 3-9, the sites are all partially located in Flood Zone A which approximately corresponds to the defended area noted in the CFRAM mapping. We can confirm from our site visit that the flood extents shown match the gradients observed on site.

JBA mapping is a preliminary set of mapping prepared for Limerick City and County Council. As per section 2.3 of the SFRA, the definition of the Flood Zone is based on an undefended scenario and does not take into account the presence of flood protection structures such as flood walls or embankments.

Hence, the flood extents shown are a worst-case scenario based on all flood defences in Limerick not being operational and ignored entirely.

3.13 Estimate of Flood Zone

PUNCH Consulting Engineers have reviewed the available information as outlined in the above sections. The site is not indicated as being at risk of fluvial flooding

The breach analysis carried out by the OPW for the Flood Risk Management Plan relating to the area did not show any flooding affecting Site 1 or the western portion of Site 2 therefore the risk to those sites is currently low.

The existing flood defences are no doubt providing protection to the three sites from coastal flooding to varying degrees. If these flood defences could be accounted for Sites 1 & 2 would be classified as Flood Zone C but the residual risk of flooding would still need to be accounted for.

Again, if these flood defences could be accounted for, the eastern portion of Site 3 would be classified as Flood Zone B.

However, the FRMG advise that food zones ignore the presence of flood defences. Therefore we must conclude that the Flood Zone Areas for coastal floodplain noted in the JBA mapping and presented in the Draft SFRA is the correct zoning for each site in accordance with the FRMG.

4 Flood Risk Assessment

4.1 Sources of Flooding

When carrying out a Flood Risk Assessment, one should consider all potential risk and sources of flood water at the site. In general, the relevant flood sources are:

Fluvial Flooding

Fluvial flooding is the result of a river exceeding its capacity and excess water spilling out onto the adjacent floodplain. The proposed sites are located approximately 1km from Ballinacurra Creek and 1km from the River Shannon. From a review of the available information, and given the site levels, it is considered that the site is not at risk of fluvial flooding.

Coastal Flooding

Coastal flooding is the result of sea levels which are higher than normal and result in sea water overflowing onto the land during high tides or storm surges. The proposed sites are located 1km from the coast. From a review of the available information, the site it is considered to have a low residual risk of coastal flooding due to the existing flood embankment defences located on the River Shannon and Ballinacurra Creek.

Pluvial Flooding

Pluvial Flooding is the result of rainfall-generated overland flows which arise before run-off can enter any watercourse or sewer. It is usually associated with high-intensity rainfall. There are some areas within the site which may be subject to pluvial flooding due to their naturally low depressions. However, the provision of a suitable surface water drainage system for any proposed development on the site will mitigate against this risk.

Groundwater Flooding

Groundwater flooding occurs when the level of the water stored in the ground rises as a result of prolonged rainfall. From a review of the available information, there is no risk of groundwater flooding at the site.

4.2 Site Vulnerability

The Planning System and Flood Risk Management Guidelines gives definitions for the type of developments that can take place in each Flood Zone. Table 4 defines the classifications of vulnerability of different types of development as detailed in the Flood Risk Management Guideline. Table 4-2 shows the types of development appropriate for each Flood Zone.

The choice of appropriate development proposals at this site will be dependent on these tables within each of the flood zone designations. This is explored further in Section 4.4.

Table 4-1: Classification of vulnerability of different types of development

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	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.
Water-compatible development	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).
*Uses not listed here should be considered on their own merits	

Table 4-2: Matrix of Vulnerability versus Flood Zone to indicate Justification Requirement

	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	Appropriate	Appropriate	Appropriate

Where the Justification Test must be applied, Box 4.1 and Box 5.1 requirements must be met as reproduced and set out in Figure 10.

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

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) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];
- (ii) Comprises significant previously developed and/or under-utilised lands;
- (iii) Is within or adjoining the core[3] of an established or designated urban settlement;
- (iv) Will be essential in achieving compact and sustainable urban growth; and
- (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.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

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.

Figure 4-1: Extracts from FRM Guidelines Justification Test Requirements

4.3 Climate Change

To mitigate against the residual risk of flooding to the site any proposed building should be set so that the finished floor levels of the development are above the flood level with an allowance for climate change. Table 4-3 below replicates Table 5-3 of the LCCC DRAFT SFRA which gives guidance on the recommended finished floor levels for new developments. The site is located in a tidal, defended area. As the flood defence embankment along the River Shannon north bank is a legacy structure it cannot be confirmed whether climate change was accounted for and therefore a climate change allowance will need to be included in setting development floor levels.

Table 4-3: LCCC DRAFT SFRA Table 5-3: Recommended minimum finished floor levels.

Scenario	Finished floor level to be based on
Fluvial, undefended	1% AEP flood + climate change (as Table 5-2) + 300mm freeboard.
Tidal, undefended	0.5% AEP flood + climate change (as Table 5-2) + 300mm freeboard (or 500mm where there is a risk of storm surge and wave action).
Fluvial, defended	1% AEP flood + 300mm freeboard. Climate change does not need to be included, provided it is included in the defence height or adaption plan for the scheme. Where a breach model has been developed to further understand risks, FFL may be set based on model outputs.
Tidal, defended	0.5% AEP flood + 300mm freeboard (or 500mm where there is a risk of storm surge and wave action). Climate change does not need to be included, provided it is included in the defence height or adaption plan for the scheme. Where a breach model has been developed to further understand risks, FFL may be set based on model outputs.

Based on the information above, any proposed development on the site will require finished floor levels to be set above the 0.5% AEP flood level + freeboard + climate change. The proposed site is located nearly 1km from the Shannon and as such there is no risk of storm surge or wave action at the site. Therefore, the 300mm value for freeboard will be used. The minimum Finished Floor level for any development at this site should therefore be 5.66mAOD.

4.4 Potential Site Development

With reference to Tables 4-1 & 4-2 and the current and proposed Development Plan zoning, the following development options are available on each site:

4.4.1 Site 1

Figure 4-2 below shows extracts from the Draft Limerick Development Plan Zoning alongside the estimated coastal flood zones in the site:

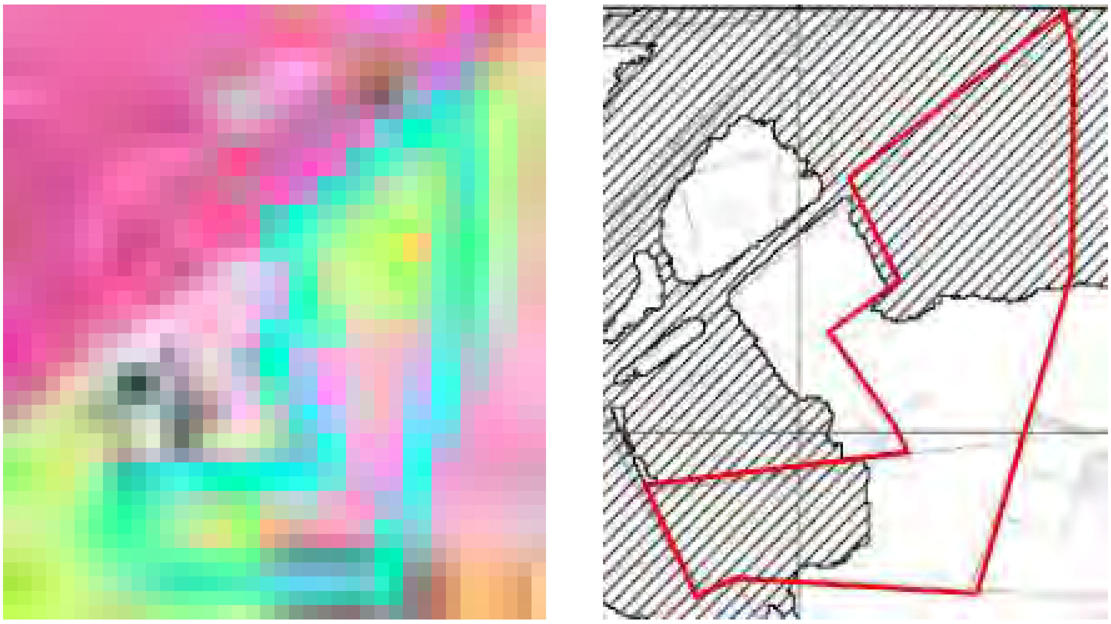


Figure 4-2: Extracts from Draft Development Zoning alongside Flood Map Zoning for Site 1

1. The unhatched area to the southeast of the site is located within Flood Zone C. All development is deemed appropriate in accordance with the FRMG subject to planning designation (current zoning: Industrial; proposed zoning: Enterprise and Employment are both deemed appropriate).
2. The western and northern portions of the site are located within defended Flood Zone A (current zoning: Industrial in the west and Enterprise and Employment/Industrial in the north; proposed zoning: Agriculture).
3. Flood Zone A is the most restrictive in terms of allowable development. It is possible to propose other type of less vulnerable development on this land from an engineering perspective however it will need to pass the Justification Test as set out in the FRMG and also noted in Figure 4.1 above. Please seek separate planning advice on this.
4. Given the low probability of flooding on the site based on various breach assessments in the area, it is highly likely that a less vulnerable use such as 'Enterprise and Employment' could be justified over the entirety of the site boundary. The site is also well serviced in regard drainage and access requirements and would therefore benefit from a 'less vulnerable' use zoning. Please seek separate planning advice on this.
5. Provided the Planning Justification (Box 4-1) is satisfied for the proposed use on the FZA portions of the site, development could proceed for the use deemed appropriate by a planning consultant, provided appropriate engineering flood mitigation measures (see further details set out in Section 4.5) could be included in the site development design proposals.

4.4.2 Site 2

Figure 4-3 below shows extracts from the Draft Limerick Development Plan Zoning alongside the estimated coastal flood zones in the site:

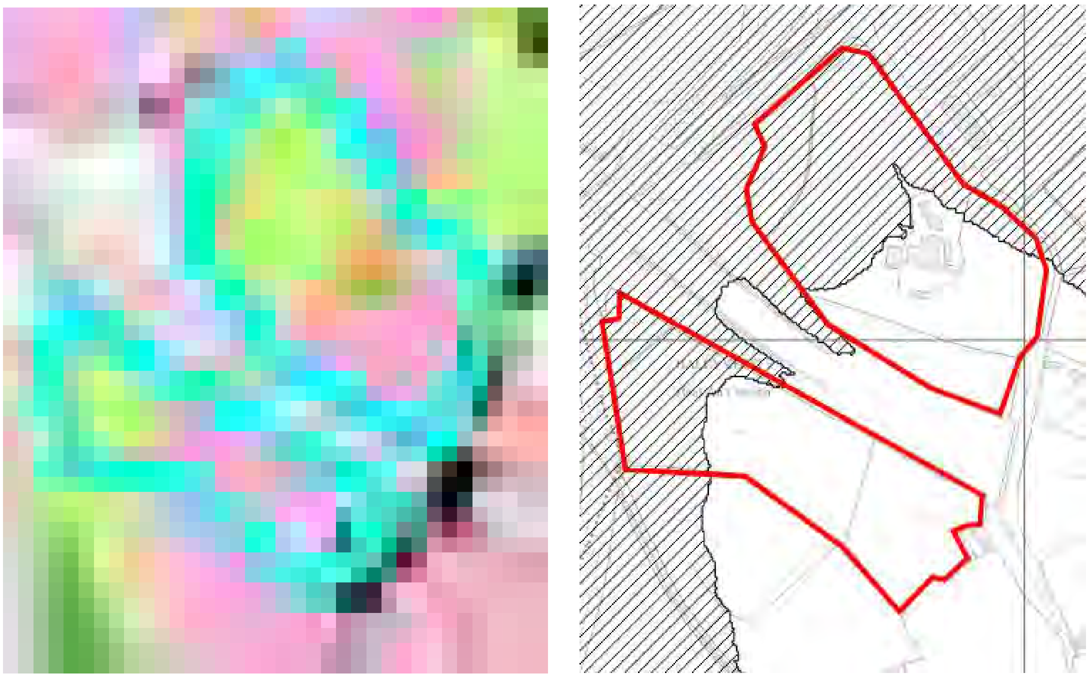


Figure 4-3: Extracts from Development Zoning alongside Flood Map Zoning for Site 2

1. The unhatched area to the southeast of the site is located within Flood Zone C. All development is deemed appropriate in accordance with the FRMG subject to planning designation (current zoning: Industrial; proposed zoning: Enterprise and Employment are both deemed appropriate).
2. The western and northern portions of the site are located within defended Flood Zone A (current zoning: Industrial in the west and Enterprise and Employment/Industrial in the north; proposed zoning: Agriculture).
3. Flood Zone A is the most restrictive in terms of allowable development. It is possible to propose other type of less vulnerable development on this land from an engineering perspective however it will need to pass the Justification Test as set out in the FRMG and also noted in Figure 4.1 above. Please seek separate planning advice on this.
4. Given the low probability of flooding on the western portion of the site based on various breach assessments in the area, it is highly likely that a less vulnerable use such as 'Enterprise and Employment' could be justified. The breach assessment showing flooding on the eastern portion of the site is also a low probability event and as such the site should be suitable for a less vulnerable development proposal such as Enterprise and Employment. The site is also well serviced in regard drainage and access requirements and would therefore benefit from a 'less vulnerable' use zoning. Please seek separate planning advice on this.
5. Provided the Planning Justification (Box 4-1) is satisfied for the proposed use on the FZA portions of the site, development could proceed for the use deemed appropriate by a planning consultant, provided appropriate engineering flood mitigation measures (see further details set out in Section 4.5) could be included in the site development design proposals.

4.4.3 Site 3

Figure 4-4 below shows extracts from the Draft Limerick Development Plan Zoning alongside the estimated coastal flood zones in the site:

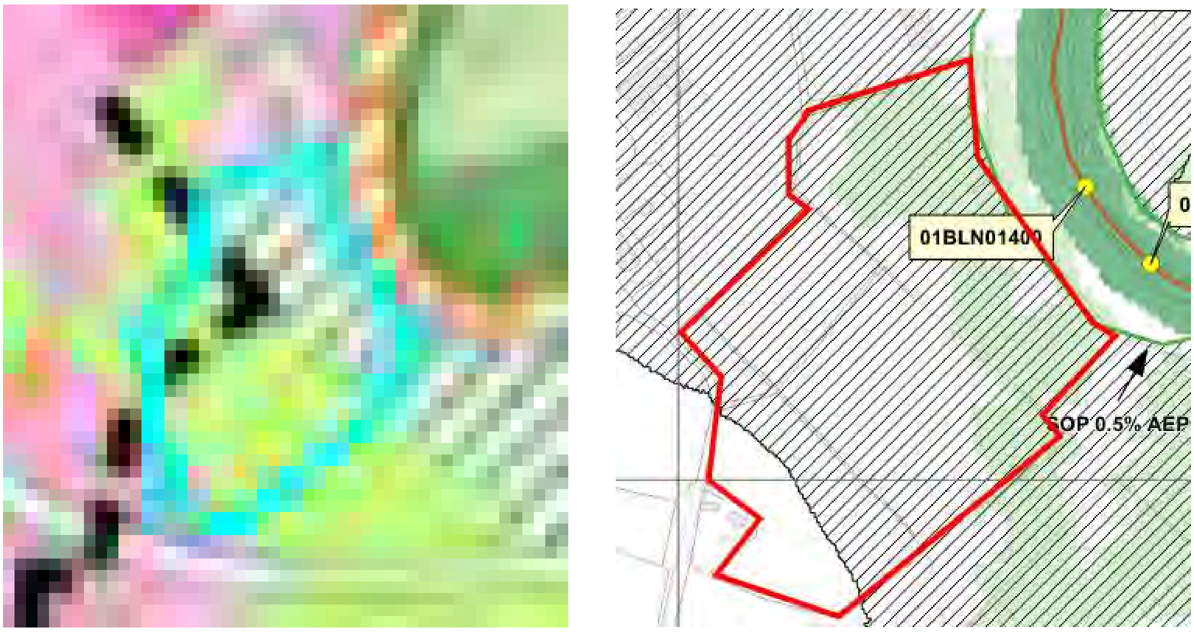


Figure 4-4: Extracts from Development Zoning alongside Flood Map Zoning for Site 3

1. The unhatched area to the southwest of the site is located within Flood Zone C. All development is deemed appropriate in accordance with the FRMG subject to planning designation (current/proposed zoning: Enterprise and Employment are both deemed appropriate).
2. The central portion of the site are located within defended Flood Zone A (current zoning: Enterprise and Employment; proposed zoning: Agriculture).
3. The western portion of the site is located within defended Flood Zone A. The green hatch refers to the Flood Zone B designation if the defences were considered (current/proposed zoning: Semi-Natural Open Space).
4. Flood Zone A is the most restrictive in terms of allowable development. It is possible to propose other type of less vulnerable development on this land from an engineering perspective however it will need to pass the Justification Test as set out in the FRMG and also noted in Figure 4.1 above. Please seek separate planning advice on this.
5. Given the low probability of flooding on the central portion of the site based on various breach assessments in the area, it is highly likely that a less vulnerable use such as ‘Enterprise and Employment’ could be justified. The breach assessment showing flooding on the eastern portion of the site is also a low probability event and as such the site should be suitable for a less vulnerable development proposal such as Enterprise and Employment. The site is also well serviced in regard drainage and access requirements and would therefore benefit from a ‘less vulnerable’ use zoning. Please seek separate planning advice on this as there may be reasons other than flooding for zoning the area Semi-Natural Open Space.
6. Provided the Planning Justification (Box 4-1) is satisfied for the proposed use on the FZA portions of the site, development could proceed for the use deemed appropriate by a planning consultant, provided appropriate engineering flood mitigation measures (see further details set out in Section 4.5) could be included in the site development design proposals.

4.5 Standard Mitigation Measures

Parts of the sites are located in a defended Flood Zone A. As such the risk of flooding to the site is lessened and the key consideration from an engineering perspective when assessing flood risk for a particular development is to ensure that the residual risk of flooding at the site is addressed.

Every site proposal is different where the topography and constraints will be unique to that particular site proposal. However, there are a number of flood mitigation engineering options that are common to all sites that when implemented, can assist in reducing the flood risk to properties constructed. The following engineering options can be considered at these sites:

1. The finished floor level for any proposed development within the sites should be set to a minimum level as noted in Section 4.3. Given the existing site levels, consideration to raising any proposed buildings on stilts could be explored.
2. Due to the coastal nature of flooding predicted on the sites, earthwork compensation should not be required from a volumetric perspective if filling of land is proposed in order to raise buildings above the flood level. The disturbance of flow paths caused by the filling will however need to be addressed.
3. All surface water flows generated within any development will be captured by a dedicated surface water drainage network which will be designed for a 1 in 100-year storm event allowance for climate change. The proposed surface water drainage system will mitigate against any pluvial flood risk at the development.
4. Any development proposed for the lands should include water compatible construction where relevant. This will include features such as hard floors at ground level and sockets set at high level along walls.
5. Emergency access to any proposed development on the sites will need to be considered.
6. As part of any proposed site maintenance plan, all future proprietors should inspect all road gullies in the vicinity and report any blockages to the Local Authority and/or Irish Water. The proprietor should also inspect all surface water drainage within the site, in particular following periods of inclement weather, which may cause debris to obstruct stormwater inlets.

Additional engineered mitigation measures can also be implemented to further assist in reducing the flood risk of properties on any proposed development. These are usually specific to and, incorporated into any proposed development site layout and detailed design of the proposed structures. Other than recommending that FFL's are above the residual flood risk level of 5.66m AOD and in the absence of any proposal for the lands, no additional specific engineered mitigation measures can be recommended at this time.

5 Conclusions

PUNCH Consulting Engineers were appointed by Mr Michael Gabbett to carry out a Site-Specific Flood Risk Assessment for three sites located on the Dock Road.

This Site-Specific Flood Risk Assessment has been carried out in accordance with *"The Planning System & Flood Risk Management Guidelines*" published by the Department of the Environment, Heritage and Local Government in November 2009 and the Limerick City Local Area Plan.

A review of the flood risk in the area was carried out as the site is located near the River Shannon and Ballinacurra Creek.

Flood Maps produced as part of the CFRAMS were consulted to establish the Flood Zone. It was determined that all three sites are currently protected by existing flood defences on the River Shannon and Ballinacurra Creek to a varying degree and the actual flood risk to the site is currently low. However, the FRMG advise that food zones ignore the presence of defences. Therefore, we must conclude that each site has an area designated Flood Zone A as per the JBA mapping presented in the Draft SFRA.

Potential development options are discussed in the report based on the relevant flood zoning designation. The type of development proposed on the Flood Zone A areas may be subject to a Justification Test in accordance with The Planning System and Flood Risk Management Guidelines dependent on the site development proposals put forward. Given the low probability of flooding on the Flood Zone A designated site areas, it is highly likely that a 'less vulnerable use' such as 'Enterprise and Employment' could be justified. The sites are all well serviced in regard drainage and access requirements and would therefore benefit from a 'less vulnerable' use zoning. Further planning advice is required for the Planning Justification (Box 4-1).

The residual risk of flooding must be addressed. Potential flood mitigation measures appropriate for the sites were discussed and based on an appropriate site development proposal they can be explored further.

Appropriately zoned development on the Flood Zone A portions of the site can be delivered at low risk of flooding and not increase the risk of flooding to adjacent or nearby areas through the implementation of standard flood mitigation measures and specifically engineered development flood mitigation measures.

Appendix A Site Visit Images

Image 1: Existing entrance to site 3

Image 2: Existing OPW channels crossing Site 3

Image 3: Existing flood defence bordering Ballincurra Creek to the east of site 3

Image 4: Site 2 (west)

Image 5: Existing farmyard in site 2 (east)

Image 6: Existing OPW channel crossing southern boundary of Site 2 (east)

Image 7: Entrance to site 2 (east)

Image 8: Site 1

Image 9: Abandoned house in middle of site 1

Image 10: Wet ground observed at south-west corner of site 1

Appendix B OPW Historic Flood Events Record

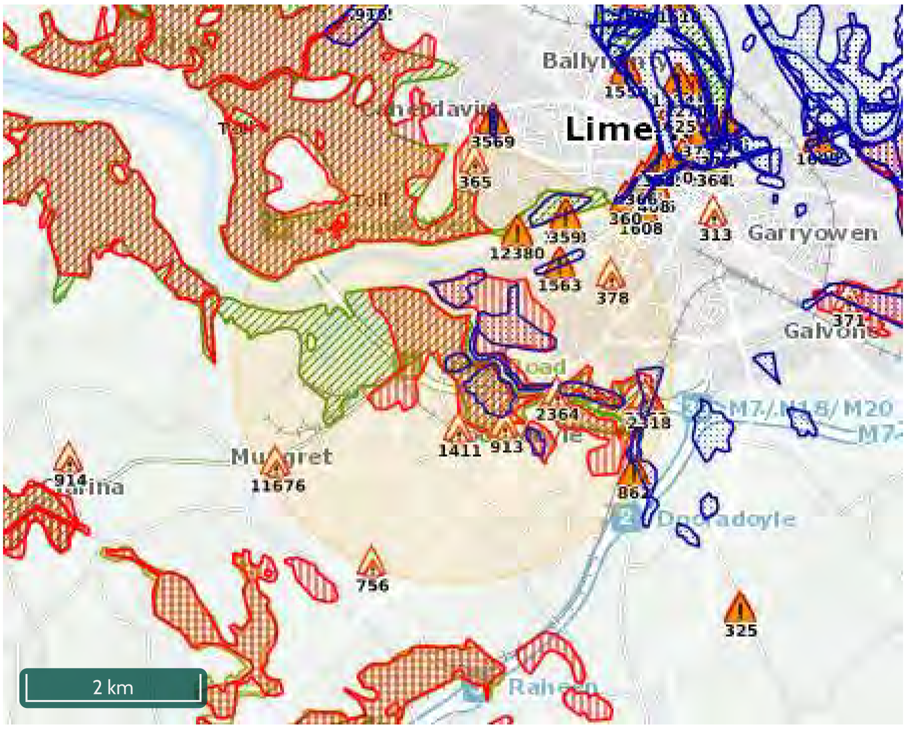
Past Flood Event Local Area Summary Report

Oifig na nOibreacha Poiblí
OPW
Office of Public Works

Report Produced: **5/8/2021 16:48**

This Past Flood Event Summary Report summarises all past flood events within 2.5 kilometres of the map centre.

This report has been downloaded from www.floodinfo.ie (the **"Website"**). The users should take account of the restrictions and limitations relating to the content and use of the Website that are explained in the Terms and Conditions. It is a condition of use of the Website that you agree to be bound by the disclaimer and other terms and conditions set out on the Website and to the privacy policy on the Website.



Map Legend

- Single Flood Event
- Recurring Flood Event
- Past Flood Event Extents
- Drainage Districts Benefited Lands*
- Land Commission Benefited Lands*
- Arterial Drainage Schemes Benefited Lands*

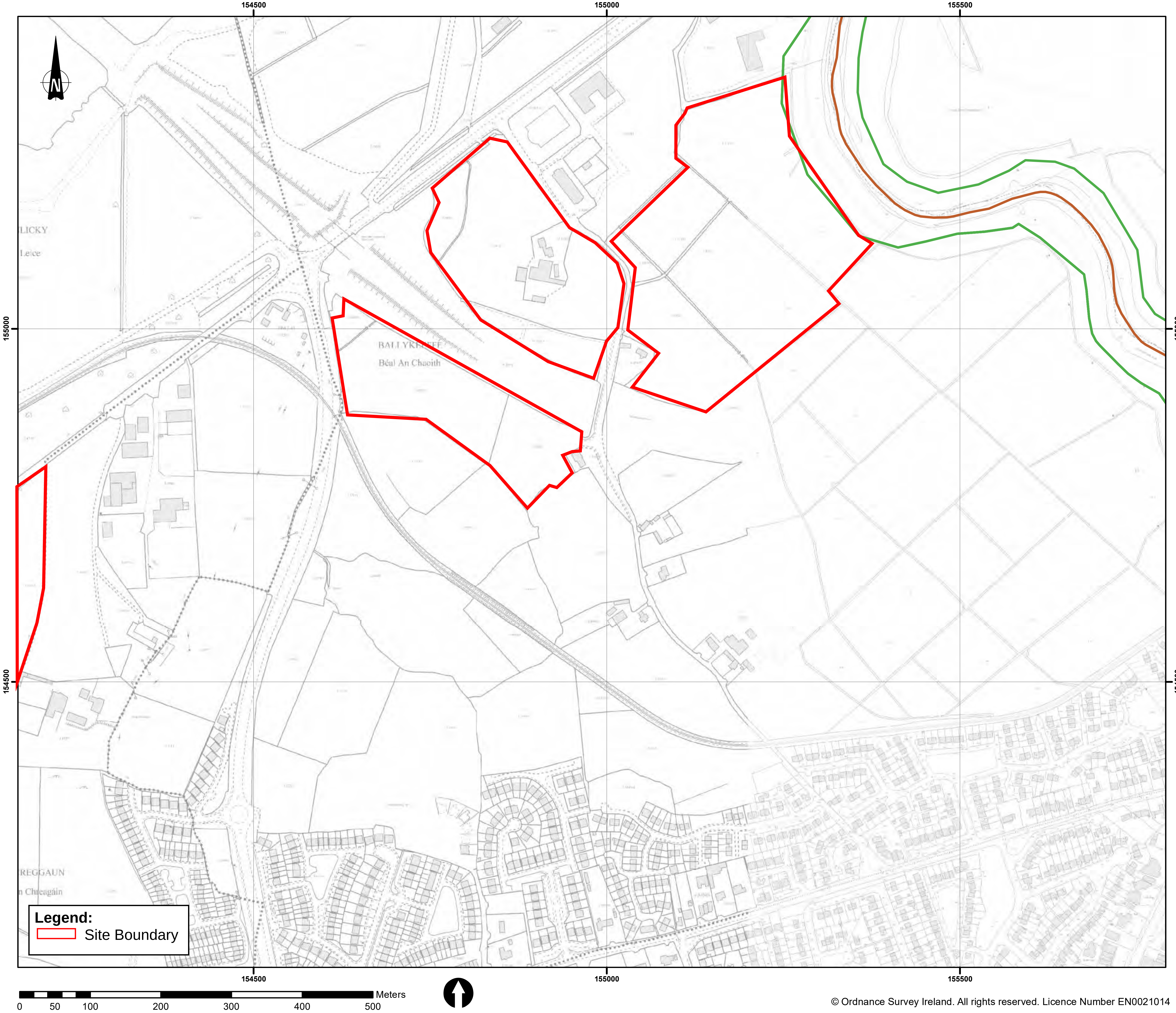
* Important: These maps do not indicate flood hazard or flood extent. Their purpose and scope is explained on Floodinfo.ie

21 Results

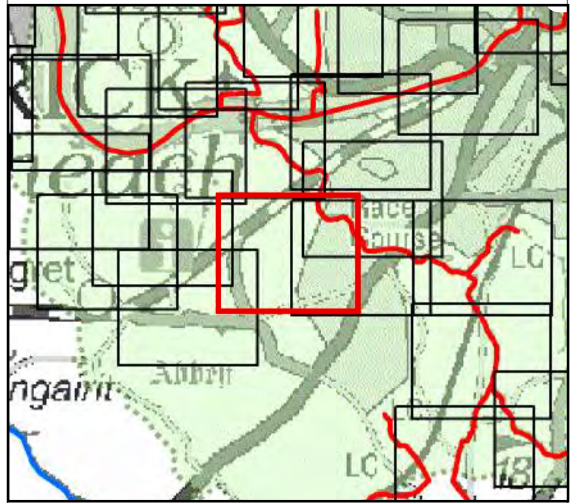
	Name (Flood_ID)	Start Date	Event Location
1.	Shannon Dock Road Limerick Dec 1999 (ID-301)	25/12/1999	Area
	Additional Information: Reports (5) Press Archive (1)		
2.	Ballynaclough River Limerick Dec 1999 (ID-1986)	25/12/1999	Area
	Additional Information: Reports (3) Press Archive (0)		
3.	Greenfield Road Rossbrien Dec 1999 (ID-304)	25/12/1999	Area
	Additional Information: Reports (3) Press Archive (1)		
4.	Raheen Dooradoyle, Limerick Feb 1990 (ID-541)	01/02/1990	Area
	Additional Information: Reports (1) Press Archive (0)		
5.	Ashbrook Gardens Limerick Recurring (ID-365)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)		
6.	Shannon Condell Road Limerick Feb 2002 (ID-359)	11/02/2002	Approximate Point
	Additional Information: Reports (3) Press Archive (0)		

		Name (Flood_ID)	Start Date	Event Location
7.		South Circular Road St Mary's Limerick Recurring (ID-378)	n/a	Exact Point
	Additional Information: Reports (1) Press Archive (0)			
8.		Turlough - Loughmore Common Limerick (ID-756)	n/a	Approximate Point
	Additional Information: Reports (3) Press Archive (0)			
9.		Ballyclogh River Rossbrien Limerick Feb 1995 (ID-862)	07/02/1995	Exact Point
	Additional Information: Reports (1) Press Archive (0)			
10.		Dooradoyle-St Nessans/Fr Russell recurring (ID-913)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)			
11.		Dooradoyle Limerick recurring (ID-1411)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			
12.		Limerick Dock Rd Jan 1995 (ID-1563)	25/01/1995	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			
13.		Limerick Condell Road Feb 1990 (ID-1603)	01/02/1990	Approximate Point
	Additional Information: Reports (2) Press Archive (0)			
14.		Condell Road Limerick Feb 1997 (ID-1607)	10/02/1997	Approximate Point
	Additional Information: Reports (2) Press Archive (0)			
15.		Ballynaclogh Rosbrien August 1986 (ID-2318)	05/08/1986	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			
16.		Ballynaclogh Rosbrien Recurring (ID-2363)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			
17.		Ballynaclogh Ballinacurra Recurring (ID-2364)	n/a	Approximate Point
	Additional Information: Reports (2) Press Archive (0)			
18.		Shannon Westfields Limerick Dec 1999 (ID-299)	25/12/1999	Area
	Additional Information: Reports (3) Press Archive (2)			
19.		Shannon Adjacent Dock Road Limerick Dec 1999 (ID-302)	25/12/1999	Area
	Additional Information: Reports (3) Press Archive (1)			
20.		Limerick City 3rd January 2014 (ID-12380)	03/01/2014	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			
21.		Mungret Village, Co. Limerick (ID-11676)	n/a	Approximate Point
	Additional Information: Reports (1) Press Archive (0)			

Appendix C CFRAMS Mapping



Location Plan:



Legend:

- Nodes
- Model Reach
- AFA Boundary
- Flood Defence: Wall
- Flood Defence: Embankment
- Defended Area

10% AEP Fluvial Flood Extent
(1 in 10 chance in any given year)

1% AEP Fluvial Flood Extent
(1 in 100 chance in any given year)

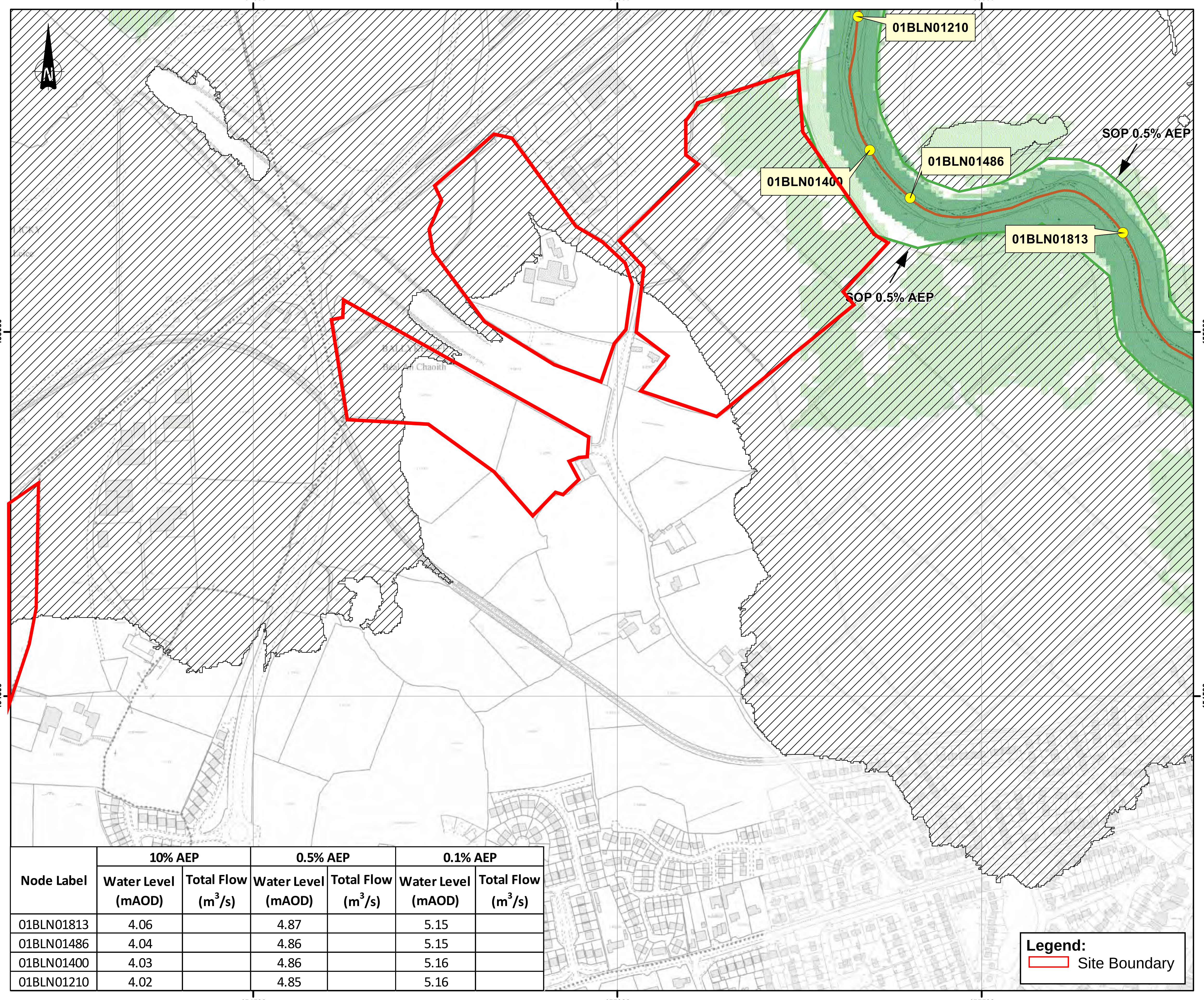
0.1% AEP Fluvial Flood Extent
(1 in 1000 chance in any given year)

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

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
C15 NX36

Merrion House
Merrion Road
Dublin 4
D04 R2C5

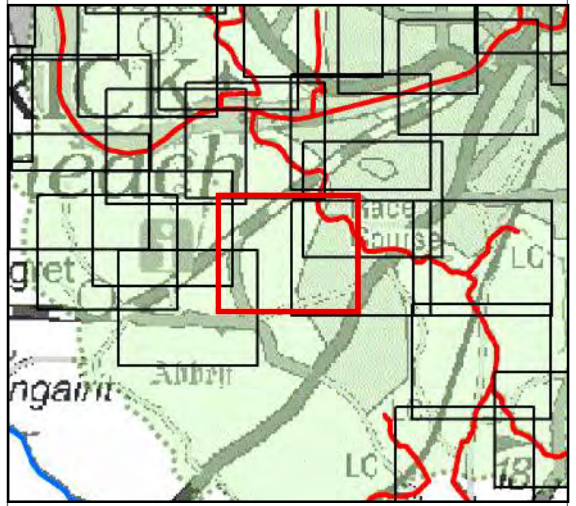
Project:	SHANNON CFRAM STUDY
Map Type:	EXTENT
Source:	FLUVIAL
Area:	LIMERICK
Scenario:	EXISTING
Drawn by: EH	Date: June 2016
Checked by: KM	Date: June 2016
Reviewed by: MC	Date: June 2016
Approved by: PS	Date: June 2016
Map No.:	S2526LIK_EXFCD_F1_52
Sheet: 52 of 59	Revision: 0
Map Scale: 1: 5000	Plot Scale: 1:1 @ A3



Node Label	10% AEP		0.5% AEP		0.1% AEP	
	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)
01BLN01813	4.06		4.87		5.15	
01BLN01486	4.04		4.86		5.15	
01BLN01400	4.03		4.86		5.16	
01BLN01210	4.02		4.85		5.16	

0 50 100 200 300 400 500 Meters

Location Plan:



Legend:

- Nodes
- Model Reach
- AFA Boundary
- Flood Defence: Wall
- Flood Defence: Embankment
- Defended Area

10% AEP Coastal Flood Extent (1 in 10 chance in any given year)

0.5% AEP Coastal Flood Extent (1 in 200 chance in any given year)

0.1% AEP Coastal Flood Extent (1 in 1000 chance in any given year)

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

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath
C15 NX36

JACOBS
Merrion House
Merrion Road
Dublin 4
D04 R2C5

Project:	SHANNON CFRAM STUDY
Map Type:	EXTENT
Source:	COASTAL - TIDAL
Area:	LIMERICK
Scenario:	EXISTING
Drawn by: EH	Date: June 2016
Checked by: KM	Date: June 2016
Reviewed by: MC	Date: June 2016
Approved by: PS	Date: June 2016
Map No.:	S2526LIK_EXCCD_F1_52
Sheet: 52 of 65	Revision: 0
Map Scale: 1: 5000	Plot Scale: 1:1 @ A3

Dooradoyle Crescent

LCC – C62 – 149

APPENDIX 1

Dooradoyle Portland Urban Quarter Strategic Flood Risk Assessment Summary Report

- A Strategic Flood Risk Assessment (SFRA) report was prepared by ARUP in July 2020 in respect of Dooradoyle Portland Urban Quarter. This was augmented by supplementary reports prepared in October 2020 to consider the residual risk arising from any downstream breach of the existing embankments and to undertake a preliminary geotechnical assessment of existing flood defence embankments immediately adjoining the lands.
- The Shannon Catchment Flood Risk Assessment and Management (CFRAM) study was reviewed in detail as part of the initial flood risk review of the site and surrounding area. The CFRAM study found that the majority of the subject lands are at risk of tidal flooding, but that the risk is low as the site is protected in all but the most extreme events by existing OPW flood defence embankments. In the most extreme events, flooding of the subject lands originates from overtopping of the existing flood defence embankments at the eastern extent of the lands in the vicinity of the disused railway line. The CFRAMS established that fluvial flood risk is only a consideration in the vicinity of the Rossbrien and further upstream.
- The Arup SFRA then considered the subject site in greater detail that the CFRAMS, by incorporating more recent survey of the lands and embankment, updating the hydrological analysis of the upstream catchment and developing a detailed 1D-2D model of the river system.
- The updated survey confirms that the existing embankment is circa 200mm lower than its original design intent at the upper (eastern) end of the lands due to settlement and consolidation of the embankment material over time.
- The updated hydrological assessment of the Ballinacurra Creek and surrounding tributaries provided updated estimates of peak flows and a hydrograph shape for use as input into the hydraulic model built for this study.
- The hydraulic model confirmed that the subject lands are currently subject to tidal flooding which propagates from the flood defence embankments low point at the eastern end of the site
- In accordance with the Planning System and Flood Risk Management Guidelines (OPW 2009) the existing flood defence embankments were not considered in classifying the flood zoning of the subject lands. Thus, the majority of the subject lands lie within Flood Zone A and therefore a Justification Test is required in considering the development potential of the lands. Such a Development Plan Justification Test was recently completed by John Spain Associates and included in Appendix A above.
- An analysis of potential flow paths from a breach of the embankments downstream of the site (on both the Shannon and the Ballinacurra Creek) confirmed that this risk

is very low due to the protection offered by the elevated N18 roadway to the north and naturally higher ground to the west and south. Therefore, the only potential flow path from downstream would arise from a breach over a circa 480m length of the Ballinacurra Creek embankments from west of the R526 as far as the N18. However, for a breach in this location to affect the subject lands, it would need to coincide with at least a 1 in 50 year tidal flood event. Even at this, the lower lying lands at Ballykeefe and the large tract of agricultural land to its west, would first have to be inundated to a depth of over 2m before flood waters could propagate further east to the subject lands. The joint probability of such an event is extremely remote. Whilst these embankments are located outside of Clancourt owned lands, given the large area of already built up lands in Dooradoyle which are protected by these embankments, it is envisaged that maintenance of these embankments to a high standard must be and will be an ongoing priority for both LCCC and OPW.

- Given the above, the primary focus for flood protection to the subject lands is the sections of OPW embankments east of the R526. These existing OPW embankment have historically offered and continue to offer a high degree of protection, with no recorded failure to date. A preliminary geotechnical assessment of existing Ground investigation data as well as a review of past reports on these embankments confirm that OPW have previously topped up these embankment and for the most part their crest level is above the design 1 in 200year tidal level save for a very short section to the east that is only low by circa 200mm. As the underlying ground conditions both underneath and to the rear of the embankment does not vary significantly, repair and upgrading of the existing embankment is considered to represent to most likely optimum solution to bring flood protection to these lands up to the required standard. This is due to requiring far less new imported material and due to the fact that the existing embankment has at this stage already undergone the majority of its consolidation and therefore any future consolidation or settlement would be minimal compared to a new embankment.

- A straightforward solution to the flooding mechanism identified above to protect the main Clancourt site adjoining the Crescent Centre, is to restore the existing embankment to the 1 in 200-year design standard. The hydraulic modelling undertaken for this study demonstrates that this can be achieved with flood protection measures entirely on Clancourt lands and without increasing flood risk outside of the Clancourt lands.

- The hydraulic modelling work undertaken as part of this SFRA identified a potential additional option which has the potential to remediate flood risk, not just for the Clancourt lands, but for the entire Dooradoyle Portland Urban Quarter Masterplan area and for existing housing developments upstream on the Ballinacurra Creek and Ballysheedy River. Importantly, it would also alleviate the flooding of the Rossbrien Road which is identified as an important corridor for sustainable travel.

- An integrated approach can be achieved by Clancourt providing low level defences either side of the Ballinacurra Stream downstream of Rosbrien Road which would essentially tie into the upstream fluvial defences proposed as part of the Shannon CFRAMS study. Containing the flow in the channel here would marginally increase flood levels locally upstream of the Rosbrien Road and would thus require a modest increase (estimated to be a maximum of less than 0.2m increase at downstream end) in the height of the proposed Shannon CFRAMS defences, but in the context of the wider area benefits, this additional cost would be represent very high value for money.

- In Summary, this Strategic Flood Risk Assessment Report has demonstrated that whilst lying in Flood Zone A, the flood risk to the site is very low due to the protection afforded by the existing OPW embankments which will need to be maintained given the large built-up area they all protect. The SFRA has shown that with modest scale interventions to improve upon and extend the existing flood defences, it is straightforward to provide the required standard of protection to the main Clancourt site, by works located solely on Clancourt lands. Furthermore, the SFRA has identified an opportunity to adopt a holistic approach to solve the current flooding issues for the lands bordering the Ballinacurra Creek in the Rosbrien Road areas, by delivering an integrated fluvial and tidal solution through cooperation and coordination of the defences to be upgraded on Clancourt lands with the CFRAM defences to be delivered upstream

PLAN MAKING FLOOD RISK JUSTIFICATION TEST

Dooradoyle Urban Quarter / Portland Park Lands

Prepared for

Clancourt Group

Prepared by

John Spain Associates

January 2022

JSA John Spain Associates
Planning & Development Consultants
Chartered Town Planners & Chartered Surveyors

39 Fitzwilliam Place,
Dublin 2, D02ND61
Telephone: (01) 662 5803
E-mail info@johnspainassociates.com
www.johnspainassociates.com

1.0 INTRODUCTION

1.1 This document comprises the Flood Risk Plan Making Justification Test Report in respect of the Dooradoyle Urban Quarter / Portland Park Lands in Limerick.

1.2 The report has been prepared in accordance with the requirements of *The Planning System and Flood Risk Management* Guidelines published by the Minister for the Environment, Heritage & Local Government in November 2009 under Section 28 of the Planning & Development Act 2000 (as amended). This report should be read in conjunction with the Strategic Flood Risk Assessment prepared by Arup Consulting Engineers.

1.3 The Guidelines outline two Justification Test processes by which development proposals considered to be in areas of moderate or high flood risk should be assessed by planning authorities.

1.4 The ***Plan-Making Justification Test*** should be applied by a planning authority at the plan preparation and adoption stage where it is intended to zone or otherwise designate land for development which is at moderate or high risk of flooding. The ***Development Management Justification Test*** is applied when the planning authority is considering a planning application for development in an area which may be vulnerable to flooding.

1.5 In accordance with the requirements of the Guidelines, a proposed development to which the Guidelines apply, must comply with the Justification Test for Development Plans in reviewing the current plan and preparing the new Development Plan.

1.6 it is noted that it would ultimately be the responsibility of the Local Authority to undertake a Strategic Flood Risk Assessment (SFRA) as part of the plan making process. In this regard a development plan justification test has been prepared and is submitted to support the bringing forward of the subject lands for development as part of the preparation of the new Development Plan for Limerick.

1.7 As required by the Flood Risk Management Guidelines, it is also required to show compliance with the 'Justification Test for Development Management' as part of any planning application. In this respect we would refer to the Strategic Flood Risk Assessment prepared by Arup Consulting Engineers, which sets out that a technical solution is achievable to address flood risk if the lands are to be developed.

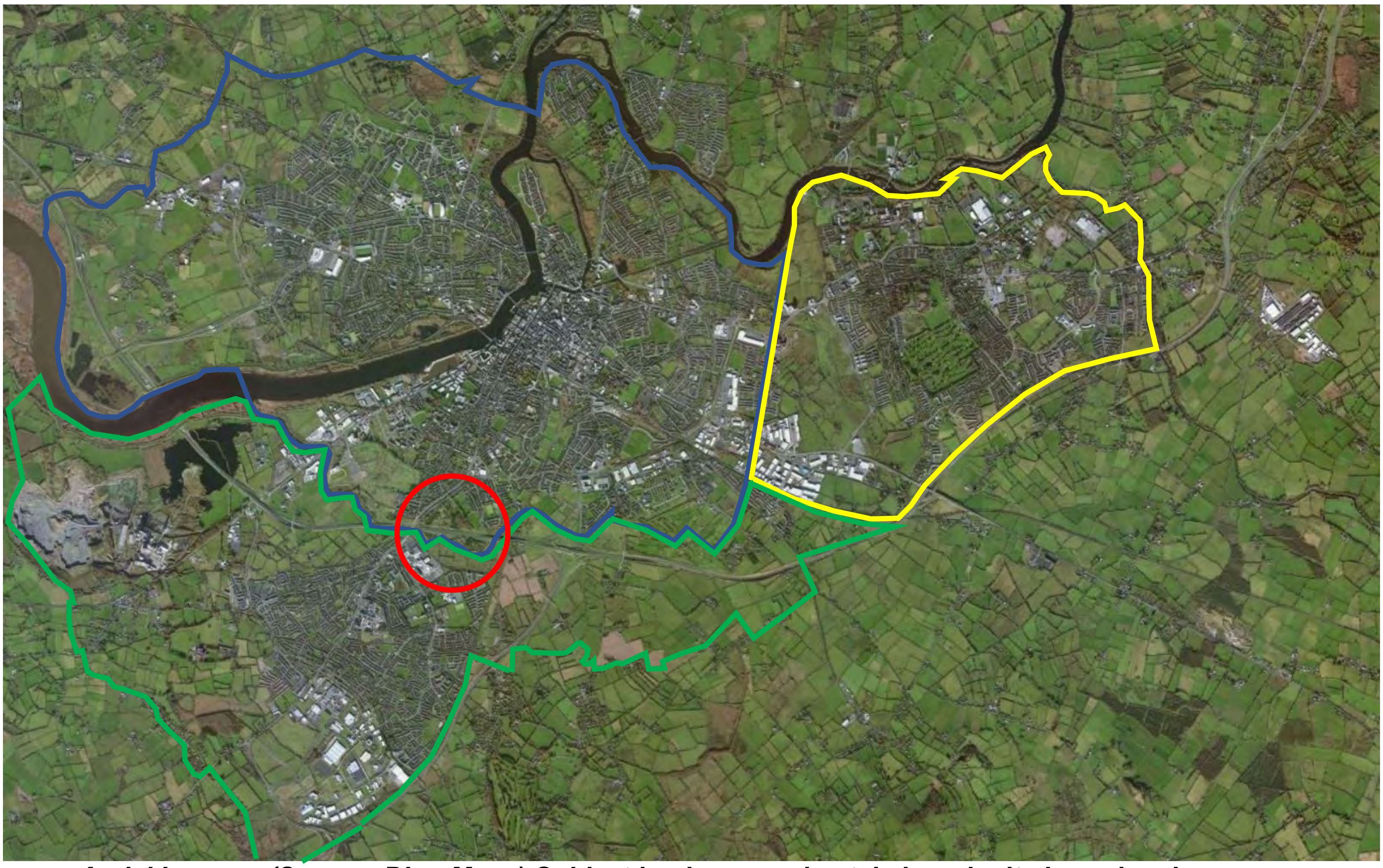
2.0 SITE LOCATION AND CONTEXT

City Context

2.1 The subject lands are located in the urban area of limerick, between the city centre and southern suburbs of Dooradoyle and Raheen.

Figure 1: Site Context (Source: Open Street Map).

2.2 The lands are located at a key undeveloped location at the confluence of the developed areas of the city and southern suburbs, as illustrated below for the Development Plan and Local Area Plan boundaries. The site is located along existing public transport routes, with existing services at the District Centre of the Crescent. Key employment locations along this corridor include the city centre, the Crescent, University Hospital Limerick and Raheen Industrial Estate.



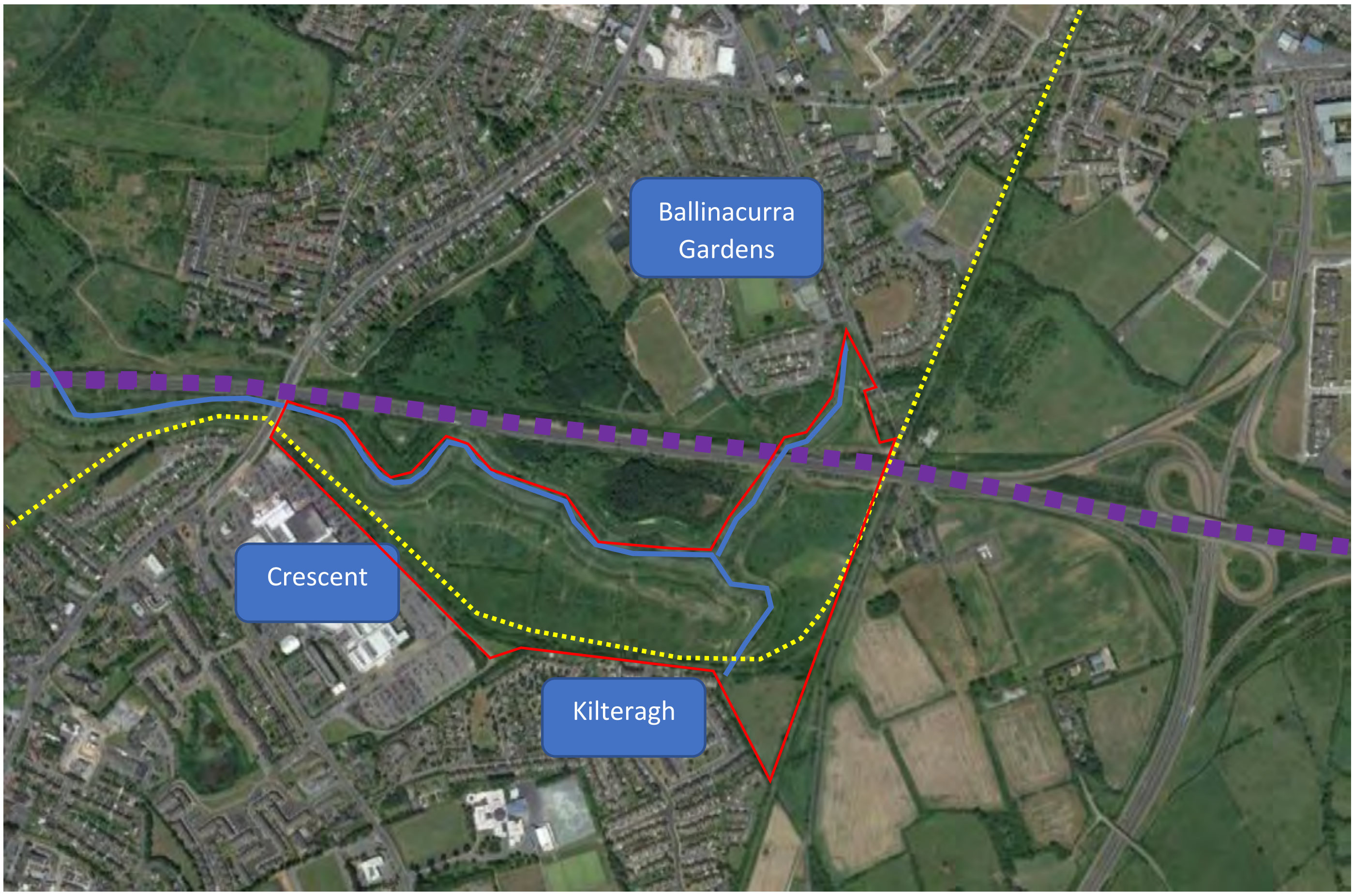
Aerial Imagery (Source: Bing Maps) Subject lands approximately in red; city boundary in blue; Southern Environs LAP in Green; and Castletroy LAP in yellow

2.3 The lands represent a large infill site in an urban area, located between two of the primary locations of the Limerick Metropolitan Area (city and southern suburbs).

Local Context

2.4 The lands are undeveloped in nature and strategically located between the city centre and southern suburbs. To the immediate north is the Ballinacurra Gardens estate, with playing pitches for Ballinacurra Gaels and Catholic Institute.

2.5 To the immediate south is the Crescent Shopping Centre, Kilteragh estate and Crescent Comprehensive. The Crescent serves as a District Centre for the wider area and hinterland.



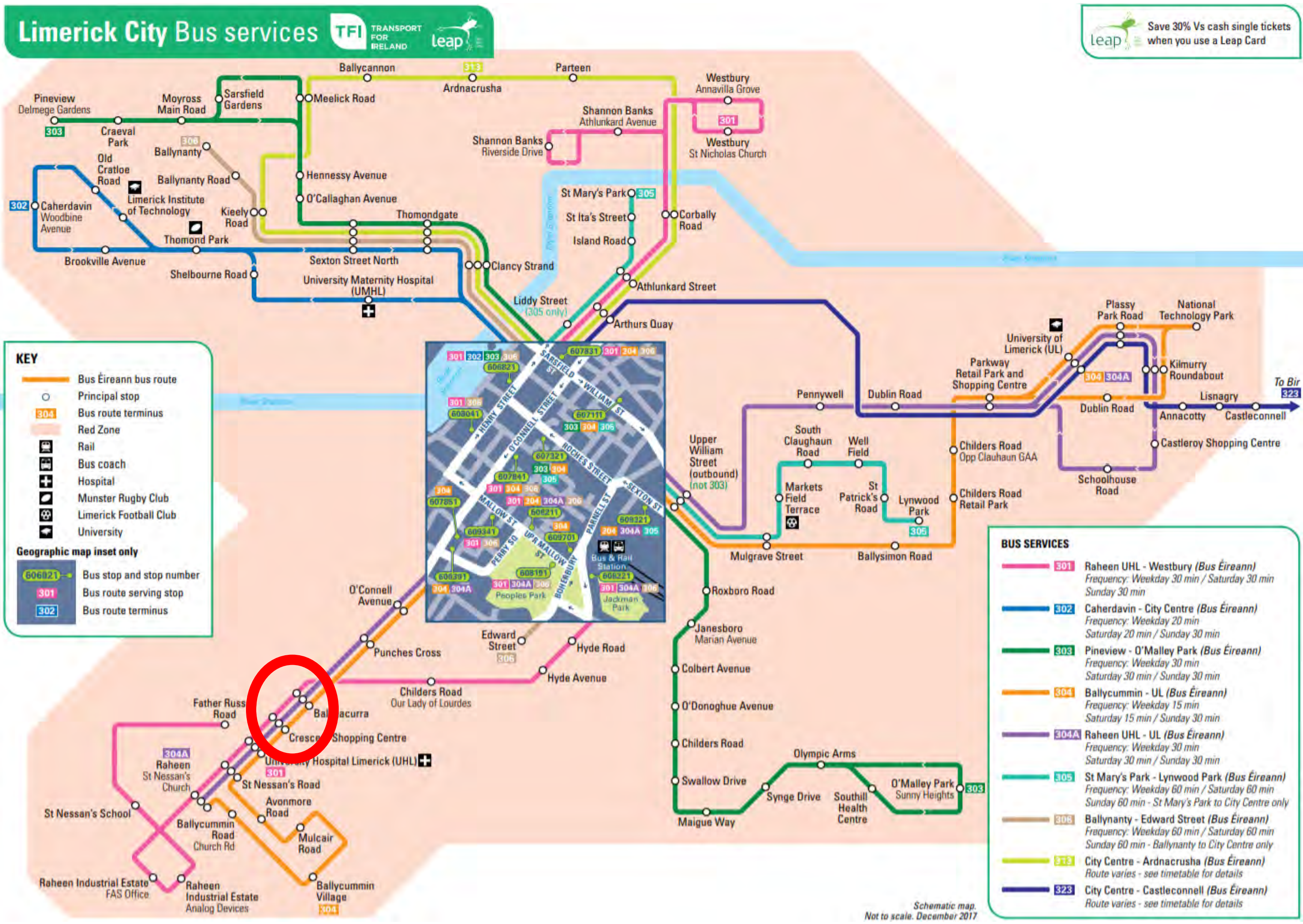
Aerial Image of Local Context – (Source: Google Maps) approximate outline of lands in red; N18 in purple; disused rail line to Mungret Cement in yellow; and watercourse in blue

2.6 North of the N18 is Portland Park, which comprises scrubland and trees. Aside from the pedestrian and cycle link it is generally of low quality and represents an opportunity for improvement for amenity and biodiversity. The lands south of the N18 are largely inaccessible with an incomplete riverbank route and represent another opportunity for improvement in terms of amenity and biodiversity through their opening up as part of development. The benefits of development alongside the delivery of amenity is that it provides activity, vibrancy and passive surveillance.

Accessibility to Modes of Transport

2.7 The lands are exceptionally well located for various modes of transport, including local, national (N18, N24, N69) and motorway (M7, M20) road networks, bus, bicycle and pedestrian facilities.

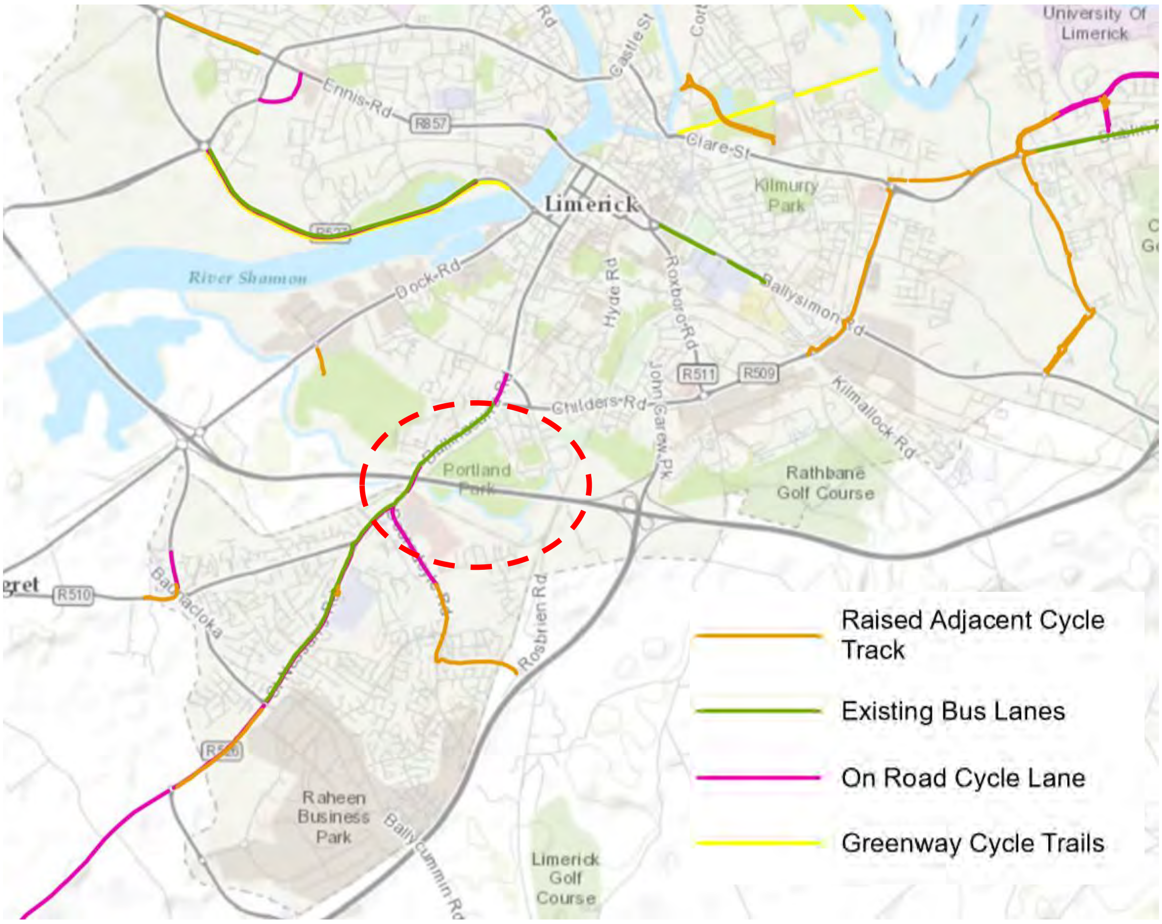
2.8 Bus Routes servicing the lands include the 301 (Raheen/University Hospital Limerick to Westbury via Childers Road and City Centre), 304 (Ballycummin to University Limerick via University Hospital Limerick, City Centre, Ballysimon Road and Childers Road) and 304A (Raheen/University Hospital Limerick to University of Limerick via City Centre and Dublin Road). Frequency of services vary from 15-30 minutes.



Limerick City Bus Services (Source: TFI)

2.9 The bus services also link with other local, regional and national bus, rail and airport services from the city centre.

2.10 There are a number of bicycle lanes in the vicinity:



Existing Cycle Facilities (Source: Limerick Metropolitan Cycle Network Study)

2.11 As noted earlier, in terms of permeability, the N18 and Ballinacurra Creek represent hard edges, limiting their crossing and funnelling various modes of transport through limited connections, such as the N18 overpass. In this respect, there is an opportunity for improvements of all modes of transport (primarily bicycle and pedestrian and also vehicular) in terms of permeability and connectivity. An 'Improved Public Transport Linkage/Coverage' opportunity is identified in particular through the lands in the Limerick Metropolitan District Movement Framework Study:

Figure 7.3 Preliminary Proposed Schemes – Southern Corridor (Source: Limerick Metropolitan District Movement Framework Study)

2.12 Such improvements which may be delivered as part of development are supported by the Southern Environs LAP 2021-2027:

"To promote and facilitate a sustainable transport system that prioritises and provides for walking, cycling and public transport facilities while ensuring appropriate traffic management.

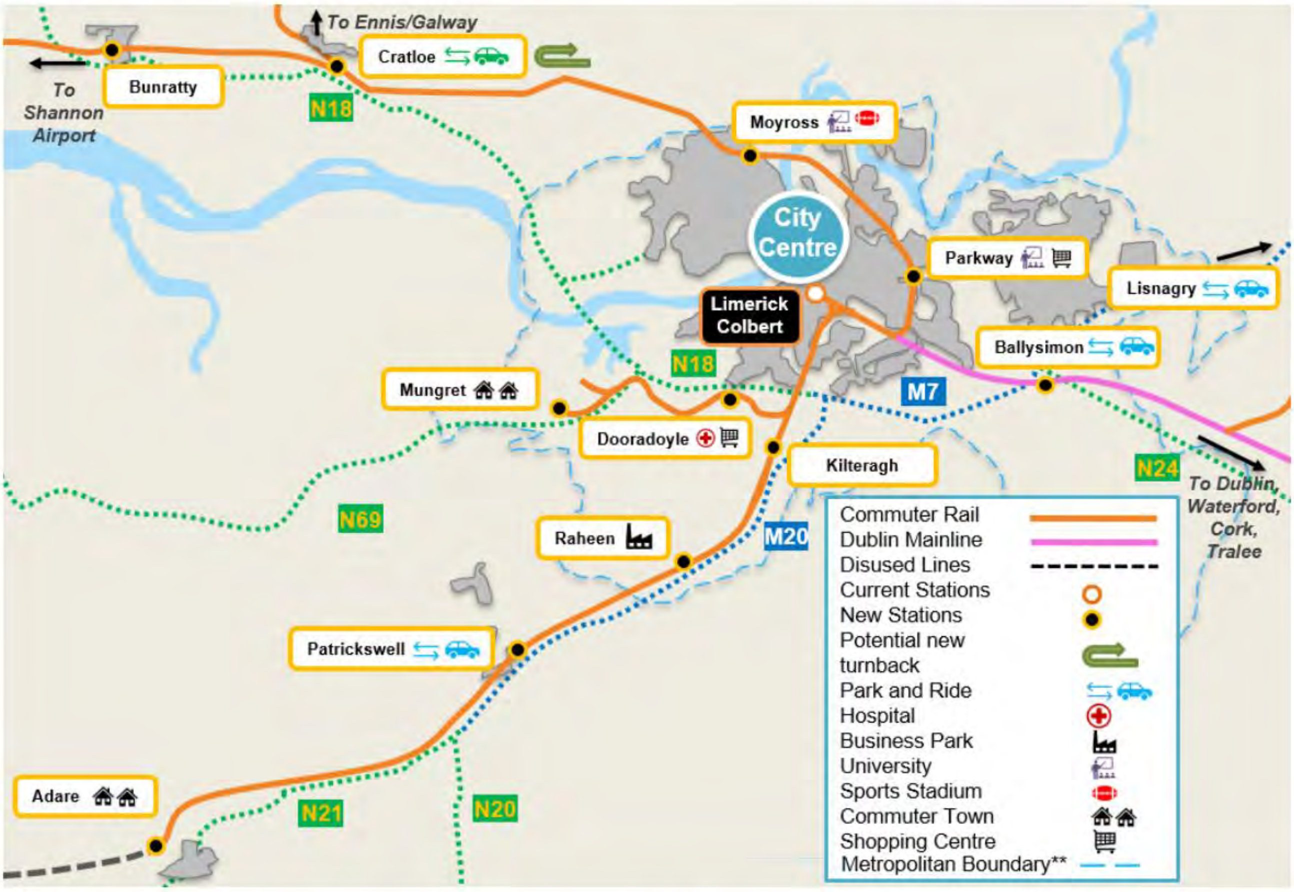
2.13 We would additionally note, in Irish Rail's submission on the new City and County Development Plan, the potential for utilising the existing rail lines to Foynes and Irish Cement (Mungret) as commuter rail corridors were highlighted to be explored which would provide for six new stations, including one along the northern boundary of the Crescent.

2.14 The submission states:

"Iarnród Éireann note the objective of the Council "to support and encourage new and upgrading of existing rail networks", and while the draft LSMATS provides proposed transport objectives to 2040, there are possibilities which Iarnród Éireann believe should be considered during the lifetime of the new Development Plan period to support the Councils objective and transform transport in Limerick City and County, and the Shannon Area. I refer to the June 2020 Programme for Government which stated that

in line with the commitment in the National Planning Framework to balanced regional development, the Government would "prioritise rail projects in Cork, Galway, Limerick, and Waterford on existing and unused lines". Our rationale for presenting these also allows me to revert back to two key earlier points in this submission; interventions in the transport sector should be based on a long term strategic vision for the sustainable mobility of people and goods. This is driven by the principle that structural reform of policies takes a considerable time to implement and must be the subject of detailed advanced planning. Rail in particular, is subject to this reality and thus, consideration should be given now to a future rail vision for Limerick and to the steps to achieve it. This is a critical milestone as Ireland and the wider-EU have committed for climate-neutrality by 2050. The possibilities presented in this submission supports this aim and as they can largely be delivered incrementally to 2030 by Iarnród Éireann."

Figure 5: Limerick-Shannon Suburban Rail Possibilities – Station Locations and Amenities**



***Shannon rail link (Branch line) route alignment is indicative only*

Source: Irish Rail submission on the Draft Limerick City and County Development Plan

2.15 The additional public transport capacity that would be provided by such a proposal (as is clearly being explored by Irish Rail), in addition to the excellent existing bus infrastructure highlights the confluence of public transport infrastructure (a node) at this location. The submission by Irish Rail. It is also noteworthy that a critical mass of population is required for such projects to be feasible which supports the case for the development of the lands.

2.16 National objectives for a compact urban form set out that a key element to sustainable development and more efficient use of lands is for development to be located along such public transport corridors. In addition, the undeveloped nature of this key landbank between the city centre and southern environs represents an opportunity for improved connectivity to be delivered as part of the development of the lands.

Current Zoning Objectives

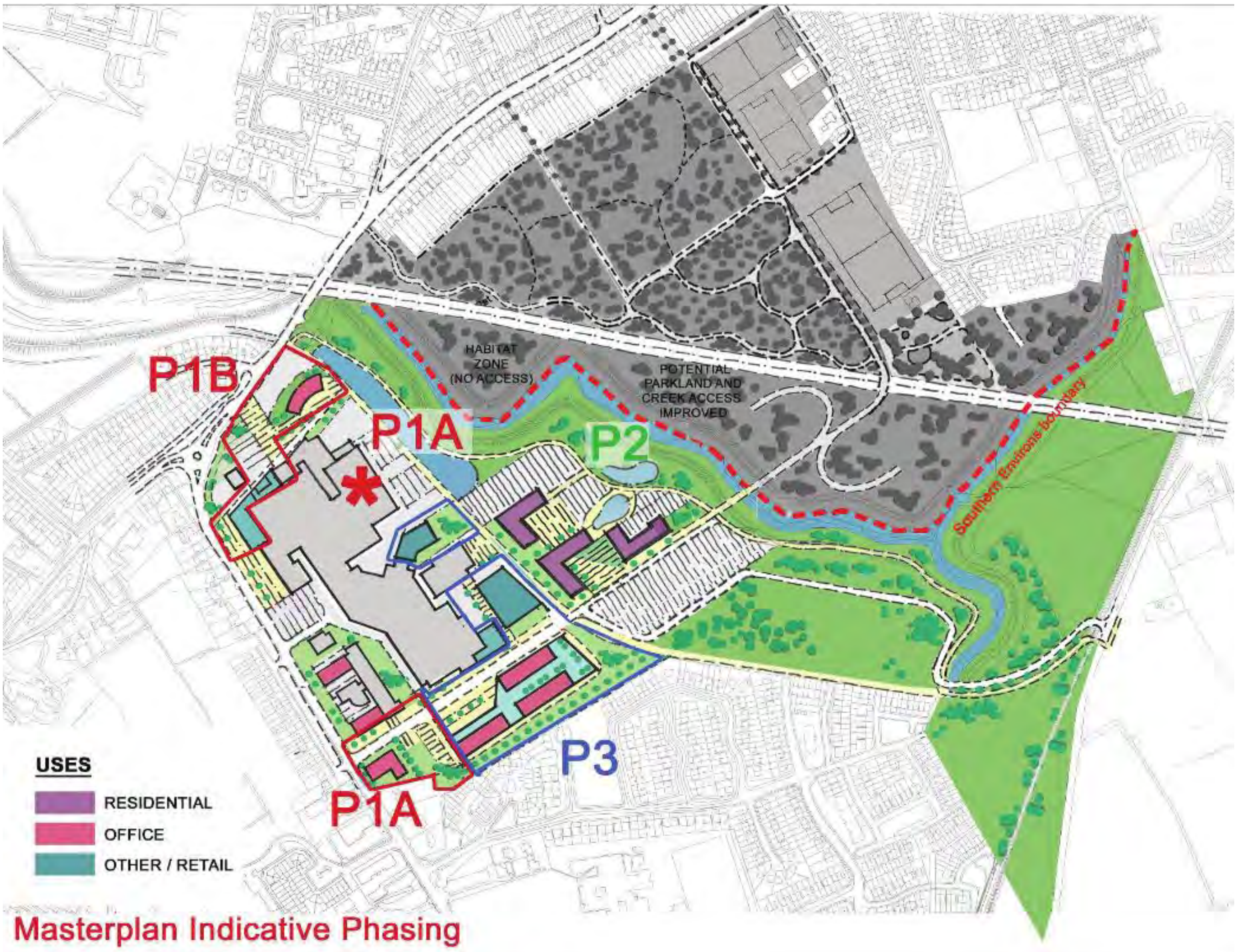
2.17 The lands south of Ballinacurra Creek have a zoning objective ‘Semi-natural Open Space’. The lands north of the Balinacurra Creek primarily have a zoning objective ‘Open space, park’ and a portion of lands with the ‘Agriculture’ zoning objective.

3.0 PROPOSAL

3.1 The proposal has been revised from previous submissions made to the City and County Council to exclude 'highly vulnerable' uses including residential. The image below illustrates the potential for the delivery of:

- Employment uses
- Retail/Restaurant Uses
- Improvement of District Centre services
- Public open space, improved amenities and leisure uses
- Release of inaccessible lands for amenity and improved biodiversity
- Cycle and pedestrian permeability
- Elements of greenway

3.2 A concept plan illustrating the proposal is shown below:



Concept Plan – Dooradoyle Urban Quarter

4.0 GUIDELINES FOR PLANNING AUTHORITIES ON 'THE PLANNING SYSTEM AND FLOOD RISK MANAGEMENT (NOVEMBER 2009)'

4.1 The relevant planning policy context for the Flood Risk Justification Test is provided by the "*Guidelines for Planning Authorities on the Planning System and Flood Risk Management* (November 2009)".

4.2 The purpose of the Guidelines is to introduce *'comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process.'* The document goes on to state:

"Planning authorities will ensure that only developments consistent with the overall policy and technical approaches of these Guidelines will be approved and permission will be refused where flood issues have not been, or cannot be, addressed successfully and where the presence of unacceptable residual flood risks to the development, its occupants or users and adjoining property remains."

4.3 The Guidelines identify three geographical areas known as 'Flood Zones' within which the likelihood of flooding is in a particular range. These zones are seen as a key tool in flood risk management. The three types or levels of flood zones are defined as follows:

- **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 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and

- **Flood Zone C** – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

4.4 The lands are located within Flood Zone A, B and C.

Table 1: Classification of vulnerability of different types of development, extract from Table 3.1 of Flood Risk Guidelines

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

*Uses not listed here should be considered on their own merits

Table 2: Matrix of Vulnerability, extract from Table 3.2 of Flood Risk Guidelines

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

Table 3.2: Matrix of vulnerability versus flood zone to illustrate appropriate development and that required to meet the Justification Test.

4.5 The uses proposed as part of the concept for the lands would be considered appropriate and also require a Justification Test.

4.6 The key principles upon which the Guidelines are based are:

- Avoid development in areas at risk of flooding;
  If this is not possible, consider substituting a land use that is less vulnerable to flooding;
  Only when both avoidance and substitution cannot take place should consideration be given to mitigation and management of risks;
- Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted;
- Exceptions to the restriction of development due to potential flood risks are provided for through the use of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated.

4.7 It is a core objective of the guidelines to *“avoid unnecessary restriction of national, regional or local economic and social growth”* and to this extent the guidelines specifically allow a less rigid application of the guidelines in the case of development that makes a significant contribution to achieving fundamental objectives of national, regional and local planning policy provided that the technical requirements of flood risk management are met.

4.8 Fundamental objectives of national and regional planning policy are to achieve compact urban growth, with a particular emphasis on infill development and development contagious with existing development. The subject lands are located at the confluence of the city centre and southern environs and therefore represent a significant opportunity to contribute towards compact urban growth within the defined settlement boundary on sequentially favourable and underutilised land.

5.0 JUSTIFICATION TEST FOR DEVELOPMENT PLANS

5.1 Section 4.23 of the Guidelines provide the planning authority must be satisfied that the development is necessary on the basis of the Justification Test as it applies to development plan preparation (Box 4.1 of the Guidelines, attached as Figure 3 below) where designating land for development in areas at high or moderate risk of flooding. It is stated:

"*Section 4.23 – Having prepared a Strategic Flood Risk Assessment and mapped flood zones as part of its development plan review process and any more detailed flood risk assessment as necessary, situations can arise where a planning authority will need to consider the future development of areas at a high or moderate risk of flooding, for uses of development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2. In such cases, the planning authority must be satisfied that it can clearly demonstrate on a solid evidence base that the zoning or designation for development will satisfy the Justification Test outlined in Box 4.1 opposite.*"

Figure 3: Box 4.1: Justification Test for Development Plans

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

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) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];

(ii) Comprises significant previously developed and/or under-utilised lands;

(iii) Is within or adjoining the core[3] of an established or designated urban settlement;

(iv) Will be essential in achieving compact and sustainable urban growth; and

(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.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

5.2 A response to each of the criteria of Box 4.1 of the Guidelines is set out below.

1. The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or

under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

National and regional planning policy in the form of the National Planning Framework 2040 and the Regional Spatial and Economic Strategy - Southern Regional Assembly both promote consolidation of the Limerick Metropolitan Area.

5.5 Consolidation of the Limerick Metropolitan Area is seen as paramount in order to achieve a successful regional development through the promotion of higher densities at appropriate locations in harmony with improved public transport systems.

5.6 The NPF recognises the importance of consolidation of cities in order to realise a competitive city, stating that:

"Develop cities and towns of sufficient scale and quality to compete internationally and to be drivers of national and regional growth, investment and prosperity."

5.7 This consolidation is achieved through use of strategically located lands such as the site which are highly accessible and which provide a natural infill between existing developed areas of the city and southern suburbs, adjacent a District Centre and public transport corridor.

5.8 The National Planning Framework (NPF) is the Government's plan to cater for the extra one million people that will be living in Ireland, the additional two thirds of a million people working in Ireland and the half a million extra homes needed in Ireland by 2040.

5.9 As a strategic development framework, Ireland 2040 sets the long-term context for our country's physical development and associated progress in economic, social and environmental terms and in an island, European and global context.

5.10 National investment planning, the sectoral investment and policy frameworks of departments, agencies and the local government process will be guided by these strategic outcomes in relation to the practical implementation of Ireland 2040. The NPF sets out the importance of development within existing urban areas by *"making better use of under-utilised land including 'infill' and 'brownfield' and publicly owned sites together with higher housing and job densities, better services by existing facilities and public transport".*

5.11 Objective 3a of the NPF states that it is a national policy objective to *"deliver at least 40% of all new homes nationally within the built up envelope of existing urban settlements".* For the country's five cities, this minimum target is 50%. The proposed development is a strategically located underutilised site adjacent a District Centre in an existing urban settlement along a public transport corridor and in close proximity to the M7. The proposed development is therefore compliant with the objective of the NPF.

5.12 Objective 4 states "*ensure the creation of attractive, liveable, well designed, high quality urban places that are home to diverse and integrated communities that enjoy a high quality of life and well being".* The proposed development would provide for a high quality mixed use development in conjunction with amenity, permeability and connectivity benefits. The lands are adjacent an existing District Centre, and therefore there is a significant amount of existing services in the vicinity, which the subject lands are well linked to. The additional population and density of the proposal would further strengthen the viability of the District Centre in an appropriate location and provide significant amenities to the wider area.

5.13 It is considered that the proposed development provides for the creation of an attractive, high quality, sustainable new mixed-use development within the existing urban area of the city. The provision of the new sustainable development is therefore consistent with the NPF objective.

Objective 11 of the National Planning Framework states that *"there will be a presumption in favour of development that encourages more people, jobs and activity within existing urban areas, subject to development meeting appropriate planning standards and achieving targeted growth"*.

5.14 The proposed development would provide a significant employment opportunity, strengthening the delivery of compact growth with an integrated mix of uses, reducing commuting by car as the lands site are well served by public transport.

5.15 The proposed development is located along one of the main routes into the city centre and is well served by public transport. The existing site is underutilised and presents a key opportunity site as identified in the NPF for redevelopment of a mixed use scheme. The proposed development is therefore in accordance with the objectives of the NPF in this regard.

5.18 The RSES set out the planned direction for growth up to 2040. The lands are located within the Limerick Shannon Metropolitan Area Strategic Plan. The overview for the MASP states:

"Limerick City is the largest urban centre in Ireland's Mid-West and the country's third largest city. The NPF supports ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to achieve its potential to become a city of scale."

5.19 It is clear therefore on the basis of the NPF and RSES, that Limerick is identified for significant growth and satisfies this element of the Justification Test.

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) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement;

5.20 The subject lands are a natural infill site between the developed areas north and south. The zoning of the lands would facilitate the delivery of employment and amenity uses and deliver on compact growth objectives through the use of an infill site in the interest of the proper planning and sustainable development of Limerick.

(ii) Comprises significant previously developed and/or under-utilised lands;

5.21 The subject lands are undeveloped and given the location with development north and south, represent an opportunity for infill development along a public transport corridor with existing retail and services adjoining, and in this respect in particular, are underutilised having regard to their strategic location.

(iii) Is within or adjoining the core of an established or designated urban settlement;

5.22 The lands represent an infill site between the established designated urban settlements of the city and southern suburbs. Dooradoyle Crescent is an established District Centre. In all respects, the lands are within or adjoining the core of an established urban settlement. The subject lands are within or immediately contiguous to the CSO defined Limerick City & Suburbs, within which at least 50% of all future housing must be located.

(iv) Will be essential in achieving compact and sustainable urban growth; and

5.23 This issue has been substantively addressed above under sub-sections (i), (ii) and (iii). As noted, the subject lands form a sequentially preferable and most logical location for the delivery of new economic and amenity development within the administrative area of Limerick. They form a natural infill to the existing established developed areas within the city boundary and southern suburbs. They are located in a highly accessible and strategic location adjacent a District Centre with associated services and along a transport corridor and in close proximity to the city centre.

5.24 The subject lands are therefore an important area for development in the context of the strategic development of the region. The subject lands are therefore essential for the achievement of the compact and sustainable urban growth of Limerick.

(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.

5.25 The DOEHLG Development Plan Guidelines outline that a sequential approach to the development of land should be promoted whereby zoning should extend outwards from the centre of an urban area, with undeveloped lands closest to the core and public transport routes being given priority. The subject lands therefore offer suitable and available land adjoining the existing urban areas to accommodate development.

5.26 Appendix 1 of this document provides a diagrammatic representation of the current Development Plan Guidelines for the zoning of lands in a sequential manner, and demonstrates that the subject lands sequentially are favourable due to comprising an infill site on a public transport corridor adjacent and existing established District Centre, and as sought under the NPF and RSES, would deliver homes, economic development and associated amenities and services within the existing urban area on an infill site.

5.27 Appendix 2 Provides a note prepared by Arthur Cox, Solicitors outlining the legal basis for undertaking strategic flood risk assessments, and how such assessments should be undertaken at an early stage in the plan making process.

3. A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

5.28 A Strategic Flood Risk Assessment (SFRA) and Strategic Environmental Assessment (SEA) would be undertaken as part of the Development Plan making process. It is noted that notwithstanding the flood maps for the area, the existing embankments constructed in the 1960's provide flood defences to a 1 in 200-year tidal event, which is significant. We also understand that consultants are to be appointed to bring forward the Limerick Flood Scheme, and defences along the Ballinacurra Creek watercourse would form part of the Scheme. This would provide a defended corridor along Balinacurra Creek and further emphasise the strategic nature of the subject lands for development.

6.0 SUMMARY AND CONCLUSIONS

6.1 It has been identified that the subject lands are partially located in a Zone A, B and C in terms of flood risk. Having regard to the location of the lands, the nature of the development and the requirements of *'The Planning System and Flood Risk Management'* Guidelines, it has been determined that the subject proposal, in relation to the Flood Zone A and B lands, must be examined under the Justification Test for Development Plans for certain uses of the concept plan as set out in the Flood Risk Guidelines.

6.2 Having carried out the required Plan-Making Justification Test assessment, it has been determined that the subject proposal complies with the requirements of the Justification Test for Development Plans. The following points are of particular relevance:

(i) The lands are located within the Southern Regional Assembly, encompassing the Limerick Metropolitan Area. The NPF recognises the importance of consolidation the such areas in order to realise a competitive city.
(ii) The lands strategic location in the existing urban are on a sequentially favourable infill site and present an excellent opportunity to create a high quality mixed use development and provide access to enhanced amenities and services.
(iii) The development of the subject lands will help to better connect the Dooradoyle area with the city core.
(iv) The development of the subject lands will also provide for the delivery of a critical mass of residential, economic social and amenity development which will support increased investment in the area, promote sustainable development and therefore result in both direct and indirect planning gain benefits to the County.

6.3 On the basis of the above, it is considered that the assessment under the Plan-Making Justification Test has demonstrated that the proposed development of the subject lands is appropriate.

APPENDIX A – SEQUENTIAL ANALYSIS OF LAND

Sequential Analysis

In its most basic description, a sequential analysis for the purposes of land use zoning, in order to achieve compact growth and in the context of Limerick City and Environs (the defined settlement boundary), seeks to assess lands with respect to its relative proximity to the city centre.

Compact Sustainable Growth is one of the Guiding principles for the Limerick and Shannon Metropolitan Area Spatial Plan (MASP) contained in the Regional Spatial and Economic Strategy (RSES):

Compact sustainable growth – The development of brownfield and infill lands to achieve a target of at least 50% of all new homes within or contiguous to the existing built up area in Limerick City and 30% in Shannon and other settlements.

The Sustainable Residential Development in Urban Areas – Guidelines for Planning Authorities (2009) provides for the following guidance on the sequential approach to the zoning of land:

"When land is zoned in a development plan without the benefit of a more detailed local area plan designation, the development plan should identify where practicable the sequential and co-ordinated manner in which zoned lands will be developed, so as to avoid a haphazard and costly approach to the provision of social and physical infrastructure. The sequential approach as set out in the Department's Development Plan Guidelines (DoEHLG, 2007) specifies that zoning shall extend outwards from the centre of an urban area, with undeveloped lands closest to the core and public transport routes being given preference, encouraging infill opportunities, and that areas to be zoned shall be contiguous to existing zoned development lands and that any exception must be clearly justified in the written statement of the development plan."

The Development Plan Making Guidelines (2007; Section 4.19) states:

"In order to maximise the utility of existing and future infrastructure provision and promote the achievement of sustainability, a logical sequential approach should be taken to the zoning of land for development:

(i) Zoning should extend outwards from the centre of an urban area, with undeveloped lands closest to the core and public transport routes being given preference (i.e. 'leapfrogging' to more remote areas should be avoided);

(ii) A strong emphasis should be placed on encouraging infill opportunities and better use of under-utilised lands; and

(iii) Areas to be zoned should be contiguous to existing zoned development lands.

Only in exceptional circumstances should the above principles be contravened, for example, where a barrier to development is involved such as a lake close to a town. Any exceptions must be clearly justified by local circumstances and such justification must be set out in the written statement of the development plan."

For the purposes of this exercise, lands will be categorised as follows and in order of where development should be targeted:

- Generally developed - Sites in this category are primarily brownfield (vacant or underutilised) and located in the developed area of the settlement footprint
- Consolidated infill – Sites in this category represent larger scale infill sites, located between developed areas
- Contiguous expansion – Sites in this category represent an outward expansion contiguous to existing developed areas

A useful exercise is to review aerial imagery of the settlement to determine, broadly, the categorisation of lands. Such an exercise is an initial screening of lands, to broadly identify where development and zoning of lands such be explored and targeted.

As part of this sequential assessment, we have carried out this exercise (below). The diagram, overlaid on aerial imagery (Google Maps) identifies the developed area, areas which would provide for consolidated infill of lands and areas which if developed would comprise contiguous expansion. As part of this exercise, the current BusConnects proposals (it is acknowledged certain roads may not be delivered where not existing) and the existing heavy rail lines (referenced as potential future passenger rail by Irish Rail in their Strategic Issues Paper submission to LCCC) are also mapped. This exercise is a mapped illustration of the guidance provided in the Development Plan Guidelines on where land should be zoned and sequentially in which order of priority (outwards from the centre and along transport corridors).

Note on Flood Risk Assessment

In 2009 the Minister for the Environment issued the Planning System & Flood Risk Management Guidelines (the "**Guidelines**"). The Minister's Foreword states that the guidelines require the planning system at national, regional and local levels to avoid development in areas at risk of flooding, particularly flood plains, **unless there are proven wider sustainability grounds that justify appropriate development and where the flood risk can be reduced or managed to an acceptable level without increasing flooding risk elsewhere**. A core objective of the guidelines is to avoid **inappropriate** development in areas at risk of flooding.

At the outset it is important to recognise that there is no outright planning prohibition on development in areas affected by flood risk. Nor is there a policy of excluding the possibility of lands located within flood plains from being zoned for development. Inappropriate types of development that would create unacceptable risks from flooding should not be planned for or permitted. However, by following the Guidelines, once certain criteria are met and certain procedures are followed, zoning for appropriate development, and development accordingly in certain flood risk areas may proceed, as is outlined below.

Planning authorities are to identify flood hazard and potential flood risk **at the earliest stage.** The Guidelines require that a **sequential approach** to flood risk management be adopted when preparing a development plan in general. This is based firstly on avoidance of areas at risk of flooding. If avoidance is not practicable, consideration should be given to substituting a land use that is less vulnerable to flooding. When for planning reasons both avoidance and substitution cannot take place, consideration should be given to mitigation and management of risks.

How development may be accommodated within flood risk areas is provided for through the use of a **Justification Test** set out in the Guidelines, **where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated.**

Justification Test for Development Plans

Where, as part of the preparation of a development plan, a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding (dwellings are considered highly vulnerable development) that would generally be inappropriate, all of the following criteria must be satisfied:

1. The urban settlement is targeted for growth under the National Planning Framework, Regional Spatial & Economic Strategy, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.
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:
    a. Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement;

b. Comprises significant previously developed and/or under-utilised lands;

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

d. Will be essential in achieving compact and sustainable urban growth; and

e. 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.

3. A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

In summary the Guidelines provide the framework within which Planning Authorities can zone land for development which is located within identified Flood Risk Zones (A & B) in certain circumstances which there is an identified planning need to do so, and where an engineering solution is available which can manage the risk without causing unacceptable adverse impacts elsewhere.

The Guidelines identify that the assessment of potential flooding risk in the form of Strategic Flood Risk Assessment (SFRA), should be undertaken at the early stages of the development plan making process, and before decisions are made on the zoning of land.

The Office of Public Works (OPW) is the lead agency for flood risk management in Ireland. In this role they actively engage with Planning Authorities who are preparing Development Plans. In their submissions to both the Draft Southern Environs LAP and the Limerick Development Plan 2022-2028 Issues Paper they identified a particular need for "*a more detailed assessment would be recommended for the SELAP and should be at a minimum a Stage 2 SFRA. The Guidelines set out that land use zoning, informed by the suitable level of FRA and if necessary a Justification Test, should be concluded at the Plan-making Stage.*"

They go on to state that:

"Chapter 5 of the Guidelines state that most flood risk issues should be raised within strategic assessments undertaken by local authorities at the plan-making stage. As flood risk assessments are integrated with the SEA process, Section 3.10 also highlights the need that FRA's be undertaken as early as possible in the process so that the SEA is fully informed of the flood risks and impacts of the proposed zoning or development".

This overall approach to flood risk assessment is summarised well in the OPW's submission to Limerick Council on the Development Plan Issues Paper when it stated:

"In the preparation of the Draft Plan, the OPW recommends that particular attention is paid to the following sections of the Guidelines;

- *Chapter 3 – The Planning Principles,*
- *Chapter 3 – The Sequential Approach, and definitions of Appropriate Development,*
- *Chapters 3 and 4 – The Plan-making Justification Test where it is intended to zone or otherwise designate land where there is a moderate or high probability of flooding, noting*

that the application of the Test should be supported by analysis to an appropriate level of detail.

The OPW advises that clear commitments and strategic objectives regarding flood risk and the principles of the Guidelines are included in the Draft Plan, and that persons with the relevant expertise review any flood risk assessments submitted Limerick City and County Council".

Concluding Comments

The first step in the process is the carrying out of a comprehensive assessment of land capacities of all potential sites located within the built up area of the city and suburbs to determine whether sufficient land is available in the right places and capable of being developed within the period of the plan to meet the projected housing needs of the city. Having then established the needs, should some of these potential sites be located within flood zones, then the Justification Tests should be carried out in accordance with the Guidelines.

From the foregoing review of the relevant national Guidelines on Flood Risk Assessment, and the advice provided by the national lead agency on flooding (OPW), it is clear that it is both necessary and appropriate for Limerick City & County Council to undertake a detailed Strategic Flood Risk Assessment as part of the preparatory work for the new City & County Development Plan. This should also include the preparation of sufficiently detailed Justification Tests on those lands which have been identified as being needed to achieve national and regional planning objectives of promoting compact sustainable growth of the city and suburbs, where they may be located with identified Flood Zones.

Clancourt Group

Dooradoyle Portland Urban Quarter

Strategic Flood Risk Assessment

262009

Draft 2 | 9 July 2020

Job number 262009

Ove Arup & Partners Ireland Ltd

Arup
50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

ARUP

Document Verification

ARUP

<table>
<tr><td>Job title</td><td colspan="3">Dooradoyle Portland Urban Quarter</td><td>Job number
262009</td></tr>
<tr><td>Document title</td><td colspan="3">Strategic Flood Risk Assessment</td><td>File reference</td></tr>
<tr><td>Document ref</td><td colspan="4">262009</td></tr>
<tr><td>Revision</td><td>Date</td><td>Filename</td><td colspan="3">Clancourt_SFRA_Draft 1.docx</td></tr>
<tr><td rowspan="4">Draft 1</td><td rowspan="4">3 July 2020</td><td>Description</td><td colspan="3">First draft</td></tr>
<tr><td></td><td>Prepared by</td><td>Checked by</td><td>Approved by</td></tr>
<tr><td>Name</td><td>Michael Phelan/Aine Delaney/Emer Kennedy</td><td>Ken Leahy</td><td>Ken Leahy</td></tr>
<tr><td>Signature</td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Draft 2</td><td rowspan="5">9 Jul 2020</td><td>Filename</td><td colspan="3">Clancourt_SFRA_Draft_2.docx</td></tr>
<tr><td>Description</td><td colspan="3"></td></tr>
<tr><td></td><td>Prepared by</td><td>Checked by</td><td>Approved by</td></tr>
<tr><td>Name</td><td>Emer Kennedy</td><td>Ken Leahy</td><td>Ken Leahy</td></tr>
<tr><td>Signature</td><td></td><td></td><td></td></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td>Filename</td><td colspan="3"></td></tr>
<tr><td>Description</td><td colspan="3"></td></tr>
<tr><td></td><td>Prepared by</td><td>Checked by</td><td>Approved by</td></tr>
<tr><td>Name</td><td></td><td></td><td></td></tr>
<tr><td>Signature</td><td></td><td></td><td></td></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td>Filename</td><td colspan="3"></td></tr>
<tr><td>Description</td><td colspan="3"></td></tr>
<tr><td></td><td>Prepared by</td><td>Checked by</td><td>Approved by</td></tr>
<tr><td>Name</td><td></td><td></td><td></td></tr>
<tr><td>Signature</td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Issue Document Verification with Document ✓</td></tr>
</table>

Contents

Appendices

Executive Summary

Arup was commissioned by Clancourt Group to undertake a Strategic Flood Risk Assessment for a proposed Dooradoyle Portland Urban Quarter Masterplan which incorporates Clancourt's landholding adjacent to and including the existing Crescent Shopping Centre in Dooradoyle, Limerick.

The Shannon Catchment Flood Risk Assessment and Management (CFRAM) study was used to carry out an initial flood risk review of the site and surrounding area. The CFRAM study found that the site is subject to tidal flooding which originates at the upper (eastern) end of the lands where the existing flood defence embankment is slightly lower (c. 0.2m due to degradation over time) than further downstream.

A hydrological assessment of the Ballinacurra Creek and surrounding tributaries was carried out to produce estimates of peak flows and a hydrograph shape for use as input into the hydraulic model built for this study. This assessment included the derivation of peak flows using several methodologies. The application of the Flood Studies Update FSU methodology was deemed the most appropriate for this study as it adopts the most recent hydrological datasets specific to Ireland and is also considered the most comprehensive flow estimation method available. Results also compare well to the IH124 and FSR6 variable methods and are more conservative than flows derived under the Shannon CFRAM study, which provides further confidence that the flow estimation is conservative.

In order to derive site specific tidal conditions, the Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study and the Irish Coastal Protection Strategy Study (ICPSS) Phase IV – Shannon Estuary were assessed. These studies were compared with historical gauge records at Baals Bridge and Limerick Dock. While all source showed good correlation the CFRAMS levels resulted in the highest boundary conditions and as such were adopted for this assessment.

A detailed coupled one-dimensional (1D) and two-dimensional (2D) unsteady flow hydraulic model of the Ballinacurra Creek and Ballysheedy tributary was constructed in order to accurately simulate flood risk in the vicinity of the subject lands, including both fluvial and coastal sources. The model was informed by a bathymetric survey of the river, LiDAR survey of the floodplain and topographical survey of the river and embankments.

The model confirmed that the subject lands are currently subject to tidal flooding which propagates the flood defence embankments low point at the eastern end of the site. In accordance with the Planning System and Flood Risk Management Guidelines (OPW 2009) the existing flood defence embankments were not considered in classifying flood zoning of the subject lands. Thus, the majority of the subject lands lie within Flood Zone A and requires a Justification Test. Such a Development Plan Justification Test was recently completed by John Spain Associates and included in Appendix G

However, the existing OPW embankment offer a high degree of protection; modelling results demonstrate that this embankment is overtopped for the 200-year tidal event along the lowest point of its crest, which is located near its eastern site boundary. A site walkover and topographical survey of this embankment confirmed that this low point is likely a result of settlement of the embankment over time from its original design level, of in the order of 0.2m. A significant volume of flood water would therefore currently inundate the subject lands during the extreme tidal events which would originally have been contained within the defended estuarine channel.

The obvious quick fix solution to the above flooding mechanism to protect the main Clancourt site adjoining the Crescent Centre, is to restore the existing embankment to the 1 in 200-year design standard. The flood modelling undertaken for this study demonstrates that this can be achieved without altering the flood risk profile outside of the Clancourt lands.

However, the flood modelling work undertaken as part of this SFRA identified a more strategic solution which has the potential to remediate flood risk, not just for the Clancourt lands, but for the entire Dooradoyle Portland Urban Quarter Masterplan area and for existing housing developments upstream on the Ballinacurra Creek and Ballysheedy River. This is shown in Figure 1.

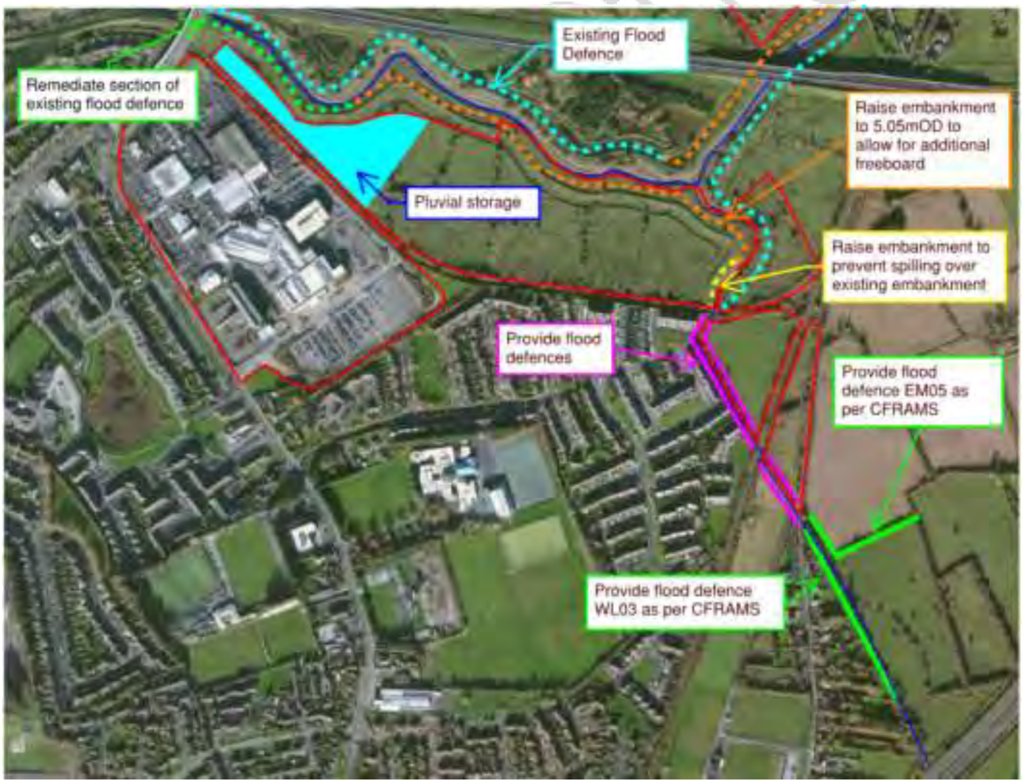


Figure 1 Overview of tie in between proposed Clancourt tidal flood protection enhancement measures and the proposed upstream Shannon CFRAMS fluvial flood protection measures (to provide holistic approach to combined tidal and fluvial flood risk in the vicinity of the Rossbrien Road)

To achieve this, it is necessary to consider any proposed flood defences in the context of the Shannon CFRAM.

The proposed defences on the Clancourt lands address the tidal risk and include defences immediately downstream of the Rosbrien Road (coloured purple in Figure 1). The Shannon CFRAMS include proposed measures to address fluvial risk immediately upstream of Rosbrien Road (coloured green in Figure 1). An integrated approach can be achieved by Clancourt providing low level defences either side of the Ballinacurra Stream downstream of Rosbrien Road which would essentially tie into the Shannon CFRAMS defences immediately upstream. Containing the flow in the channel here would marginally increase flood levels locally upstream of the Rosbrien Road and would thus require a modest increase (envisaged to be a maximum of less than 0.2m increase at downstream end) in the height of the proposed Shannon CFRAMS defences, but in the context of the wider area benefits, this additional cost would be represent very high value for money.

In Summary, this Strategic Flood Risk Assessment Report has demonstrated that, with modest scale interventions to improve upon and extend the existing flood defences, it is eminently possible, taking an integrated approach to solve the current flooding issues for the lands bordering the Ballinacurra Creek in the Dooradoyle/Rosbrien Road areas.

1 Introduction

1.1 Context

Arup was commissioned by Clancourt Group to undertake a Strategic Flood Risk Assessment for a proposed Dooradoyle Portland Urban Quarter Masterplan which incorporates Clancourt's landholding adjacent to and including the existing Crescent Shopping Centre in Dooradoyle, Limerick.

The subject lands are located in an underutilised area between the existing developed lands in Dooradoyle and the City Centre, and the development of these lands is seen as critical in creating a stronger and sustainable linkage of the two areas.

The lands are already protected to a high standard by existing OPW embankments. The main aim of this commission is to provide an evidence base to justify the development of these strategic lands, and to demonstrate that the development can satisfactorily address flood risk both on and adjoining the lands, in a manner which is compatible with any future flood relief works (as identified in the Shannon CFRAMS) and which does not worsen flood risk elsewhere.

1.2 Scope

The scope of the study is as follows:

- Undertake a site visit to gain a thorough understanding of the flood risk at the site, and ground truth all topographical datasets and historic flood maps.
- Scope and procure up to date topographic surveys of the site to facilitate the study.
- Undertake a hydrological assessment of the Ballinacurra Creek and its minor tributary that are both adjacent to the site. The assessment will use methods appropriate to the size of the catchment, including the recent Flood Studies Update (FSU), which has not previously been applied.
- Undertake an assessment of the design tidal levels in the Shannon Estuary and Ballinacurra Creek using best available data.
- Consider the joint probability of fluvial/tidal events at the site.
- Develop a detailed 1D/2D hydraulic model of the relevant reach of the Ballinacurra Creek and its floodplain to represent the existing and future condition.
- Review the risk of groundwater flooding at the site for both the existing scenario and for a potential future development scenario.
- Consideration of pluvial flood risk and the existing urban surface water drainage catchment which drains to the Creek.
- Liaison with the specialist Planning Consultants advising the project, in terms of the wider planning issues relating to a future development of the site.

- Preparation of a Strategic Flood Risk Assessment Report that sets out our key findings.

1.3 Study Area

The study area, highlighted in Figure 1 below, is located south of Limerick City adjacent to the N18 to the north. The study area lies directly north of the Crescent Shopping Centre lands (in Clancourt's ownership) and is traversed by the Ballinacurra Creek.

Figure 2: Study Area identified as 'undeveloped land' highlighted in yellow

The land south of the Creek is in the ownership of Clancourt Group whereas most of the lands directly to the north of the Creek (Portland Park) are owned by Limerick City and County Council.

Figure 2 below shows the Study Area in the context of the wider Limerick City metropolitan boundary.

It can be seen from this figure that the combined lands along the Ballinacurra Creek present an opportunity to provide connectivity between Limerick City and the Southern Suburbs.

Figure 3: Map of Limerick and Southern Suburbs

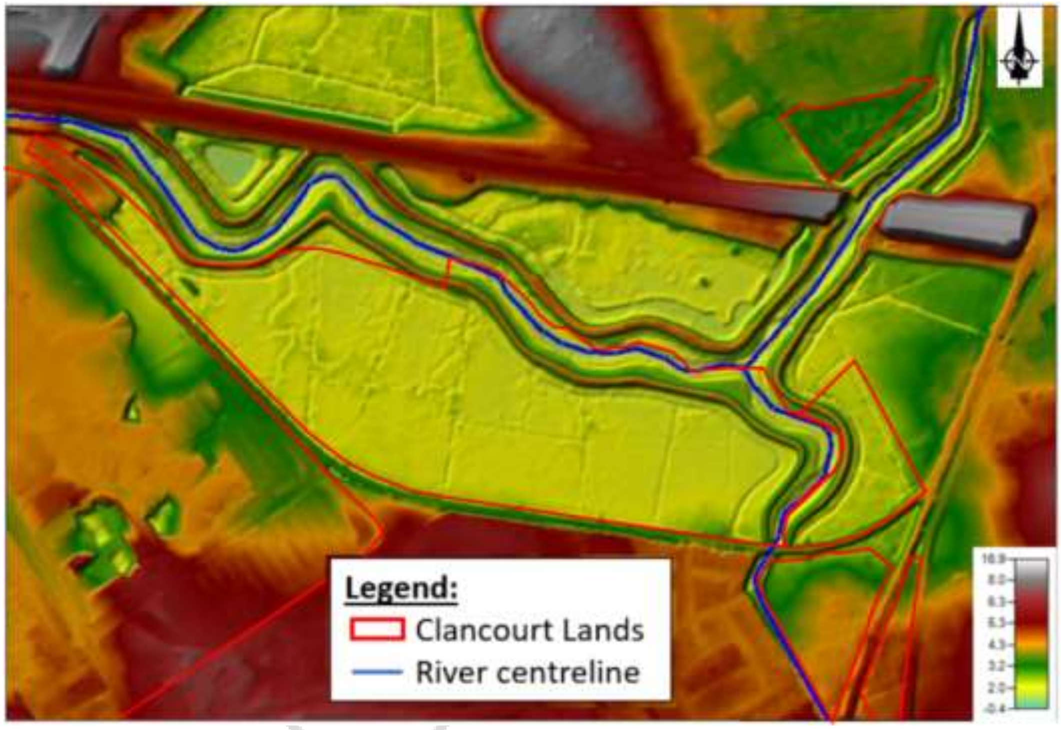
Figure 4 below provides finer detail in terms of the landownership within the Study Area.

Figure 4 Details of landownership

1.4 Study Area Description

The overall site area in Clancourt's ownership is approximately 35 ha (including the Crescent Shopping Centre development) with the largest area south of Ballinacurra Creek being approximately 16.8 ha. The topography of area west of the main railway line does not vary significantly across the site ranging in level from approximately 2.20mOD at the southern end of the site to 1.9mOD at the northern end of the site. The ground rises further and more sharply to the east of the railway line. Refer to Figure 4 below for LIDAR mapping illustrating ground levels within the Study Area.

Figure 5: Existing Ground Levels – LIDAR



An OPW flood protection embankment runs along both banks of the Ballinacurra Creek as far east as the railway line and its tributary, the Ballysheedy Stream as far as the Rosbrien Road. Levels of the top of the embankment vary from 3.75mOD in the east to 5.3mOD at the western end of the site. Refer to Appendix A for an embankment survey drawing provided by Punch Consulting Engineers (2014), including plan and vertical profile.

1.5 Description of Masterplan Proposal

Following the adoption of the Regional Spatial & Economic Strategy (RSES) for the Southern Region, including the Metropolitan Area Strategic Plan (MASP) for Limerick, which were both published on the 31st January 2020, Limerick City & County Council will shortly commence preparations of a new City & County Development Plan for the combined Council area. This new Development Plan must be aligned and be fully consistent with the Regional Strategy.

Having regard to the planning policies and objectives contained in the RSES/MASP, Clancourt believes that its land holding can be utilised to contribute towards meeting the significant housing and employment needs the city will face arising from the very significant population growth targets set out for Limerick in the National Planning Framework (NPF).

The Crescent Centre and adjoining lands (i.e. the study area) sit on an important strategic public transport corridor which links the southern suburbs with the city centre. However, much greater sustainable transport linkages need to be developed to cross the existing barrier which is the M7/N18 corridor and the Ballinacurra Creek to improve connectivity with the city centre.

Directly to the north of the Creek are lands owned by Limerick Council (Portland Park), which, while being laid out as a public park, are underutilised, poorly supervised in terms of passive surveillance and not well kept. The combined lands to the northeast of the Crescent Centre along the Ballinacurra creek and the lands around and including Portland Park present a gap in the continuity of the city's urban fabric and limit the connectivity of the city to Dooradoyle/ Raheen. We believe the combined lands offer immense potential and opportunity to help knit the southern suburbs into the city and to provide a major infill site for both housing and employment, as well as recreational use.

Rezoning these unutilised lands could provide in the region of 1,900 housing units – around 20% of Limerick City's requirements by 2026. Developing this underutilised asset will also make a significant contribution towards meeting Limerick City's target of 50% of future housing to be on infill/brownfield sites within the city & suburbs. Importantly, the development will also be in close proximity to existing retail and other services and to areas of high-density employment.

A preliminary concept of the proposed masterplan is shown in Figure 6 below.

The Masterplanning has been informed by the detail strategic flood risk assessment (SFRA) described in this report recognising that the study area is already protected to a high standard but will require further flood risk management measures to be developed to provide confidence in providing sustainable development in the areas.

The following sections of this report set out the processes undertaken and the key findings of the SFRA,

Figure 6 Preliminary Concept Sketch of Masterplan

2 Data Collection

Early in the Masterplanning process, site walkovers were carried out (between April and July 2018). During these walkover surveys, the topographical features of the site and the relevant watercourses were recorded. Refer to Appendix B for photographs taken during the walkover of 18 July 2018.

Following the initial site walkover, river survey data was provided by Murphy Surveys Ltd (May 2018). The survey data consisted of a long section along the watercourses, cross-sections and photographs along the watercourses at approximately 50 - 100m spacings as well as at any structures along the watercourses.

Light Detection and Ranging (LIDAR) was also acquired from Fugro (May 2018) in order to define the surrounding ground elevations.

The following data was also collected and reviewed:

- Flooding history of the site from the OPW National Flood Hazard Mapping website (www.floodmaps.ie)
- Site geological data from the Geological Survey of Ireland website (www.gsi.ie)
- Limerick County Development Plan 2010 – 2016 (as extended)
- Southern Environs Local Area Plan 2011 - 2017
- Ordnance Survey Ireland Discovery Series Map
- Shannon CFRAM Study

All levels quoted in this report relate to Malin Head datum.

3 Planning Context

3.1 Introduction

The following planning policy documents are relevant to the assessment of this proposed development.

- The national planning guidelines published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled 'The Planning System and Flood Risk Management: Guidelines for Planning Authorities'.
- In terms of planning policy context, the following documents apply:
  - Ireland 2040 NPF
  - Regional Spatial & Economic Strategy for the Southern Region
  - Limerick County Development Plan 2010-2016
  - Southern Environs Local Area Plan 2011 – 2017.

3.2 The Planning System and Flood Risk Management Guidelines

3.2.1 Introduction

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public works jointly published a Guidance Document for Planning Authorities entitled "The Planning System and Flood Risk Management".

The guidelines are issued under Section 28 of the Planning and Development Act 2000 and Planning Authorities and An Bord Pleanála are therefore required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The Minister's foreword to the Guidelines '*recognise the fact that many of the areas where people live and work are already subject to flood risk, and that the needs of regeneration and growth can be reconciled, while taking due account of the need to minimise and mitigate such risks.*'

This principle applies directly to the subject lands.

Since the introduction of the guidelines on the 'Planning System and Flood Risk Management' in 2009, flood risk assessment now rightly forms a key part of good spatial development planning, recognising that developments in areas at risk of flooding should be limited to those areas where '*there are proven wider sustainability grounds that justify appropriate development and the flood risk can* *be reduced or managed to an acceptable level without increasing flood risk elsewhere'*.

The guidelines require the adoption of a Sequential Approach (to Flood Risk Management) of Avoidance, Reduction, Justification and Mitigation and they require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to the guidelines is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site master planning stage.

Accordingly, the flood risk assessment work undertaken in preparing this report has informed the development of the proposed masterplan.

3.2.2 Definition of flood zones

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range.

There are three types of flood zones defined in the Guidelines. Refer Table 1 below.

Table 1: Flood zone definitions

Flood Zone A	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	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 year and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

3.2.3 Definition of vulnerability classes

Table 2 summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each.

Table 2: Vulnerability classes

Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water-based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

3.2.4 Types of vulnerability class appropriate to each zone

Table 3 illustrates the different types of Vulnerability Class appropriate to each Zone and indicates where a Justification Test will be required.

Table 3: Justification test applicability

	Flood Zone A	**Flood Zone B**	**Flood Zone C**
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

The flood risk management guidelines recognise that there is a need to reconcile the desire to avoid development in areas at risk of flooding while also ensuring sequential and compact urban development as several large urban centres are already located in areas that are at risk of flooding. Section 3.7 of the guidelines state the following;

"*Notwithstanding the need for future development to avoid areas at risk of flooding, it is recognised that the existing urban structure of the country contains many well-established cities and urban centres, which will continue to be at risk of flooding. At the same time such centres may also have been targeted for growth in the National Spatial Strategy, regional planning guidelines and the various city and county development plans taking account of historical patterns of development and their national and strategic value. In addition, development plans have identified various strategically located urban centres and particularly city and town centre areas whose continued growth and development is being* *encouraged in order to bring about compact and sustainable urban development and more balanced regional development. Furthermore, development plan guidelines, issued by the Minister for the Environment, Heritage and Local Government under Section 28 of the Planning and Development Act 2000, have underlined the importance of compact and sequential development of urban areas with a focus on town and city centre locations for major retailing and higher residential densities*".

3.3 Ireland 2040 and RSES (Southern Region)

National and regional planning policy in the form of the National Planning Framework 2040 and the Regional Spatial and Economic Strategy - Southern Regional Assembly both promote consolidation of the Limerick Metropolitan Area.

Consolidation of the Limerick Metropolitan Area is seen as paramount in order to achieve a successful regional development through the promotion of higher densities at appropriate locations in harmony with improved public transport systems.

The National Planning Framework is the Government's plan to cater for the extra one million people that will be living in Ireland, the additional two thirds of a million people working in Ireland and the half a million extra homes needed in Ireland by 2040.

As a strategic development framework, Ireland 2040 sets the long-term context for our country's physical development and associated progress in economic, social and environmental terms and in an island, European and global context.

National investment planning, the sectoral investment and policy frameworks of departments, agencies and the local government process will be guided by these strategic outcomes in relation to the practical implementation of Ireland 2040. The NPF sets out the importance of development within existing urban areas by "making better use of under-utilised land including 'infill' and 'brownfield' and publicly owned sites together with higher housing and job densities, better services by existing facilities and public transport".

Objective 3a of the NPF states that it is a national policy objective to "deliver at least 40% of all new homes nationally within the built-up envelope of existing urban settlements". For the country's five cities, this minimum target is 50%.

The RSES set out the planned direction for growth up to 2040. The subject lands are located within the Limerick Shannon Metropolitan Area Strategic Plan. The overview for the MASP states: "Limerick City is the largest urban centre in Ireland's Mid-West and the country's third largest city. The NPF supports ambitious growth targets to enable Limerick City to grow by at least 50% to 2040 and to achieve its potential to become a city of scale."

3.4 Limerick County Development Plan

Section 8.3.6 of the Limerick County Development Plan outlines specific objectives for flood risk which have been developed in accordance with "The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009." These objectives ensure that flood risk management is fully integrated into the County Development Plan. The objectives outlined in Section 8.3.6 include:

- **Objective IN O36: Minimise threat and consequences of flooding**

  "It is the objective of the Council to avert, or where this is not possible, to minimise the threat of flooding in new developments and existing built up areas. Priority will be given to the protection of vulnerable uses that would be seriously affected by the consequences of flood events. The Council will have regard to Government Guidelines, 'The Planning System and Flood Risk Management' and OPW data and advice in the assessment of all development proposals and any subsequent amendments."

- **Objective IN O37: Manage river catchments and surface water run-off**

  "It is the objective of the Council to assist in the sustainable management of river catchments to reduce both the quantity of water run-off and its speed and unpredictability, allow rivers to take their natural flow, and allow flooding only to occur in lower sensitivity areas."

- **Objective IN 038: Screening for Flood Risk**

  "It is the objective of the Council to continue to screen for flood risk as part of the Strategic Environmental Assessment (SEA) process."

- **Objective IN O 39: Flood risk management and development**

  "It is an objective of the Council to ensure that land uses are zoned, and developments allowed where there is minimum flood risk, prioritising the protection of certain land uses particularly vulnerable to the effects of flooding. To this end:

  a) *The sequential approach to zoning and assessment recommended in 'The Planning System and Flood Risk Management', DEHLG November 2009 and any subsequent document will be adopted.*

  b) *The Council will work with the OPW to ensure up to date data and assessment, and to take a precautionary approach where there are gaps in data. Attention will be given to the records and assessments of past flood events, the position of OPW benefiting lands, and the position of alluvial soils in establishing a preliminary estimate of risk.*

  c) *It is an objective of the Council to prepare a Strategic Flood Risk Assessment for relevant areas of County Limerick.*

  d) *Require any development proposal in a location identified as being subject to flooding to:*

1. *Carry out a flood risk / catchment analysis for the development to assess the likely level of flood hazard that may affect the site to the satisfaction of the Council;*
2. *Design the development to avoid flood levels, incorporating building design measures and materials to assist evacuation and minimize damage to property from flood waters;*
3. *Demonstrate that the proposal will not result in increased risk of flooding elsewhere, restrict flow across floodplains, where compensatory storage / storm water retention Volume 1 Transport and Infrastructure Limerick County Development Plan 2010-2016 November 2010 (as varied) 8 - 27 measures shall be provided on site and will not alter the hydrological regime up stream or downstream or at the development location so as to pose an additional flood risk or to increase flood risk;*
4. *Proposals should have provision to reduce the rate and quantity of runoff i.e. minimisation of concrete surfaces and use of semi permeable materials and include adequate measures to cope with the flood risk, e.g. sustainable drainage systems.*

e) Have regard to the Office of Public Works Planning Policy Guidance in the design and consideration of development proposals; and

f) Preserve riparian strips free of development and ensure adequate width to permit access for river maintenance. All flood risk assessments should have regard to national flood hazard mapping, predicted changes in flood events resulting from climate change and the River Shannon Catchment Flood Risk and Management Plan Studies (CFRAM) when completed by the OPW and the Shannon International River Basin Management Plan. The 'development management justification test' and the 'plan - making justification test' as detailed in The Planning System and Flood Risk Guidance document will guide Council responses to development proposals in areas at moderate or high risk of flooding."

- **Objective IN O40: To minimise the impact of structures and earthworks on flood plains and river flow.**

  "It is an objective of the Council in general not to permit development of the following types in or across flood plains or river channels unless it can be clearly demonstrated using flood impact assessments, that they would not create or exacerbate risk of flooding in sensitive locations such as:

  a) construction of embankments, wide bridge piers or similar structures.

  b) raising of ground levels where this would interfere with natural river flow or currents."

- **Objective IN O41: Sustainable Urban Drainage systems**

  "It is the objective of the Council to reduce insofar as possible, the rate and quantity of surface water run-off from all new developments. Developments

should where possible, incorporate sustainable urban drainage systems (SuDS)."

3.5 Southern Environs Local Area Plan

On 16 May 2016 Limerick City & County Council extended the duration of the Southern Environs Local Area Plan 2011-2017 for a further five years, until May 2021.
The Local Area Plan identifies the following objectives:

- **Objective IN 5: Flood risk assessment**

  "It is an objective of the Council to require a comprehensive flood risk assessment for proposals in zoned areas at risk of flooding or areas adjoining same. The effects up and down stream shall be considered as cumulative effects of these developments. Flood risk assessment shall be carried out to the appropriate level of detail to demonstrate that flood risk to and from the development can and will be adequately managed. Such assessment will have to be guided by the contents of the The Planning Systems and Flood Risk Management (November 2009) guidelines and any subsequent guidance on the topic. Where development is permitted in areas subject to flooding, flood mitigation requirements will be required by the Council in terms of design, both internal and external and in layout and in the provision of appropriate Sustainable Urban Drainage Infrastructure (SUDS)."

- **Objective IN 6: Flood risk and the Shannon CFRAM report**

  "It is an objective of the Council to be guided by the measures proposed by the forthcoming Shannon CFRAM report."

4 Definition of Flood Hazard & Flood Mechanisms

4.1 Potential Sources of Flooding

The potential sources of flooding considered for the proposed site can be categorised as:

Fluvial Flooding

Fluvial flooding occurs when rivers exceed their capacity due to sustained or heavy precipitation. The potential risk of fluvial flooding on these lands is from the Ballinacurra Creek and associated tributaries.

Coastal Flooding

Coastal flooding occurs when normally dry, low-lying land is flooded by sea water. Coastal flood risk is applicable on these lands due to the tidal influence of the Ballinacurra Creek.

Pluvial flooding

Pluvial flooding occurs when the capacity of the local urban drainage network is exceeded during periods of intense rainfall. At these times, water can collect at low points in the topography and cause flooding. In the case of these lands, pluvial flood risk can also arise due to the surface water outfalls being 'tidelocked' during periods of high tide resulting in surface water backing up behind the existing flood defence embankments.

Groundwater flooding

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

4.2 Historic Flooding

Reports and maps from the OPW Flood Hazard Mapping website (www.floodmaps.ie) have been examined as part of this flood risk assessment. A total of nine single flood events are recorded within proximity to the site, refer to Figure 6 for the locations of these events.

Figure 7: Historic Flood Events – Floodmaps.ie

Table 4 below gives a summary of these flood events including the flood event name, start date, flood quality code and additional information where available.

Table 4: Summary of flood records

Label No.	Flood Event Name	Start Date	Flood Quality Code*	Additional Information
1	Ballynaclough Ballinacurra Recurring	-	3	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=2364
2	Ballynaclough River Limerick Dec 1999	25 Dec 1999	3	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=1986
3	Greenfield Road Rosbrien Dec 1999	25 Dec 1999	2	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=304
4	Ballynaclogh Rosbrien Recurring	-	3	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=2364
5	Raheen Dooradoyle, Limerick Feb 1990	01 Feb 1990	1	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=541
6	Greenfield Road Rosbrien Dec 1999	25 Dec 1999	2	http://floodmaps.ie/View/FloodReports.aspx?Type=Reports&FloodId=304

*Code 1: Contains, for a given flood event at a given location, reliably sourced definitive information on peak flood levels and/or maximum flood extents.
*Code 2: Contains, for a given flood event at a given location, reliably sourced definitive information on flood levels and/or flood extents. It does not however fully describe the extent of the event at the location.
*Code 3: Contains, for a given location, information that, beyond reasonable doubt, a flood has occurred in the vicinity.

4.3 Summary of Flood Mechanisms

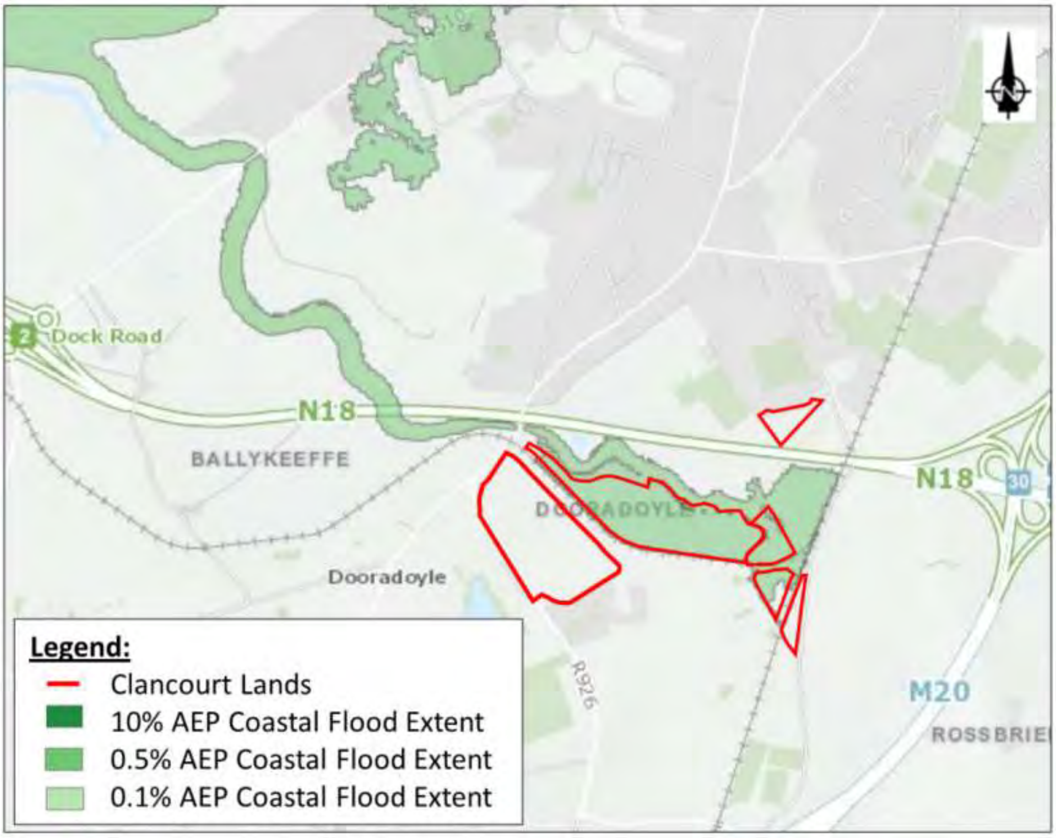
4.3.1 Tidal Flooding

As much of the subject lands lie within the historic estuarine floodplain of the Ballinacurra Creek, the greatest flood risk to the subject lands is from tidal flooding. The area was later protected by extensive OPW flood defence embankments which serve to protect a wide area of the existing development in the Dooradoyle Area from tidal flooding.

The Shannon Catchment Flood Risk Assessment and Management (CFRAM) study was used to carry out an initial review the coastal flood risk of the site and surrounding area.

Figure 7 below, taken from www.floodinfo.ie shows the predicted tidal flood extents for various return periods in the vicinity of the subject lands.

Figure 8: Coastal Flooding Location – floodinfo.ie



As can be seen in Figure 7 above, whilst the existing flood protection embankment which run along the Ballinacurra Creek on the northern boundary of the site provide a high level of protection, some flooding can occur from tidal events at or above the 1 in 10-year event. Only a very small portion of lands are predicted to flood in the 10% AEP event, but this increases significantly in the larger 0.5% and 0.1% AEP events. The flooding originates at the upper (eastern) end of the lands where the existing embankment is slightly lower than further downstream. The extent of flooding is a function of the tidal level in the creek and the duration over which it can spill over the embankment.

Figure 8 and 9 provide more detailed extracts of the Flood Extent Maps.

Figure 9: Shannon CFRAMs Flood Extent Maps (Drawing No.: S2526LIK_EXCCD_F1_31)

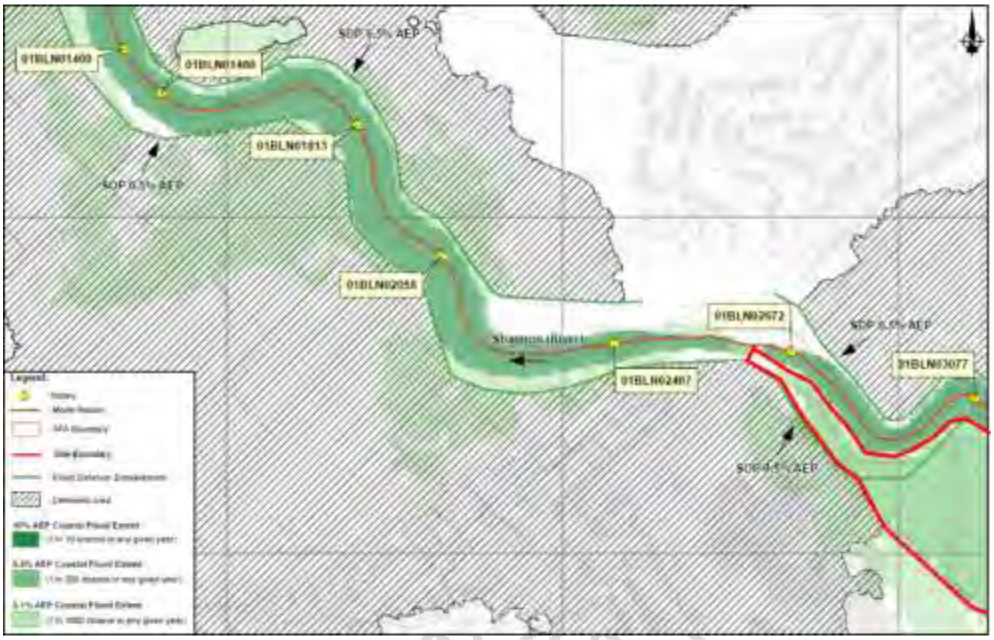
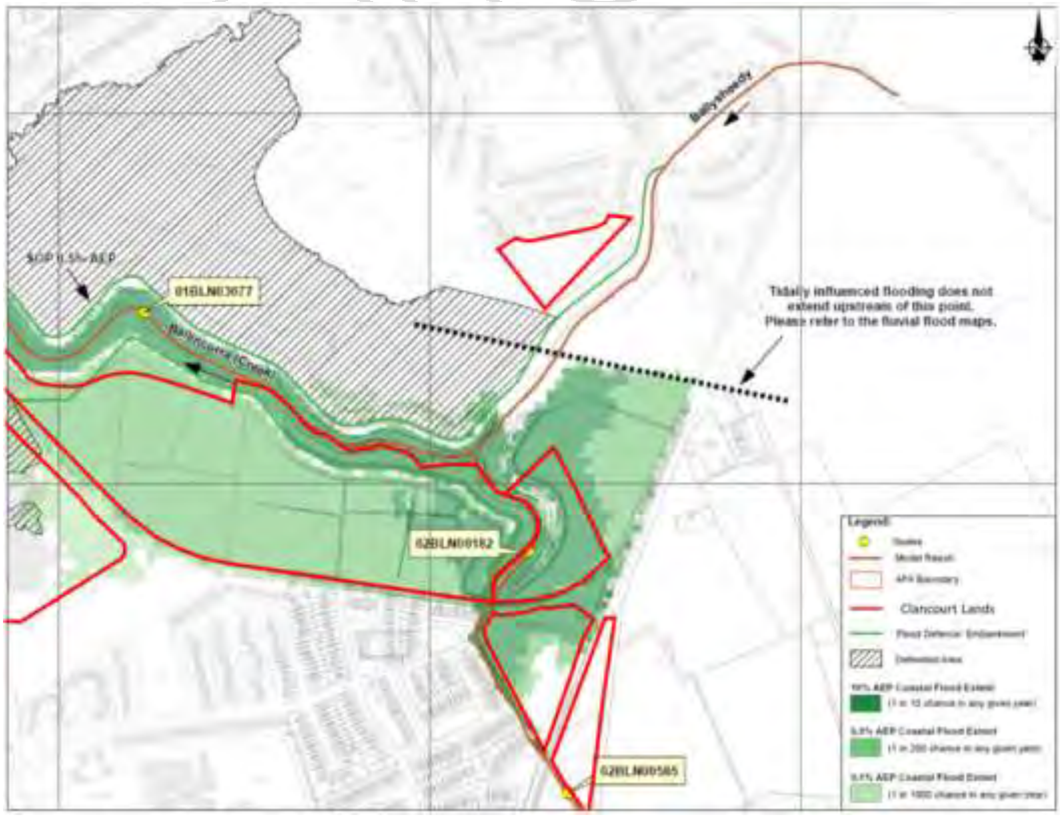


Figure 10: Shannon CFRAMs Flood Extent Maps (Drawing No.: S2526LIK_EXCCD_F1_30)



Water Level results for the nodes identified in the above extracts are tabulated below in Table 5.

Table 5: Water levels as estimated under the Shannon CFRAM

Node Label	10% AEP Event Water Level (mOD)	0.5% AEP Event Water Level (mOD)	0.1% AEP Event Water Level (mOD)
02BLN00565	4.64	4.64	4.64
02BLN00182	3.95	4.23	4.28
01BLN03077	3.94	4.25	4.33
01BLN02672	3.93	4.27	4.36
01BLN02407	4.07	4.87	5.15
01BLN02058	4.07	4.87	5.16
01BLN01813	4.06	4.87	5.15
01BLN01486	4.04	4.86	5.15

The sudden decrease in water level at and upstream of node label 01BLN02407 indicates a significant hydraulic flow restriction at the existing culvert under the Ballinacurra Road (R526).

This culvert is a 2.92 x 3.2m rectangular culvert which runs for chainage 2580 to 2631. It significantly impedes the upstream propagation of the tidal wave and thus serves to significantly reduce the flood risk upstream of this point. The difference in water level across the bridge increases with increasing tide levels as the capacity of the structure is significantly exceeded and the additional head of the more extreme tides has only a minor influence on levels upstream of the R526.

In extreme tidal events, there is very little gradient in river levels across the subject lands from the throttle at the R526 bridge to the existing railway line as the inflow is relatively small from a small upstream catchment and therefore levels are dictated by the downstream boundary at the R526 bridge.

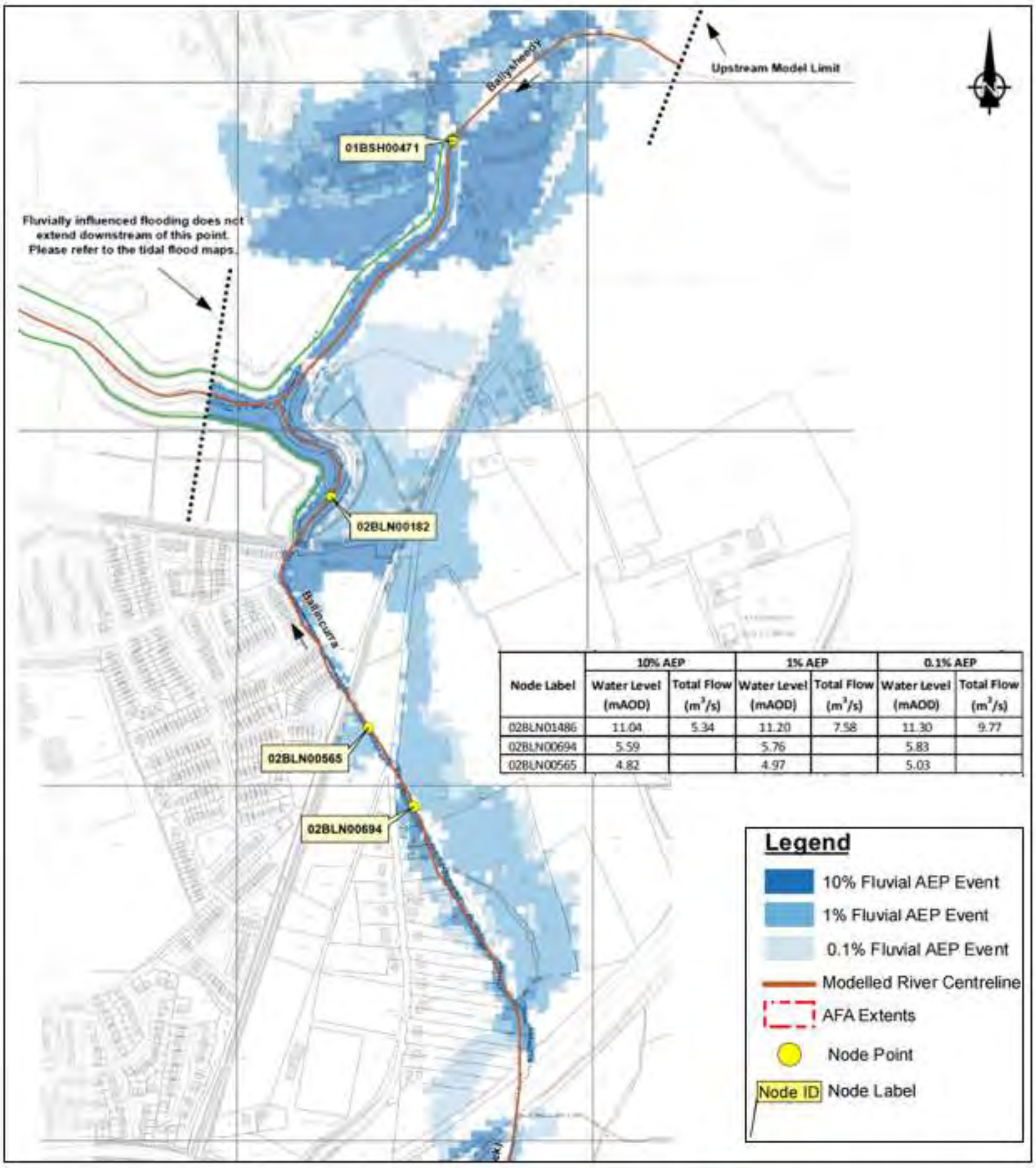
Upstream of the railway line, the gradient of the riverbed increases significantly and flood risk upstream of the railway line is driven by fluvial events. This is evidenced in the CFRAM mapping where the tidal flood extents extend only has far as the railway line which is locally elevated and serves to define a clear divide between the reach dominated by tidal events and that dominated by fluvial events.

4.3.2 Fluvial Flooding

The Shannon Catchment Flood Risk Assessment and Management (CFRAM) study was also initially used to review the fluvial flood risk in the vicinity of the subject lands and surrounding area.

As can be seen in Figure 10 below, the existing OPW flood defence embankment which runs along the Ballinacurra Creek on the northern boundary of the site, protects the site from fluvially dominated events up to and including the 1 in 1000-year fluvial flood event, thus providing a very high level of protection.

Figure 11: Shannon CFRAMs Flood Extent Maps (Drawing No.: S2526LIK_EXFCD_F1_30)



Node Label	10% AEP		1% AEP		0.1% AEP	
	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)
02BLN01486	11.04	5.34	11.20	7.58	11.30	9.77
02BLN00694	5.59		5.76		5.83	
02BLN00565	4.82		4.97		5.03	

Water levels for each of the labelled nodes in the above extract are tabulated below in Table 6.

Table 6: Water levels as estimated under the Shannon CFRAM

	10% AEP Event	1% AEP Event	0.1% AEP Event
Node Label	Water Level (mOD)	Water Level (mOD)	Water Level (mOD)
02BLN00565	4.82	4.97	5.03
02BLN00182	3.59	3.64	3.69
01BSH00471	3.61	3.66	3.69

As can be seen in Table 6 above, the fluvial water levels do not vary significantly between the three severity events in the area downstream of the railway line, again because of the large area of channel relative to the comparatively small flow, with levels largely being dictated by the downstream boundary at the R526 bridge.

The gradient increases upstream of the railway line, reflecting the change to the fluvially dominated reach with a much steeper bed gradient and smaller channel cross section.

Whilst not full apparent from the mapping due to the resolution of the grid size, the railway line is elevated versus surrounding ground and largely acts to separate flooding into separate areas upstream and downstream.

4.3.3 Pluvial Flooding

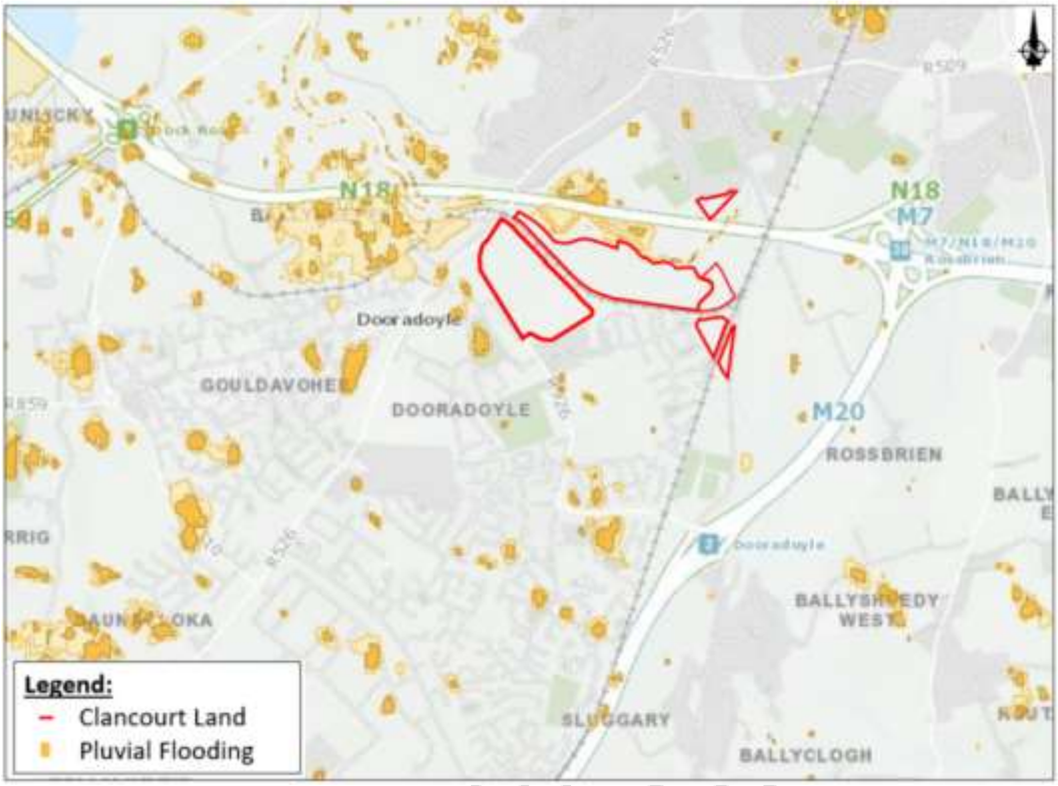
Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography. In the case of the subject lands, pluvial flooding will also occur during periods where high levels in the estuary as a result of high tides, prevents discharge from the surface water drainage system, when the system effectively becomes ‘tidelocked’.

An extract from the OPW’s Preliminary Flood Risk Assessment (PFRA) mapping is illustrated in Figure 11. This illustrates small areas of localised pluvial flooding along the northern boundary of the site on the opposite side of the creek.

Pluvial flood risk can generally be mitigated through the implementation of appropriately designed drainage systems incorporating suitably sized attenuation areas.

Given that this mapping was produced as part of a high-level strategic study, completed at a national scale with several very coarse assumptions, it is not prudent to base a site-specific flood risk assessment on this PFRA mapping alone.

Figure 12: Pluvial Flood Risk – OPW PFRA



As noted in Section 2, a detailed survey of the river channel was undertaken as part of this study. This survey identified two surface water outfalls to the river in the subject lands; one 200mm diameter pipe and one 900mm diameter pipe. The outfall levels of these pipes are located at 0.986m OD and 0.275m OD respectively, refer Figure 12 below for details. The pluvial catchment served by these pipes has been estimated through a combination of LiDAR review and site walkover. Figure 13 provides an overview of the pluvial catchment served by these pipes (Crescent Shopping Centre lands and existing development to the south “other”) as well as the catchment draining directly to the river, i.e. the overbank area within the subject site.

Figure 13: Existing stormwater outfalls

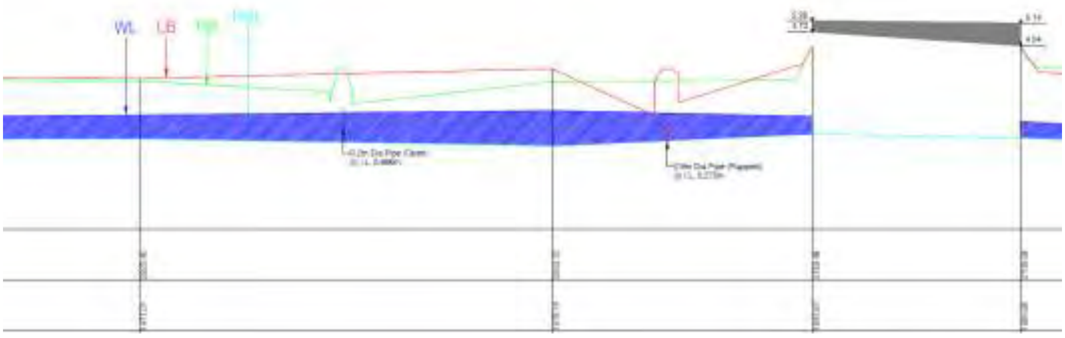


Figure 14: Pluvial catchment – existing

The existing Crescent Shopping Centre has a low point of circa 3.3m OD at the boundary with the subject site. The developed lands to the south are slightly higher at circa 4.5m OD. As the outfalls are relatively low compared to the developed lands they are servicing, pluvial risk to these catchments can be considered relatively low except during particularly high tides. For example, in a 1 in 10-year event, the predicted tidal levels at the location of the surface water outlets rise to over 3.7m OD, in which case, stormwater run-off cannot discharge by gravity. Allowing for the hydraulic gradient in the drainage system, storage of surface water behind the existing defences will be required at lower return periods.

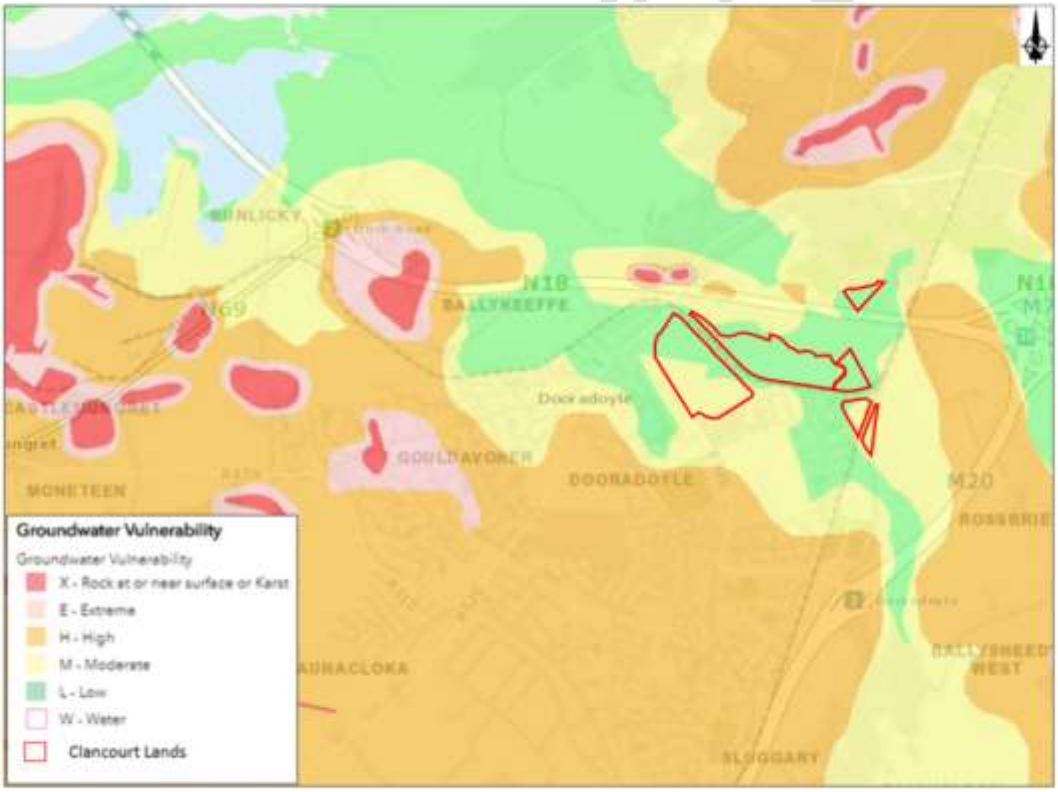
The lands within the study area are relatively low-lying at circa 2mOD. During tidal/fluvial events, excess surface water is stored in the subject lands. Therefore, surface water storage and pluvial flood risk would need to be addressed as part of any future planning development, with an appropriate surface water storage area being provided.

4.3.4 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause extended periods of flooding. Groundwater flooding is generally dependent on the geological setting.

The groundwater vulnerability for the site is presented in Figure 14. It indicates that groundwater vulnerability is relatively constant across the site. Most of the site falls into the "Low" groundwater vulnerability category with a small portion of the site along the northern boundary having a "Moderate" groundwater vulnerability classification.

Figure 15: GSI Groundwater Vulnerability Mapping



A geotechnical site investigation by Irish Geotechnical Services Ltd. (2002) consisting of 4 boreholes within the site boundary indicates the presence of groundwater, rising to an average standing level of 1.70m below ground immediately following boring. Due to the age of above investigation, further site investigation is recommended to accurately assess the current groundwater conditions of the site.

5 Hydrology

5.1 Overview

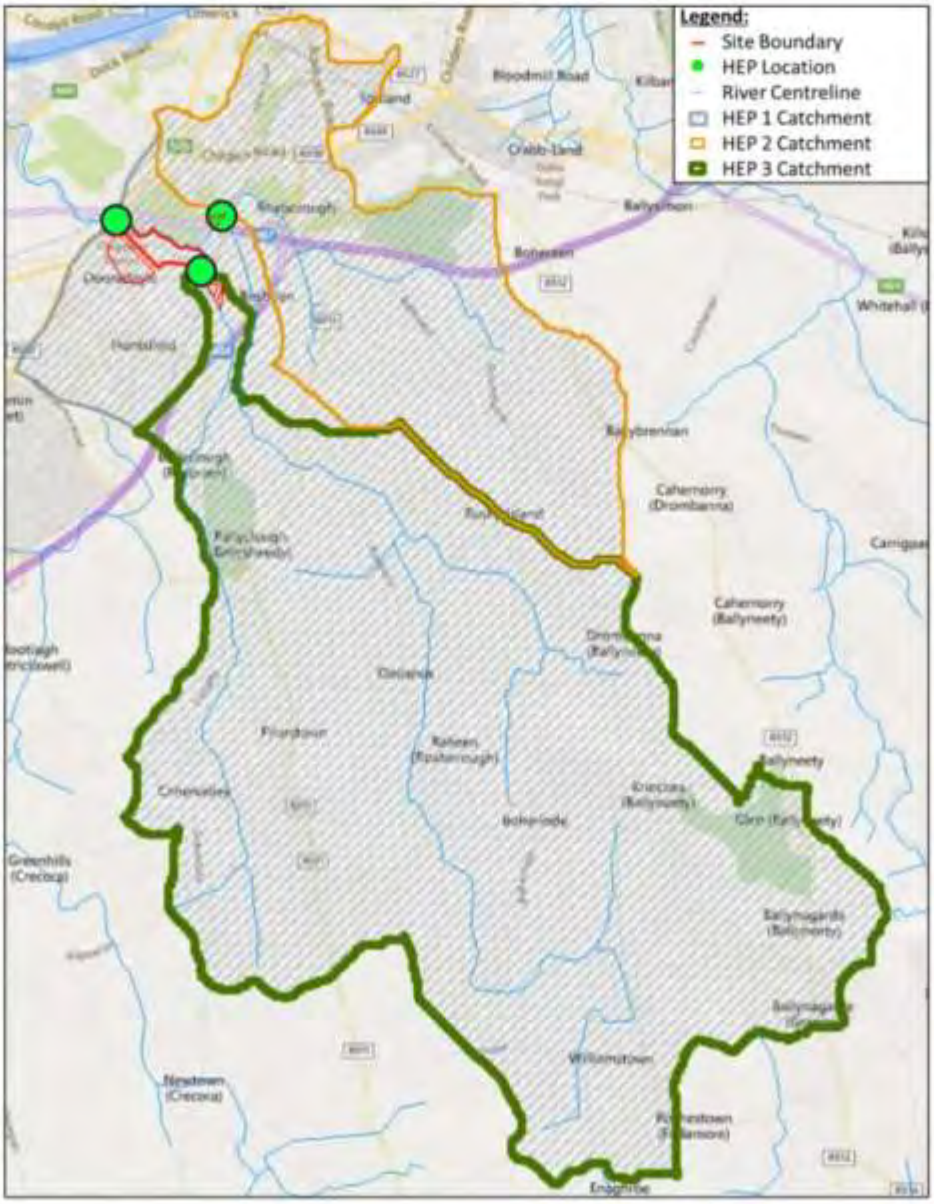
A hydrological assessment of the Ballinacurra Creek and surrounding tributaries was carried out to produce estimates of peak flows and a hydrograph shape for use as input into the hydraulic model built for this study. This assessment included the derivation of peak flows using the following methodologies:

- The Flood Studies Update (FSU)
- Flood Study Report (FSR)
- Institute of Hydrology Report No. 124 (IH124)
- FSR Unit Hydrograph

The peak flows were estimated for three Hydrological Estimation Points (HEP). The river network was sourced from the EPA river network data and the corresponding catchment was derived from the FSU database of ungauged catchments.

Figure 15 below indicates the proposed site boundary, surrounding watercourses, HEP's and the respective catchments.

Figure 16: Catchment overview (Bing Maps)



The FSU Programme, commenced in 2005, and was undertaken by the OPW with a view to developing new flood estimation methods for Ireland, which would significantly improve the quality of flood estimation to aid flood risk management. The FSU is a substantial update of the FSR and the IH124. The FSU was developed using revised datasets specific to Ireland and is now considered by OPW as the primary methodology for flood estimation in Ireland.

The OPW acknowledge that other methods should also be used; hence the FSR IH124 and FSR Unit Hydrograph methods were also employed in determining the peak flows for the river. All methods of hydrological estimation have limitations, particularly in relation to small catchments and these should be considered when reviewing flow estimations in this report.

Details of the FSU method are presented below. Please refer to Appendix C for details of the alternative flow estimation methods.

5.2 Flood Studies Update (FSU)

The FSU adopts the median annual flood, Qmed as the index flood. FSU Work package 2.3 contains a method to estimate Qmed using a regression equation which uses seven different physical catchment descriptors (PCD's). The equation estimates Qmed for a rural catchment.

$$Qmed_{Rural} = 1.237\ x\ 10^{-5} AREA^{0.937} BFIsoils^{-0.922} SAAR^{1.306} FARL^{2.217} \\ DRAIND^{0.341}\ \ S1085^{0.185} (1 + ARTDRAIN2)^{0.408}$$

The FSU 7-variable equation has a standard factorial error of approximately 1.37.

5.2.1 Subject Site

To determine the peak flows using the FSU method, the Qmed value is first calculated for the subject site using PCDs; this is then calibrated to a hydrologically similar gauged catchment to determine the appropriate peak flows for a range of design storms.

Qmed (PCD) = Qmedrural x Urban Adjustment Factor (UAF)

UAF = $(1 + \text{URBEXT})^{1.482}$

HEP 1 represents the combination of HEP 2 and HEP 3, including a portion of the river downstream of these HEP's. The FSU Webportal provides Physical Catchment Descriptors (PCDs) for HEP 2 and 3 only.

HEP 1 is in a tidally dominated area and no PCDs were available. To allow fluvial flood flow estimation, PCDs for HEP 1 were calculated based on a weighted average using the catchment areas of the overall catchment and the other two HEP's. PCDs used in the FSU index flow estimation for the subject site are detailed in Table 7.

Table 7: Physical Catchment Descriptors – Subject Lands

Physical Catchment Descriptors	Description	HEP 1	HEP 2	HEP 3
Contributing Catchment (km2)	Catchment area	46.08	10.36	31.85
BFISOIL	Base flow index derived from soil data	0.719	0.703	0.705
SAAR (mm)	Long-term mean annual rainfall amount in mm.	933	932	921
FARL	Flood attenuation by reservoir and lake	1	1	1
DRAIND (Km/km2)	Drainage density	0.711	0.503	0.859
S1085 (m/km)	The slope of the main channel between 10% and 85% of its length measured from the downstream end of the catchment	4.72	4.76	5.45
ARTDRAIN2	Percentage of the catchment river network included in the Drainage Schemes	0.180	0.042	0.011
URBEXT	Urban Extent	0.17	0.24	0.02
UAF	Urban Adjustment Factor	1.26	1.38	1.04

5.2.2 Pivotal Site

The Qmed value calculated for a subject site is equivalent to having only one to two years gauged data at the site hence it is necessary to adjust the Qmed using a gauged "pivotal site". The pivotal site is a hydrologically similar gauged site with a long-established record of flow. The pivotal site can be on the same watercourse or a different watercourse; hydrological similarity is based on AREA, SAAR and BFISOIL values.

Generally, sites with a hydrological similarity < 1.0 indicates a high similarity and a value of > 2.0 indicates a low similarity. In each case, where a pivotal site was available, the case of the lowest hydrological similarity was selected for the analysis.

The subject site adjustment factor (AdjFac) is calculated by estimating the Qmedrural for the subject site using PCDs and comparing the resulting value with the gauged (pivotal site) Qmed value i.e.:

AdjFac = Qmedrural(gauged)/Qmedrural(PCD)

The adjustment is then partially or fully transferred to the subject site:

Qmedrural, (adjusted) = (AdjFac)h x Qmedrural(PCD)

The typical procedure is to apply a full transfer by setting the exponent h to 1.0.

The pivotal site analysis was not conducted for HEP 1 as there is no PCD available on the FSU Webportal. The PCD values corresponding to the pivotal sites for HEP 2 (25034) and HEP 3 (16051) are contained in Table 8.

Table 8: FSU physical catchment descriptors – Pivotal Site

FSU Physical Catchment Descriptors	Description	HEP 2	HEP 3
Location Number	Identifier of ungauged location	25034	16051
Contributing Catchment Area (km2)	Catchment area	10.77	34.19
BFISOIL	Base flow index derived from soil data	0.759	0.676
SAAR (mm)	Long-term mean annual rainfall amount in mm.	969	895
FARL	Flood attenuation by reservoir and lake	1	1
DRAIND (Km/km^2)	Drainage density	0.273	0.755
S1085 (m/km)	The slope of the main channel between 10% and 85% of its length measured from the downstream end of the catchment	2.57	1.62
ARTDRAIN2	Percentage of the catchment river network included in the Drainage Schemes	0.678	0
URBEXT	Urban Extent	0	0
UAF	Urban Adjustment Factor	1	1
dhi	Hydrological Similarity	0.41	0.26

5.3 Qmed Estimation

The annual flood flow Qmed was initially derived using the FSU Catchment Descriptor method. This estimate was reviewed following a pivotal site analysis. No suitable pivotal site could be found for HEP1 and HEP3, however a suitable pivotal site was found for HEP2, which allowed improvement of the Qmed estimate. Table 9 summarises Qmed values calculated for each HEP.

Table 9: Qmed Estimation Results

Site	HEP 1	HEP 2	HEP 3
Sub. Qmed (m^3/s)	7.33	1.71	4.4
AdjFactor	1	1.33	1
Sub. Qmed adjusted (m^3/s)	7.33	2.29	4.4

5.3.1 Growth Curve

The growth factor used to estimate the range of flows is determined by using a Pooling Group Analysis based on the FSU methodology.

This data is then plotted in a flood frequency chart. The distribution that best fits this chart determines the growth curve.

In this instance both the EV1 and GEV distributions fit the data. However, the EV1 distribution produced a slightly more conservative growth factor and thus was used for the calculation of the design peak flow. To calculate the growth factors and subsequently the flow rates for each HEP, the EV1 distribution was adopted. This analysis was carried out for each HEP, which produced very similar results. For consistency, the most conservative growth factor was selected for each HEP. Table 10 presents the growth factors for each return period.

Table 10: FSU Method - Growth Factors

Return Period (years)	**1.3**	**2**	**5**	**10**	**50**	**100**	**200**	**1000**
AEP	75%	50%	20%	10%	2%	1%	0.5%	0.1%
Growth Factors	0.77	1	1.35	1.57	2.08	2.29	2.50	3.00

5.4 Selection of Flow Method

Table 11 below shows a summary of the Q_{100} flows calculated as well as the peak flows obtained from the FSSR16 unit Hydrograph Method. Upon review of the calculations it is deemed the FSSR 16 method produces excessively large flows and has therefore been discarded from further analysis.

Table 11: Flow results summary

Q_{100} (m^3/s)					
Site	FSU	IH124	FSR 6	Shannon CFRAM	*FSSR16 - Unit Hydrograph Method*
HEP 1	16.78	15.11	15.80	NA	*29.62*
HEP 2	5.24	5.47	4.99	4.00	*10.69*
HEP 3	10.08	10.02	8.38	8.10	*16.6*
Selected Design flows highlighted					

The application of the FSU methodology is deemed the most appropriate for this study, as it adopts the most recent hydrological datasets specific to Ireland and is also considered the most comprehensive flow estimation method available. Results also compare well to the IH124 and FSR6 variable methods and are more conservative than flows derived under the Shannon CFRAM study, which provides further confidence that the flow estimation is conservative.

5.5 Inflow Hydrographs

The FSR Rainfall Runoff hydrograph shape was adopted as the basis of the hydrograph shape, with the hydrograph being scaled to match the relevant peak flow estimates. An additional lateral inflow was added along the lower reach to match the peak flow estimates at HEP1 to provide consistency between the hydrological assessment and the hydraulic analysis.

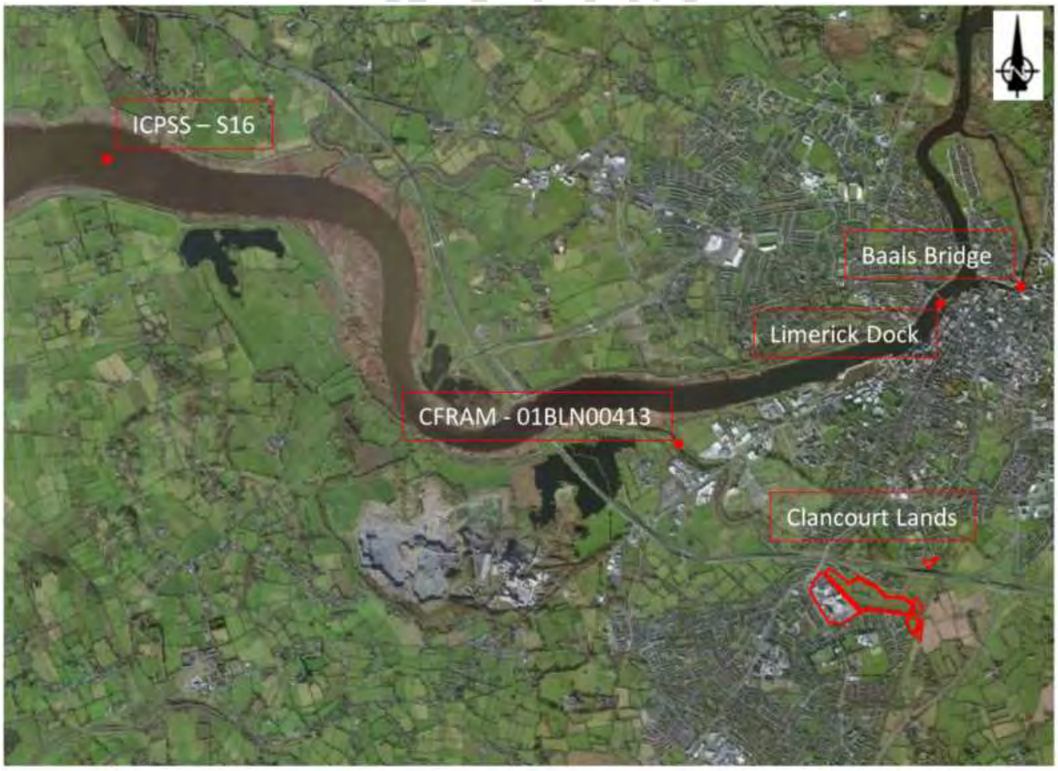
5.6 Tidal Conditions

In order to derive site specific tidal conditions, the following studies were reviewed:

- Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study.
- Irish Coastal Protection Strategy Study (ICPSS) Phase IV – Shannon Estuary.

Furthermore, historical gauge records at Baals Bridge and Limerick Dock in comparison to the ICPSS Point S16 and the Shannon tidal condition assessed under the CFRAM study were analysed. This analysis concluded that the ICPSS data, CFRAM levels and local gauge data all correlate reasonably well. Figure 16 presents a location map of the relevant gauge and data point locations in relation to the study area.

Figure 17: Gauge/data point locations



The data used for the purposes of this report were located at ICPSS Point S16 and CFRAM Nodes 01BLN02058 and 01BLN00413.

Based on the validation of the data in the above-mentioned analysis as well as the correlation seen in Figure 17, it was decided to use the CFRAM water levels to represent the downstream boundary for the analysis.

Figure 17 below illustrates the data acquired from the above studies and Table 12 presents the corresponding water levels for the downstream reach of the Ballinacurra Creek.

Figure 18: Tide Water Levels

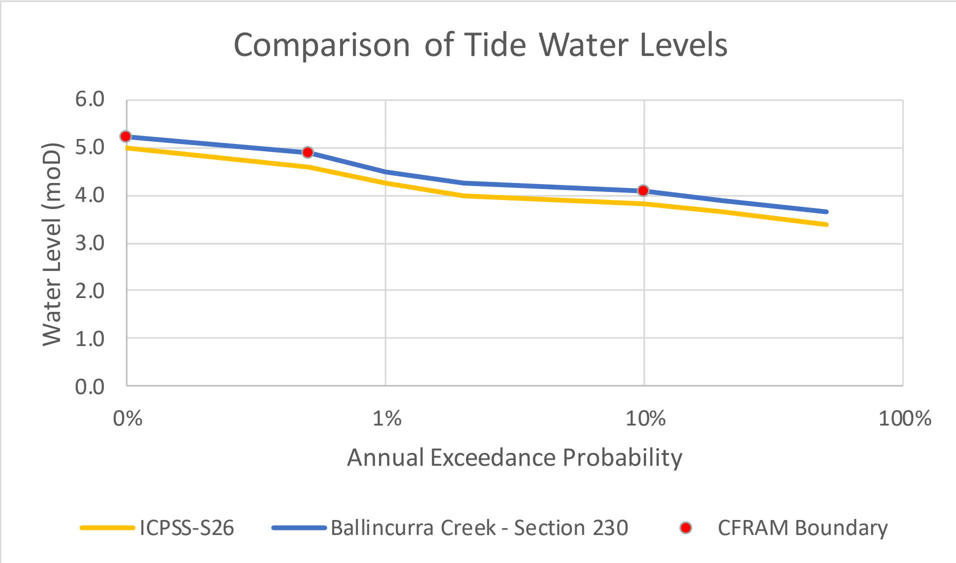


Table 12: Tidal Water Level Data as downstream boundary

RTP	AEP	Tide WL (mOD) Ballinacurra Creek (Section 230)
2	50%	3.64
5	20%	3.89
10	10%	4.07
50	2%	4.24
100	1%	4.48
200	0.5%	4.87
1000	0.1%	5.22

5.7 Joint Probability – Tidal/fluvial flows

Theoretically, fluvial and tidal flooding are not fully independent, based on the assumption that intense rainfall and tidal surges are both likely to be associated with low air pressure events. As part of the Shannon CFRAM study historical extreme river water levels were compared to extreme tide level recordings. This analysis found the likelihood of abnormal high tidal levels coinciding with peak river water levels is relatively low.

A range of theoretical joint occurrences between tidal and fluvial flooding were analysed and it was found that floods along the lower river reaches are dominated by the critical tidal events with little sensitivity to the fluvial flood source, which is also the case for the subject lands in this study.

It is therefore proposed to adopt the same methodology and assess fluvial design events with the 50% AEP tidal downstream boundary and combine the tidal design events with the 50% AEP fluvial upstream boundary, which provides for a reasonably conservative and practical approach.

5.8 Final Design Flows

Design Flows for each HEP have been calculated by multiplying the estimates of Qmed listed in Table 9 by the flood frequency curve shown in Table 10 and are presented in Table 13 below.

Table 13: Final Design Flows

Return Period	AEP	HEP1	HEP2	HEP3
		(m^3/s)	(m^3/s)	(m^3/s)
2	50%	7.33	2.29	4.40
10	10%	11.51	3.60	6.91
50	2%	15.25	4.76	9.15
100	1%	16.79	5.24	10.08
200	0.5%	18.33	5.73	11.00
1000	0.1%	21.99	6.87	13.20

6 Hydraulic Model Development and Analysis of Existing Situation

Given that the CFRAMS was undertaken at a broad catchment scale for the entire Shannon catchment, it was decided that greater definition of the local flood risk was required both to understand existing sensitivity to flood risk and to assess the potential impact of any development of these lands.

A detailed coupled one-dimensional (1D) and two-dimensional (2D) unsteady flow hydraulic model of the Ballinacurra Creek and Ballysheedy tributary was therefore constructed in order to more accurately simulate flood risk in the vicinity of the subject lands, including both fluvial and coastal sources. The model was developed using HEC-RAS 5.0.4 software.

6.1 Data Acquisition

As stated in Section 2 above, survey data was provided by Murphy Surveys Ltd. The survey data was used in order to construct the 1D element of the model. Light Detection and Ranging (LIDAR) was also acquired in order to construct the 2D element of the model. Finally, the embankment plan and vertical profile provided by Punch Consulting Engineers (2014) was used (where applicable) to model the existing embankment, linking the 1D and 2D elements of the model.

6.2 Model Geometry

6.2.1 Model Extents

The Ballinacurra Creek reach extends from just upstream of the Rosbrien Road to the downstream extent at the entrance to the Shannon River. The Ballysheedy reach extends upstream from the confluence with the Ballinacurra Creek to just upstream of the railway line. The Irish National Grid (ING) coordinates of the extent of the model is presented in Table 14 and Figure 18 shows the location of the model extents.

Table 14: Model extent coordinates

Watercourse	Upstream Extent		Downstream Extent	
	Easting	Northing	Easting	Northing
Ballinacurra Creek	157256	153951	155312	155917
Ballysheedy	157622	155026	157055	154534

Figure 19: Model extents & river reaches

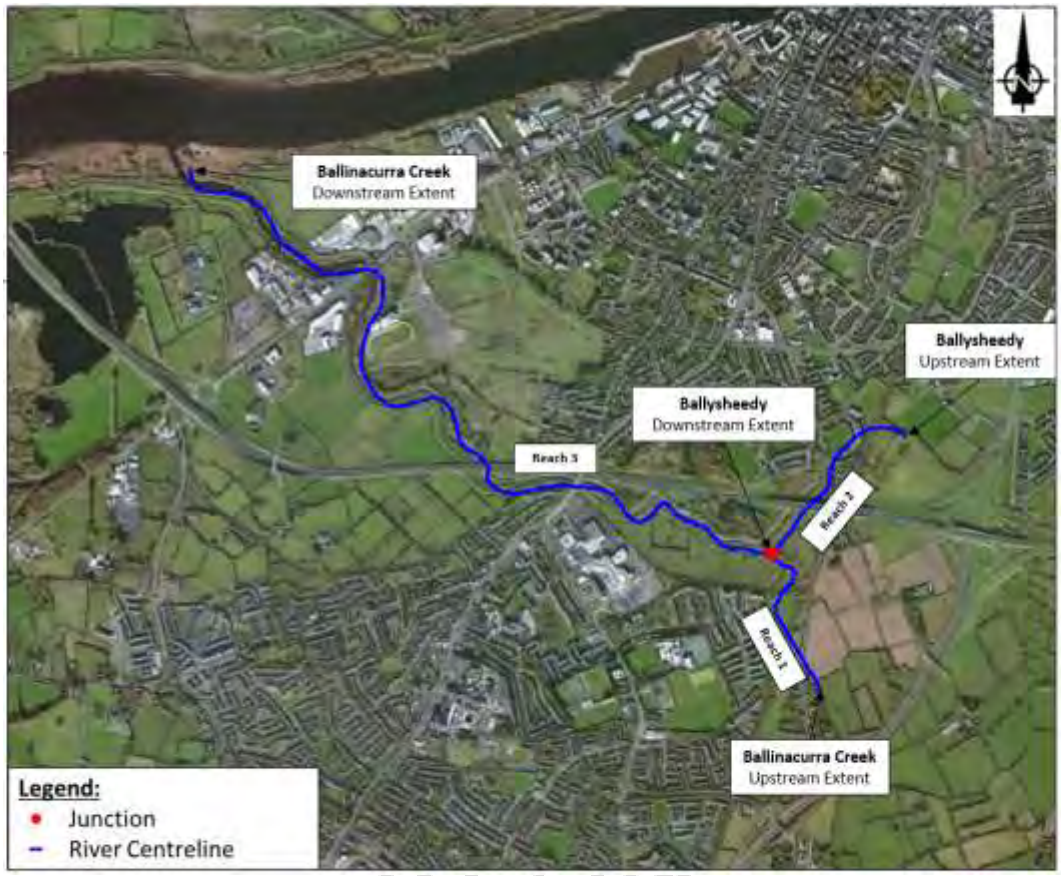
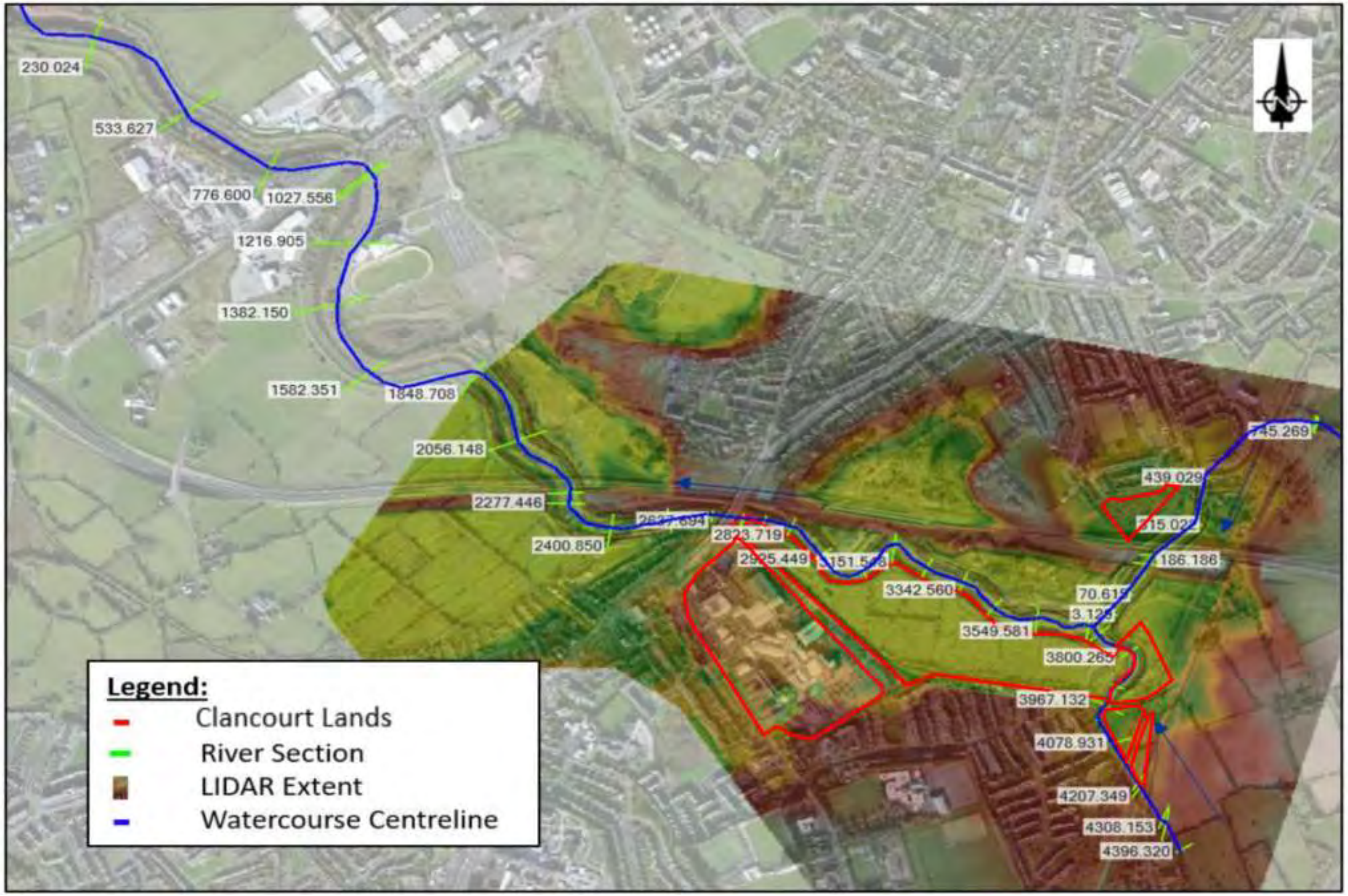


Figure 19 on the following page illustrates the numbering of River Sections within the model.

Figure 20: River Sections



6.2.2 Channel Geometry

The channel geometry for the model was imported into the model directly from the survey by Murphy Surveys Ltd. The accuracy of the imported geometry was validated using the photographs provided, the acquired LIDAR data as well as the site walkovers.

The cross-section labelling system adopted in the model is consistent with the "ISIS Chainage" given in the survey data. Appendix D presents the model cross-section.

6.2.3 Hydraulic Roughness Coefficients

The roughness values of the 1D model have been defined for three separate sections of each cross section: (1) The left bank, (2) The main channel, and (3) The right bank. These sections of each cross section in the model are defined using panel markers.

The Manning's n roughness values of the 1D model were selected based on a detailed analysis and following review of survey photographs and two site visits undertaken by Arup.

Both the Ballinacurra Creek and the Ballysheedy River are meandering with a main channel partially consisting of stones & weeds and banks consisting of relatively thick vegetation. Selected Manning's values fall within the corresponding typical ranges as presented in Table 15 and 16. Please refer to Appendix D for specific Manning's values used at each cross section.

Table 15: Typical Manning's n values for river channel

Channel Characteristics	Manning's n value
Main Channel	
Clean, straight	0.030
Clean, meandering	0.035
Stones & weeds, meandering	0.045
Banks	
Weeds & vegetation	0.040
Heavy weeds & vegetation	0.050
Mature trees and thick vegetation	0.060

Table 16: Typical Manning's n values for floodplain

Land Use	Manning's n value
Roads	0.020
Buildings	0.100
Parkland	0.030
Open space	0.035
Forestry	0.06

6.2.4 Hydraulic Structures

Within the model extents, there are several existing hydraulic structures consisting of bridges/culverts as well as the existing flood protection embankment.

6.2.4.1 Bridges/Culverts

A total of eight existing bridges/ culverts with varying dimensions were included in the model. The structures were modelled using survey information provided by Murphy Surveys Ltd. Refer to Appendix F for a brief summary and cross section of each of the hydraulic structures within the model.

6.2.4.2 Lateral Structure

In order to model the existing OPW flood protection embankment, a lateral weir embankment was included in the model. The embankment centreline positions and elevations were modelled using the embankment plan and vertical profile (Punch Consulting Engineers – 2014) where applicable. Due to the limited extents of this embankment data, LIDAR data was also used to model the embankment. All lateral weirs were modelled in an identical manner using the following weir data assumptions;

- Weir width: 2.0m
- Weir computation: Standard Weir Equation
- Weir Coefficient: 1.1
- Weir Crest Shape: Broad Crested

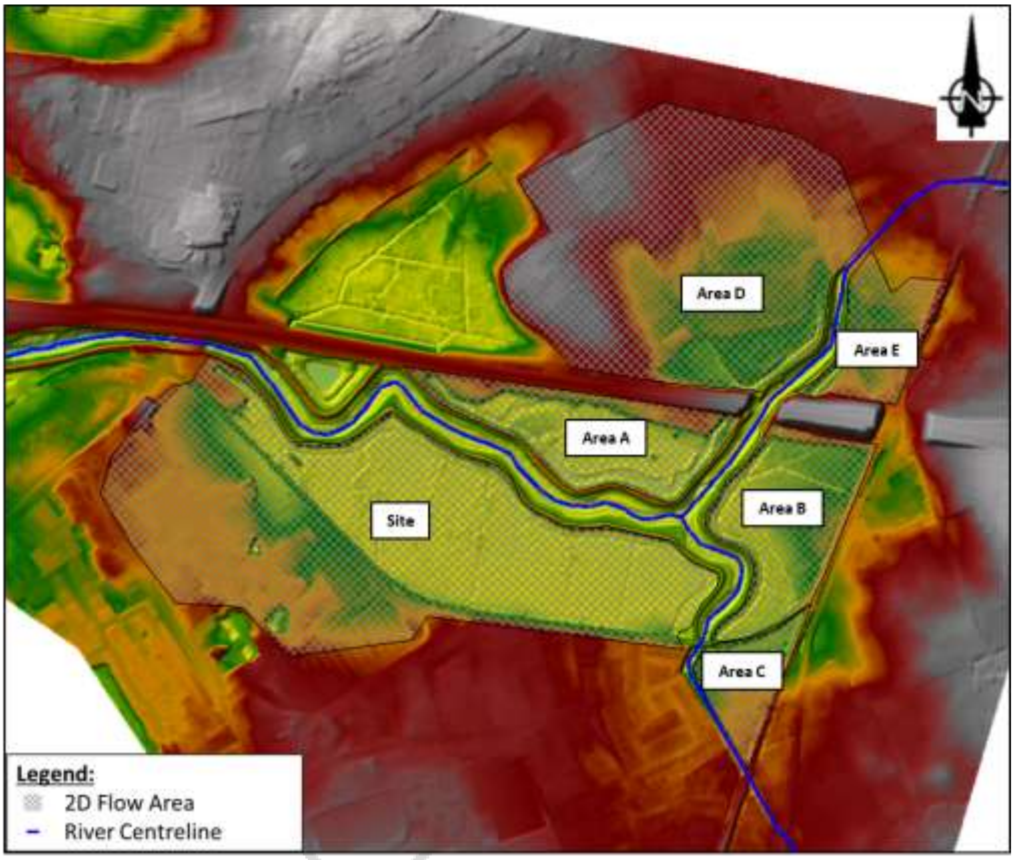
Tailwater connections for the lateral embankment weirs were set to their relevant 2D Flow Areas within the system, thus linking the 1D and 2D aspects of the model.

6.2.5 Two-dimensional Flow Area

In order to model the two-dimensional flood extents within the floodplain, several 2D flow areas were modelled.

These 2D flow areas were modelled using a 4m x 4m computational mesh with each cell covering an average area of approximately $16m^2$, providing a reasonably accurate representation of the undeveloped subject site. The 2D flow area forms the two-dimensional extents of the model and is connected to the one-dimensional extent of the model by means of the lateral structures within the model, as stated in Section 7.2.4.2 above. Refer to Figure 20 below for a graphical representation of the 2D flow areas within the model.

Figure 21: 2D flow areas



6.3 Unsteady Flow Data

6.3.1 Boundary Conditions

In order to simulate the unsteady flow within the model, three boundary conditions were included. Two inflow hydrographs at the upstream extents of the model and one downstream tidal boundary.

The FSR Rainfall Runoff hydrograph shape as detailed in Appendix C was adopted as the basis of the hydrograph shape, with the hydrograph being scaled to match the relevant peak flow estimates. Figure 21 and 22 present the inflow hydrograph shapes used before scaling.

Figure 22: Typical inflow hydrograph Ballinacurra Creek, Reach 1

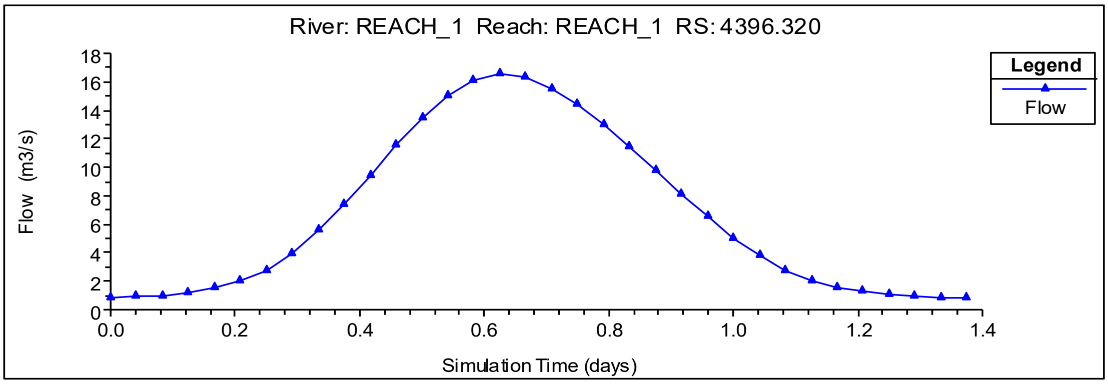
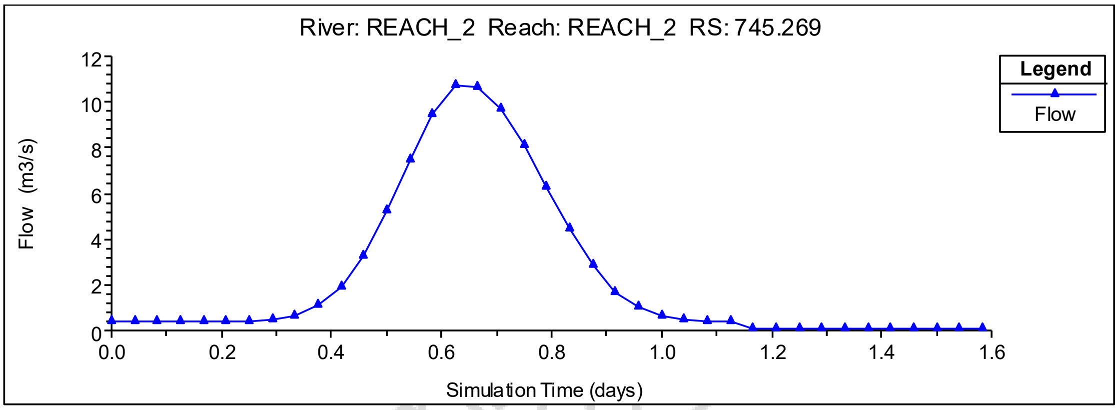


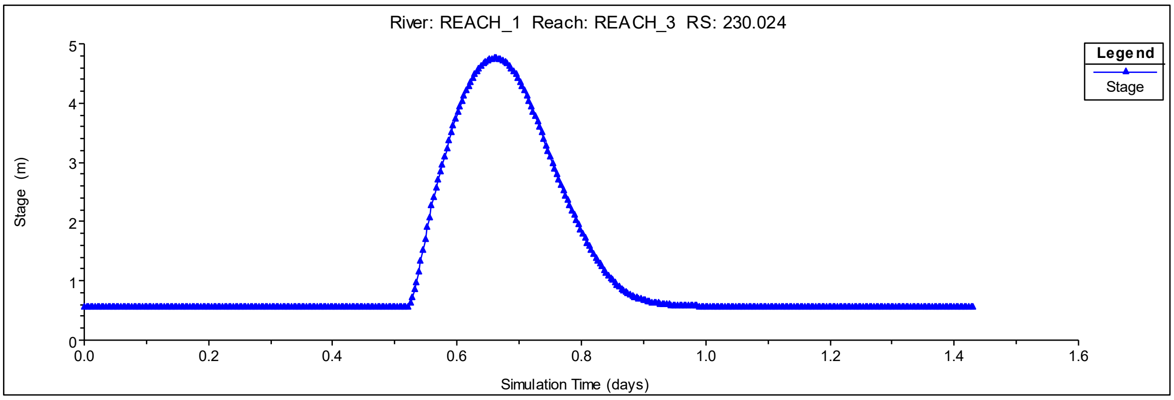
Figure 23: Typical inflow hydrograph Ballysheedy River, Reach 2



Furthermore, the model contains a downstream boundary which represents the tidal influence of the Shannon Estuary within the Ballinacurra Creek (Reach 3). The tidal stage hydrograph was constructed using a recorded water level profile for the Shannon Estuary.

Peak tidal water levels were derived from several sources and used to scale-up the template profile accordingly. Refer to Section 5.6 for further information. Figure 23 below shows the tidal stage hydrograph used in the model.

Figure 24: Typical tidal stage hydrograph Ballinacurra Creek, Reach 3



6.4 Model Calibration

There are no observed water level recordings available to allow hydraulic model calibration. However, a catchment wide hydraulic model was developed under the Shannon CFRAM, which provides information on water levels and flows for the 10-, 100- and 1000-year return period events at a number of locations. This was used to compare the site-specific hydraulic model for both the fluvially and tidally dominated events. Appendix F provides details of this comparison. The newly developed model used in this study calibrates reasonably well to the CFRAMS model.

6.5 Anchoring of Hydrology and Hydraulics

6.5.1 Insertion of Hydrological Estimation Points

Inflow hydrographs were inserted at the upstream boundaries of the Ballinacurra Creek (Reach 1) and the Ballysheedy River (Reach 2). The result of the addition of these flows was analysed and compared to the design flow estimated for the check flow point at HEP 1.

Lateral inflow was added along the lower reach between HEP1 and HEP3. This represents runoff from the catchment that is connected downstream of HEP3 and was used to anchor the hydrological flow estimates to the hydraulic model.

Table 17 below summarises the comparison of the estimated flows to the flows within the model. This demonstrates that hydrological flow estimates are anchored to the hydraulic model.

Table 17: Comparison of Hydrologically Estimated Flows vs Hydraulic Model Flows

Return Period (Years)	Hydrology	Hydraulic Model		
	HEP 1 Peak Flow (m^3/s)	HEP 1 Peak Flow (m^3/s)	Lateral Flow Added (m^3/s)	% Diff.
10	11.51	11.32	1.41	1.65
100	16.79	16.36	2.41	2.56
1000	21.99	21.3	4.28	3.14

6.5.2 Minimum Flows in Hydrograph

Minimum flows were added to certain inflow hydrographs to ensure hydraulic model stability at the start of the run. In the case of the addition of a minimum flow, the flow added was circa 10% of the peak flow of the relevant hydrograph.

6.5.3 Coincidence of Design Hydrograph Peaks

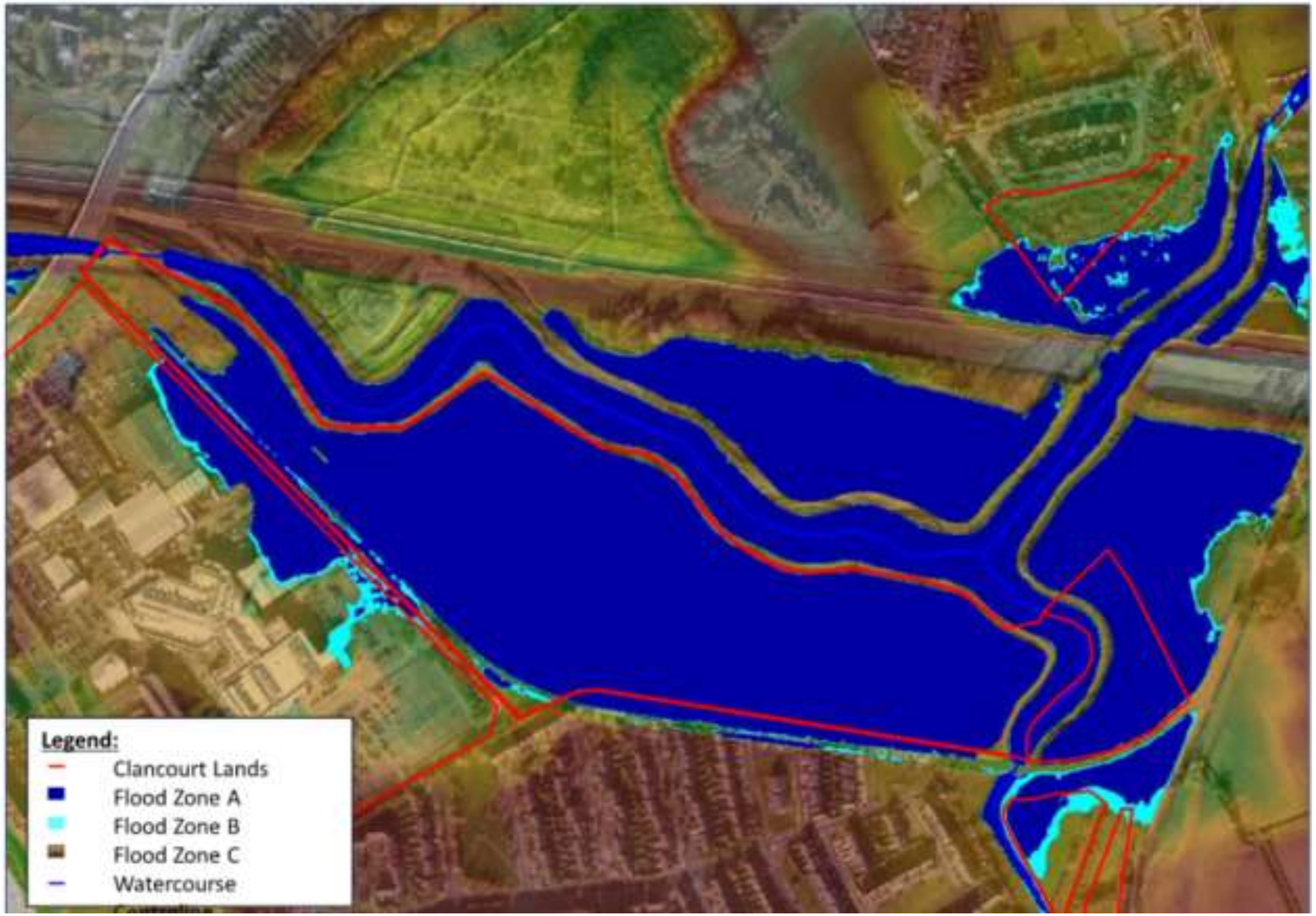
Given the relatively small size of the catchment and the lack of data, it was assumed that the design flow peaks occur simultaneously on all the sub-catchments.

The time axis of all the inflows hydrographs were therefore edited to ensure that the peak flow on all the hydrographs occurred at a model run time of 15hr.

6.6 Flood Zone Mapping

Flood zone maps for the area of interest and surrounding lands are presented in Figure 24. These are based on our site-specific model but ignores any existing defences, as per the Flood Risk Planning Guidelines (OPW, 2009).

Figure 25: Flood Zone Map



As evident in Figure 24 above, the area of interest lies within Flood Zone A. Flood risk management guidelines are discussed further in Section 10.2.

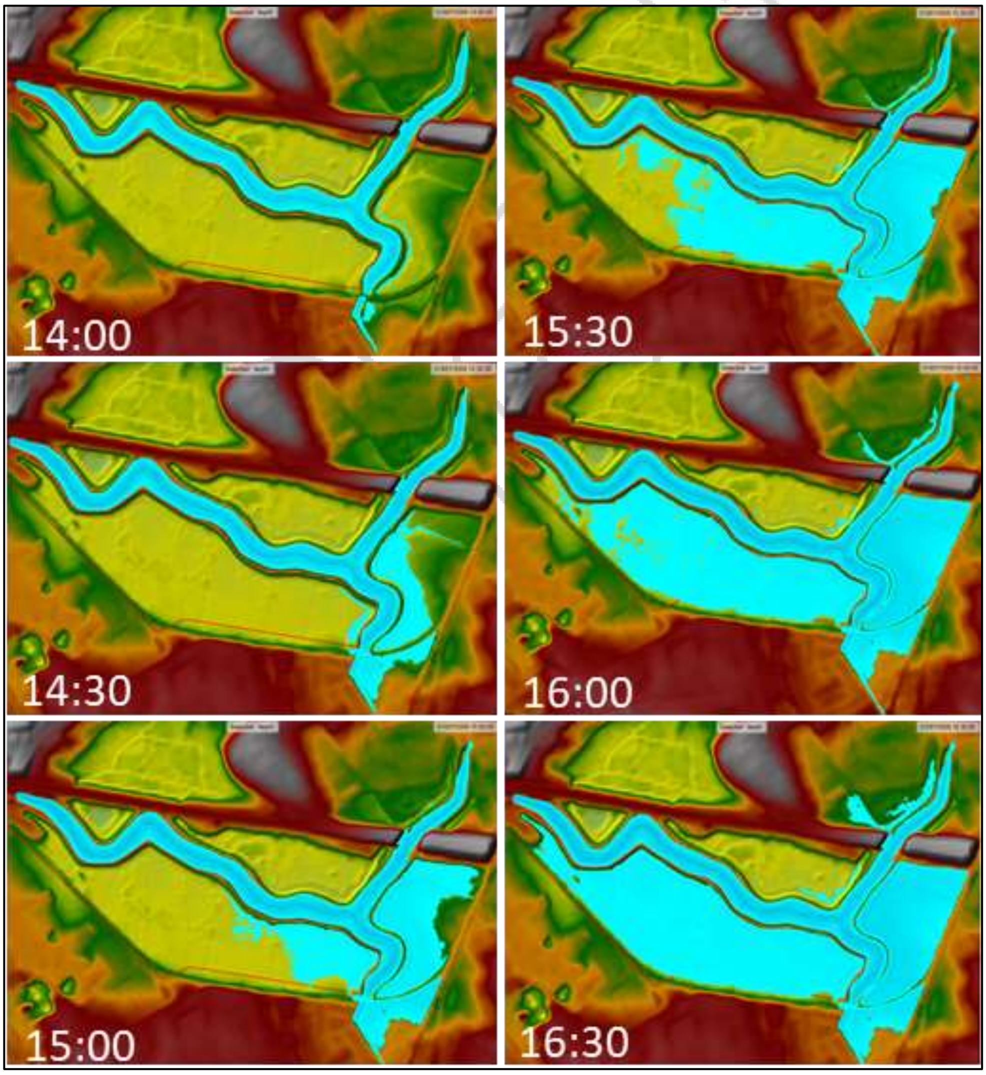
6.7 Existing Flood Condition

The subject site is located in a tidally dominated flood risk area that is defended by an existing OPW embankment which offers a high degree of protection.

Modelling results demonstrate that this embankment is overtopped for the 200-year tidal event along the lowest point of its crest, which is located near its eastern site boundary.

The following figure demonstrates the flood propagation for the 200-year tidal event in the existing condition from runtime 14:00 to 16:30.

Figure 26: Flood Propagation Existing Condition – T200



Flood depth within the site is typically around 0.7 to 0.8m with maximum flood depth up to circa 1.2m.

6.8 Sensitivity Analysis

Sensitivity testing was carried out as part of the hydraulic analysis. Findings showed that the model is relatively insensitive to the hydraulic loss coefficients. Findings do however show that the flood extents increase with a decrease in Manning's Roughness. Figures 26 and 27 below present the findings of the sensitivity analysis carried out.

Figure 27: Sensitivity Analysis Results – Culvert Entrance Coefficient

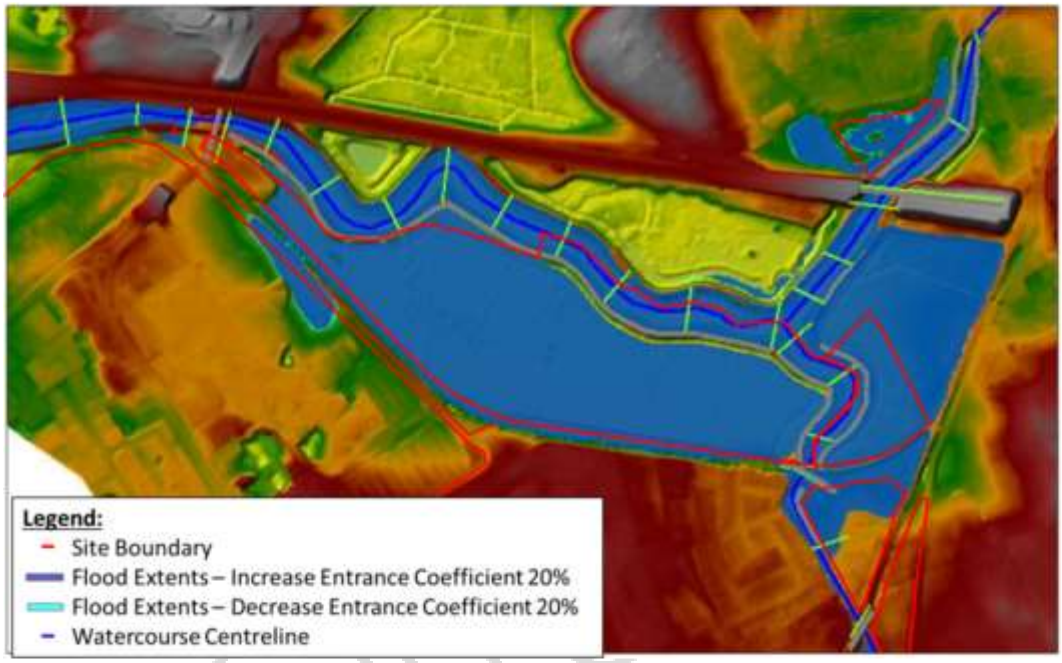
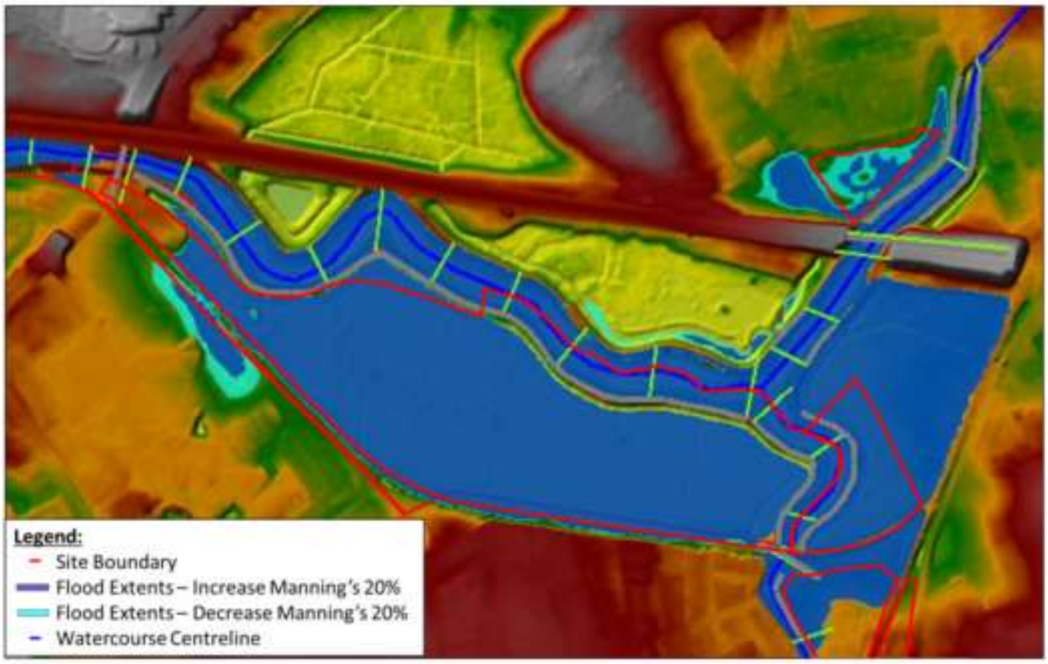


Figure 28: Sensitivity Analysis Results – Manning's Roughness



7 Pluvial Flood Risk

The urban surface water catchment draining to the Ballinacurra River via the subject lands is described in Section 5.3.3. The subject lands are relatively low-lying at circa 2m OD. During tidal/fluvial events, surface water which cannot drain by gravity due to elevated river levels, is stored within the subject lands. Thus, in developing the subject lands, it will be necessary to provide storage for stormwater run-off when the outfalls are surcharged to a level where discharge is not possible.

To quantify the volume of storage required it is necessary to consider the joint probability of a major urban rainfall event with a high-water level in the Ballinacurra River. As discussed in Section 6.7, floods along the lower river reaches of the Ballinacurra River are dominated by the critical tidal events with little sensitivity to the fluvial flood source. The key considerations to quantify the volume of storage required are:

1. Duration of high river levels (i.e. duration where no-outflow is possible) at high tide
2. Rainfall runoff coinciding with high water level.

7.1.1 Duration of high river level (at high tide)

The length of time wherein discharge is not possible is determined by examining the tidal stage hydrograph. In the absence of detailed survey of the existing urban drainage network, a full assessment of the exact level at which stormwater outflow is inhibited cannot be undertaken as part of this study but can be approximated. There are two cases to be considered as follows;

1. Overflow into the subject lands via an access point on the pipeline (note, the flood embankment will prevent backflow from the headwalls). This is considered likely to start to occur at a level of circa 2m OD.
2. In the absence of such an access point (e.g. manhole or grating) via overland flow from the low point in the contributing catchments with an allowance for freeboard of 300mm; i.e. 3.0m OD.

The tidal stage for the 50% and 10% AEPs are provided in Figures 28 and 29. It can be seen from these that the critical duration during which stormwater outflow will be inhibited is between 3 and 5.5 hours depending on the water level considered.

Figure 29: 50% AEP tidal stage hydrograph

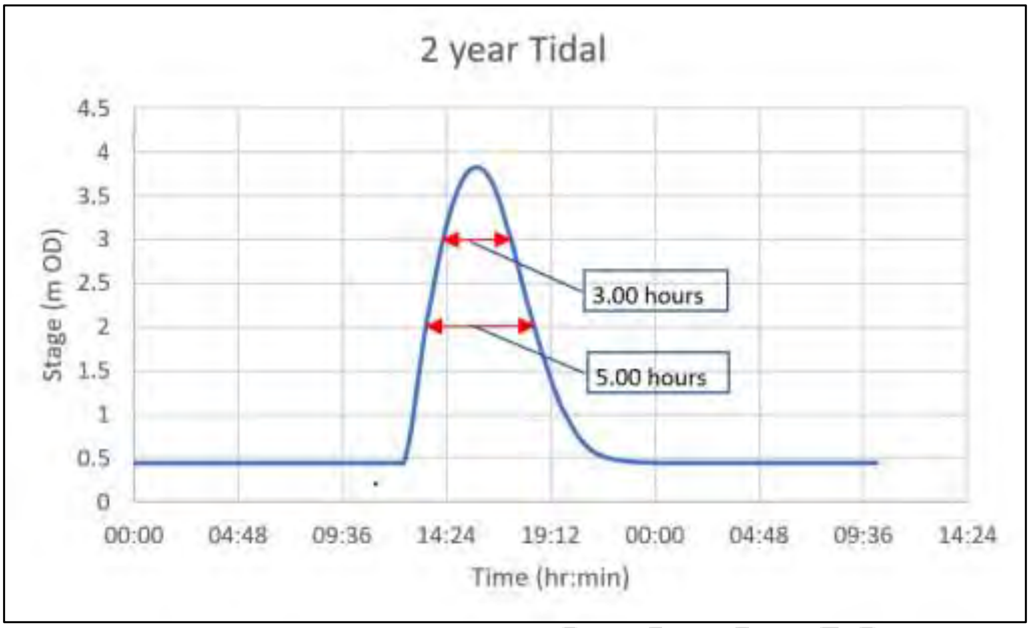
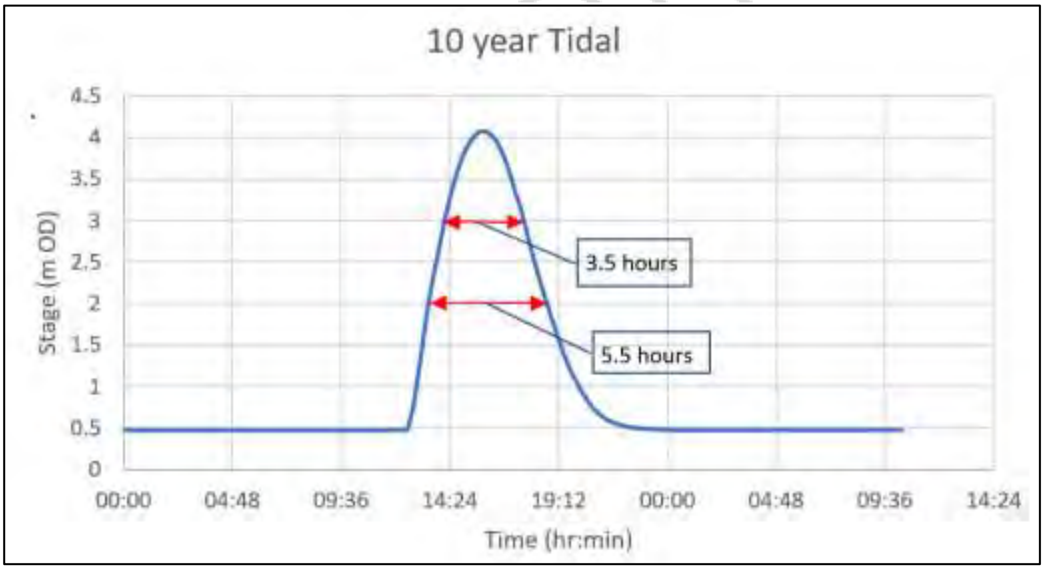


Figure 30 10% AEP tidal stage hydrograph



Any storage solution can be designed to control the spill level of the stormwater network. A level of 2m OD is relatively low given the levels of the catchment (minimum 3.3m OD) and driving head of the stormwater network. A spill level of 3.0m OD is considered achievable as it makes allowance for some driving head from the developed lands and freeboard to the existing development. Thus, the critical duration where flow may need to be stored is likely to be for a period of 3-4 hours.

7.1.2 Rainfall-runoff

The Greater Dublin Strategic Drainage Study (GDSDS) advises that "*In cases where there is a potential for life-threatening situations to develop from rapid inundation due to breach of sea or river defences, then a standard of protection greater than the 1:200-year event should be considered*". Thus, the following events, resulting in a joint return period of 200 years, are considered:

1. 1 in 2-year rainfall event with a 1 in 100-year tidal boundary
2. 1 in 20-year rainfall event with a 1 in 10-year tidal boundary
3. 1 in 100-year rainfall event with a 1 in 2-year tidal boundary

The table below outlines the average rainfall depths for a range of rainfall durations for th1 2-, 10- and 100-year ARI return periods.

Table 18: Rainfall depth

Duration (hr)	2-year ARI depth (mm)	10-year ARI depth (mm)	100-year ARI depth (mm)
2	13.5	23.8	44.2
3	15.45	26.7	49.2
4	17.4	29.6	53
6	20.1	33.6	58.8

Figure 30 below describes the catchment characteristics of the contributing area.

Figure 31: Contributing catchment

The resulting runoff volumes, based on the percentage impermeable areas presented in Figure 30, for the 2-year, 10-year and 100-year ARI were estimated using the Modified Rational Method and presented in Table 19.

Table 19 Rainfall-runoff volumes

Duration (hr)	2-year ARI		10-year ARI		100-year ARI	
	depth (mm)	volume (m3)	depth (mm)	volume (m3)	depth (mm)	volume (m3)
2	13.5	10268	23.8	18102	44.2	33618
3	15.45	11751	26.7	20308	49.2	36965
4	17.4	13234	29.6	22513	53.0	40311
6	20.1	15288	33.6	25556	58.8	44723

As can be seen from the similarity of the tidal stage hydrographs for the 50% and 10% AEP events, the duration for which pluvial outflow is not possible is not sensitive to the tidal return period. As such, to provide a 1 in 200-year standard of protection to the Crescent lands it is recommended that the joint probability event applied to pluvial storage is the 1 in 100-year rainfall event with a 1 in 2-year tidal boundary. Thus, based on Table 19, the required storage volume for the 3-4-hour duration events range from 36,965 to 40,311 m^3.

This volume is considered to be conservative as it does not account for storage in the pipe network or online storage structures, the discharge which will occur due to driving head at the start and end of the tidal event, and finally, it does not consider routing through the pipe network. Due to the conservative nature of this assessment the lower value is considered most appropriate to inform this preliminary study; i.e. circa 36,965. We detailed design; it is considered likely that a lesser volume may be justifiable.

8 Possible Flood Relief Options

There are several aspects to be considered in the design of the flood relief options as follows:

- Health and safety considerations;
- residual Flood Risk
- Aesthetic considerations;
- Ecological considerations;
- Offsite impacts;
- Practical and financial considerations.

The main flood risk to the subject lands downstream from the railway line is from tidal flooding overtopping the lowest lying section of the existing embankment at its eastern end. This low point is as a result of settlement of the embankment over time from its original design level which would originally have protected the site when first constructed.

A significant volume of flood water is therefore currently stored on the subject lands during the extreme tidal events which would originally have been contained within the defended estuarine channel.

The obvious solution to protecting the main Clancourt site adjoining the Crescent Centre from tidal flooding, is therefore to restore the existing embankment to the 1 in 200year design standard. In doing this, water levels within the channel both adjacent and upstream of the site would rise, versus the current tidal situation, and therefore it is important to assess the extent of any change and ensure that flood risk is not increased elsewhere.

As the existing defences already protect against the 1 in 100-year fluvial event, any increase to the embankment height will not alter the fluvial situation in this reach and so only the tidal situation requires to be assessed.

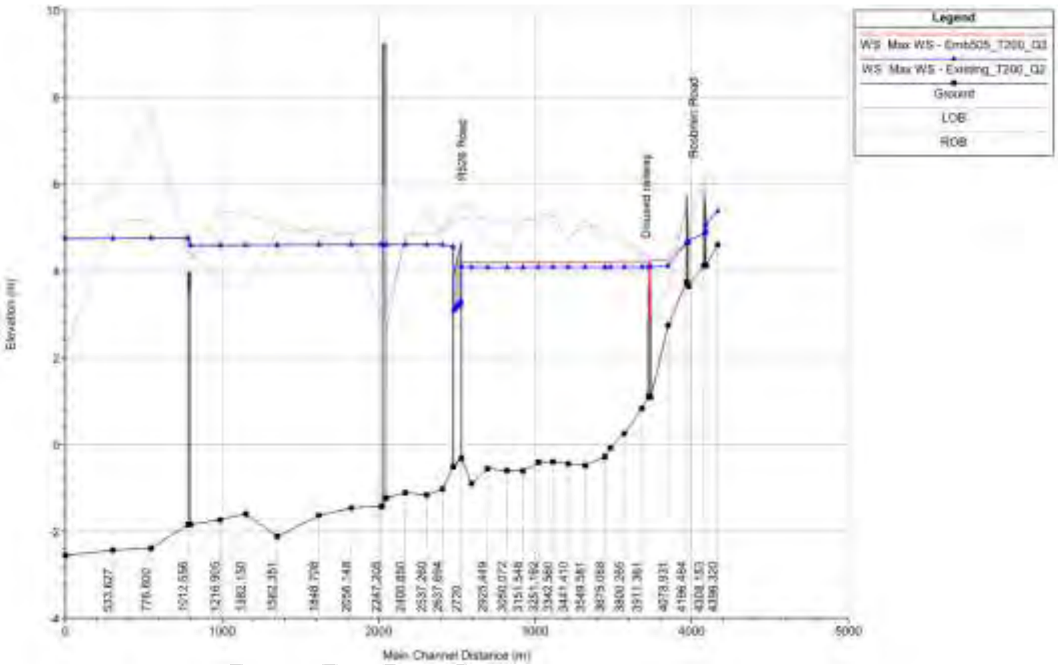
This option is described below.

8.1 Flood relief option to facilitate development of Clancourt lands immediately adjoining Crescent S.C.

The hydraulic model was therefore modified to model predicted tidal flood levels if the existing standard of protection of the embankment was restored and to establish if any localised upstream defences were required upstream.

Figure 31 presents the water surface profile in the existing condition in comparison to the option with the increased SoP of the embankment.

Figure 32: Long section showing water surface profile 1 in 200-year coastal event



Modelling results show that raising the existing embankment would increase the 1 in 200-year tidal water level in the Ballinacurra Creek along the subject lands by a maximum of circa 120mm between the R526 bridge and the railway line. This is the reach within Clancourt lands.

The predicted tidal levels are unchanged upstream of the railway line as this is fluvially dominated and not sensitive to the small scale of change in downstream levels.

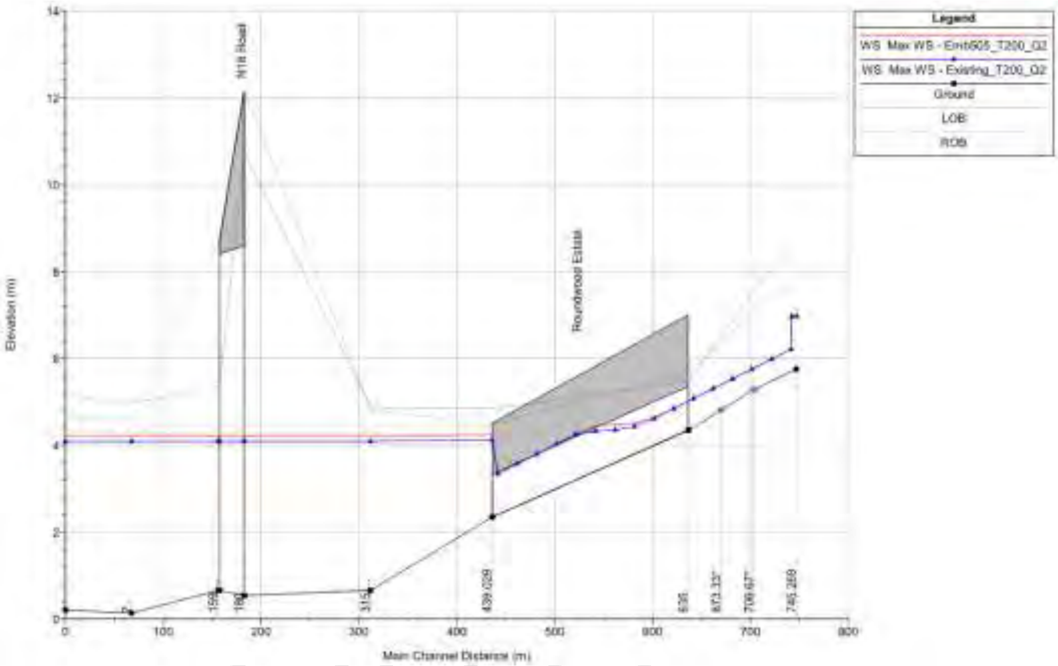
The 1 in 200-year tide water level is estimated at 4.75mOD along the lower section of the Ballinacurra Creek. The existing embankment is circa 950m long and crest levels range from 3.75mOD along the eastern boundary to 5.30mOD along the north western boundary.

The maximum predicted maximum level in the reach downstream of the disused Irish Cement rail line is estimated at circa 4.2mOD with the embankment raised. A short section between this point and the existing main rail line is slightly higher.

It is estimated that approximately 775m of the embankment would need to be raised to reinstate a consistent design defence level of 5.3mOD. However, a lower level of circa 4.5mOD would suffice for the majority of the site downstream of the disused railway line.

A similar situation arises on the Ballysheedy Stream whereby there is a slight increase in water levels adjacent to Ballinacurra Gardens before the stream is culverted under Roundwood Estate as shown in Figure 32 below.

Figure 33: Long section showing water surface profile 1 in 200-year coastal event



Raising of the main embankment on the Ballinacurra Creek will also require some local raising of the embankment adjoining Ballinacurra Gardens (which is located on Clancourt Lands).

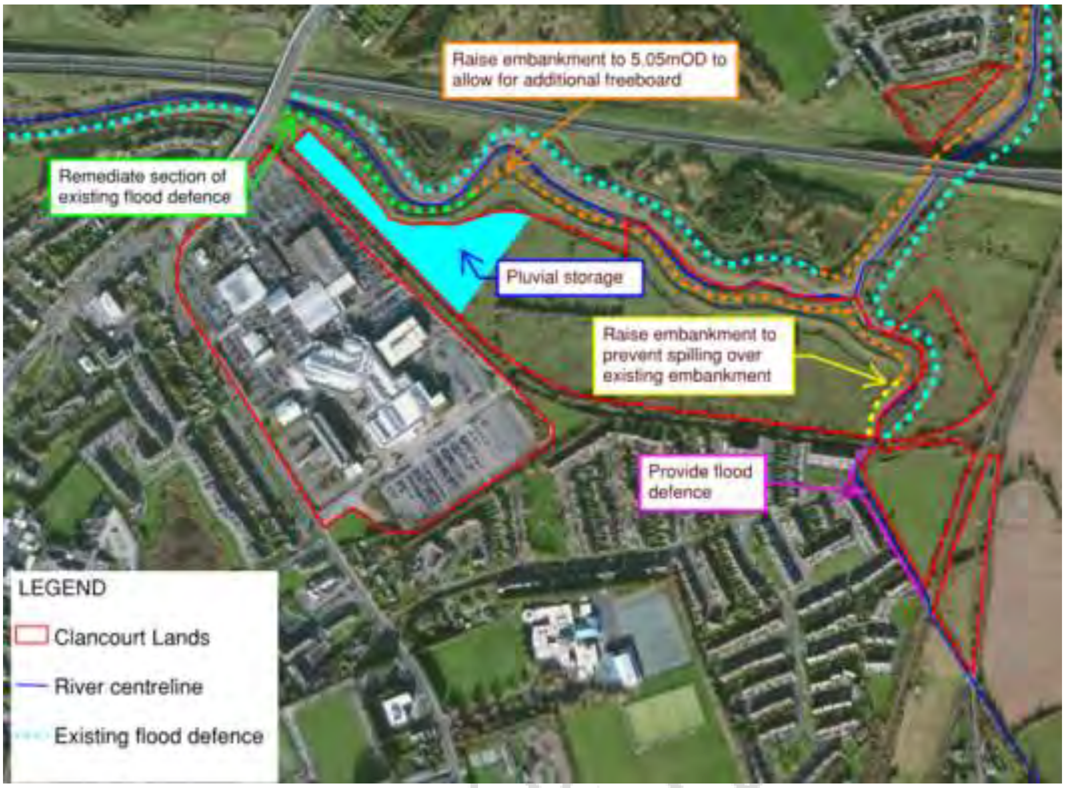
Also, as protection to the Clonmore estate is provided by a domestic blockwork boundary wall, we would also recommend that a more formal defence be constructed here.

All the above work can be completed on lands owned by Clancourt and would not result in an increase in flood risk elsewhere.

In addition to the tidal flood defences, it will also be necessary to retain a sufficient proportion of the lands to store surface water runoff for the periods when the outfall is tidelocked. This is described in detail in Section 8.

All of the works described above are shown in Figure 33 below.

Figure 34 Increasing embankment SoP and construction of flood defence wall

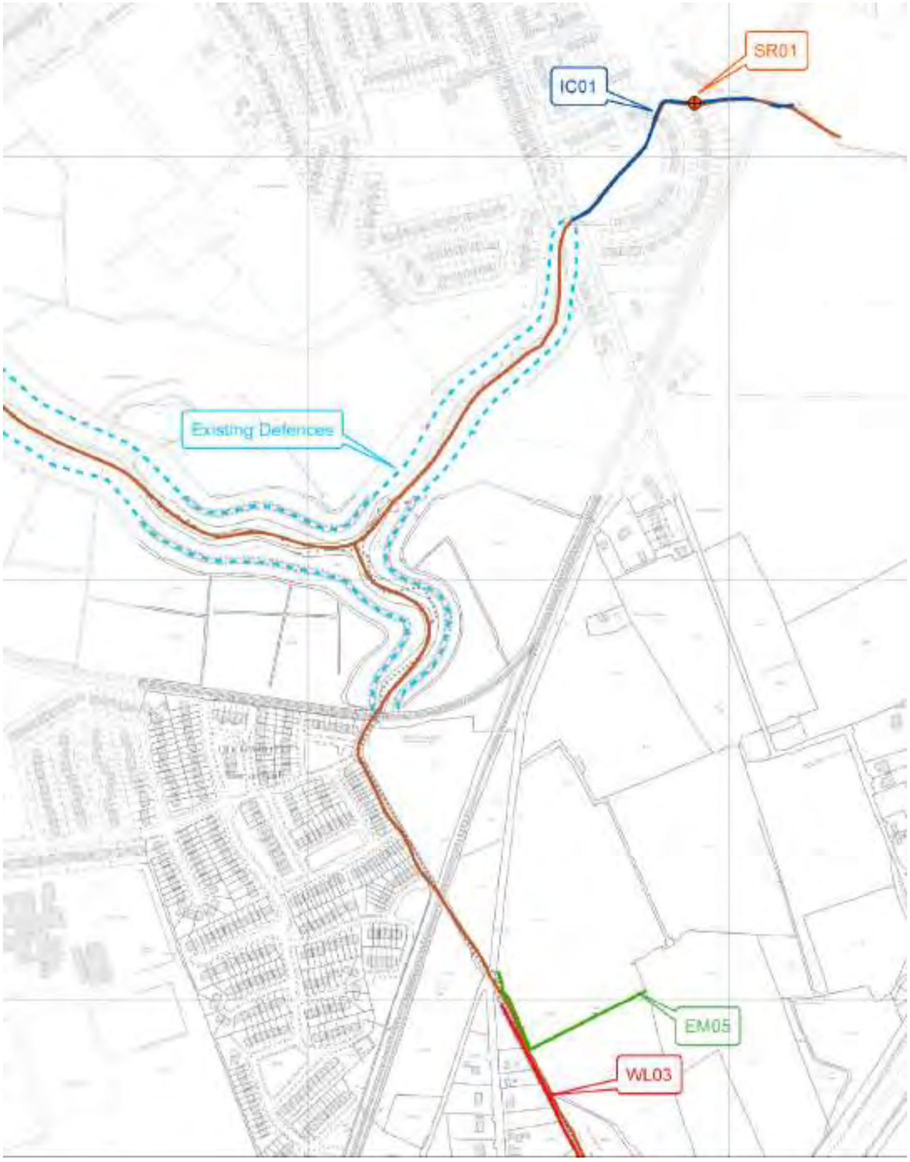


8.2 Integration with upstream fluvial defences proposed as part of Shannon CFRAMS

Whilst the approach set out in Section 9.1 can be delivered by works exclusively on Clancourt lands, it does not address the remaining flood risk to lands between the Rosbrien Road and the main Clancourt site which would continue to be at flood risk.

The Shannon CFRAMS did not propose to defend these lands but did propose to defend lands immediately upstream of the Rosbrien Road from fluvial flooding as shown in Figure 35 below.

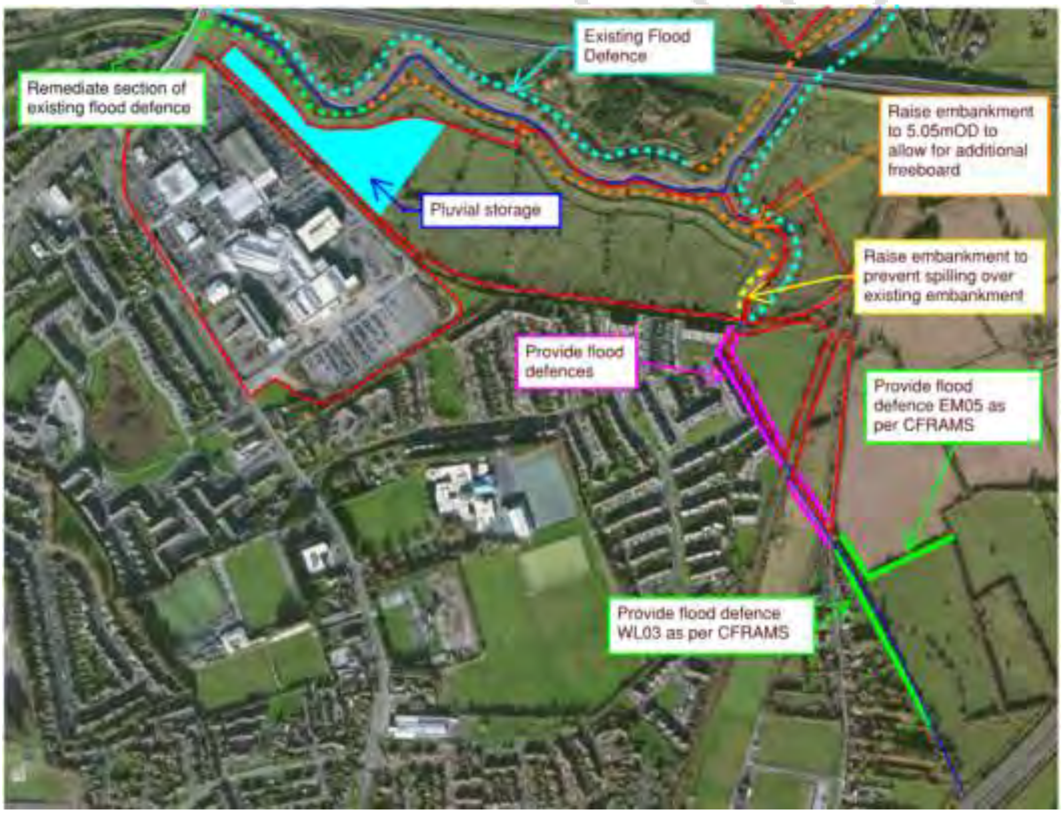
Figure 35 CFRAMS Ballinacurra River – upstream of subject lands.



As the proposed defences on the Clancourt lands address the tidal risk and include defences immediately downstream of the Rosbrien Road, and the Shannon CFRAMS include proposed measures to address fluvial risk immediately upstream, it would be far more efficient to ensure an integrated approach is adopted which addresses both in a fashion which removes all flooding in the vicinity of the railway line and Rosbrien Road.

This would be achieved by Clancourt providing low level defences either side of the Ballinacurra Stream downstream of Rosbrien Road which would essentially tie into the Shannon CFRAMS defences immediately upstream. Containing the flow in the channel here would marginally increase flood levels locally upstream of the Rosbrien Road and would thus require a modest increase in height of the proposed Shannon CFRAMS defences. However, as the watercourse is steep in this location and the proposed defences are low level (circa 800mm), the increase in height required would be very modest and not material change the nature or scale of the required defences. This solution is presented in Figure 35 below.

Figure 36: Integration with upstream defences



Further modelling would be required to accurately design such defences, but from the work completed to date and the understanding now gleaned of the regime and mechanisms, it is evident that the alignment of the proposed CFRAMS works with the recommended works on the Clancourt lands would represent the optimum solution in facilitating the sustainable development of this critical strategic land bank.

9 Summary of Proposed Flood Risk Management Strategy and Measures

The following flood risk management strategy and measures are proposed for the subject lands:

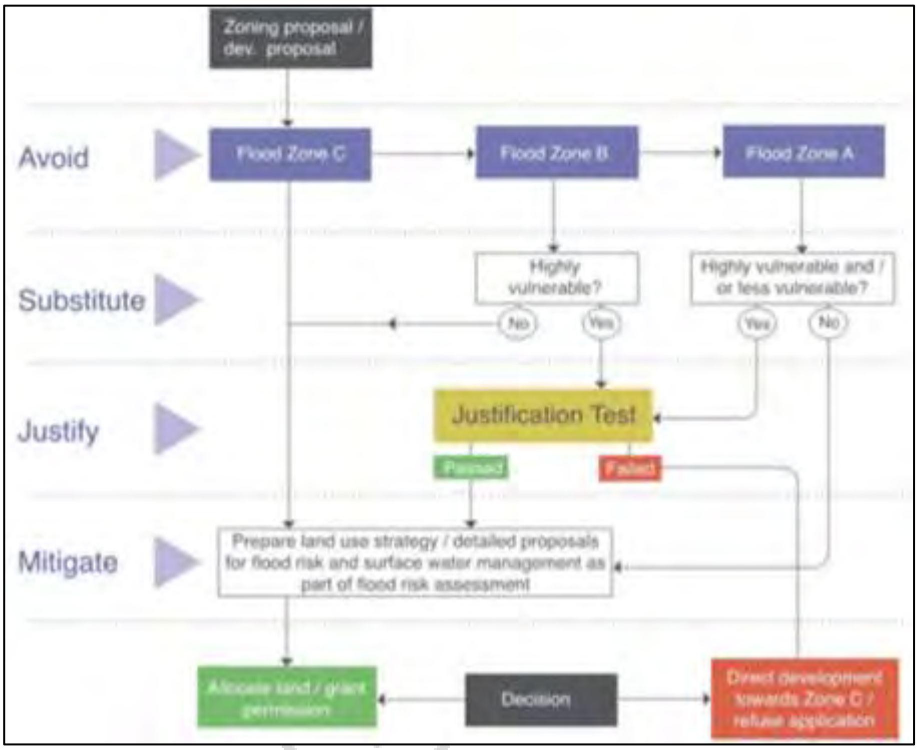
- It is recommended that the recommended tidal defence works on the Clancourt lands are aligned and integrated with the proposed fluvial flood defences measures outlined in the Shannon CFRAMS
- It is proposed that a detailed surface water drainage study is undertaken and that an appropriately sized surface water storage area (or areas) are developed to store excess surface water which cannot drain by gravity when river levels are high. This can also serve as an amenity and biodiversity feature.
- It is proposed to restore the 1 in 200-year standard of protection of the existing OPW flood defence embankment and to construct some low-level flood defences immediately upstream as far as the Rosbrien Road where they would tie into the proposed Shannon CFRAMS defences.
- A detailed seepage analysis should be undertaken to inform a decision on minimum floor levels within the area protected by the embankment.
- Public open space should have appropriately designed side slopes to ensure safe egress from all public amenity areas.
- An Emergency Response Plan should be prepared, which will contain details of safe egress routes during an extreme flood event. Given that flood risk is tidally dominant, sufficient lead time will be available to operate the Emergency Response. Details to be drawn up in conjunction with Planners and Architects.

10 Application of the Flood Risk Management Guidelines

10.1 Sequential Approach

Figure 35 below illustrates the Sequential Approach to be adopted under the 'Planning System and Flood Risk Management' guidelines. It should be applied to all stages of the planning and development management process.

Figure 37: Sequential approach



The subject lands lie within Flood Zone A.

It is currently proposed that the site is to consist of a mixed usage including residential development.

Therefore, by adopting the Sequential Approach, completion of the Justification Test is required for the proposed development.

10.2 Justification Test

The 'Planning System and Flood Risk Management' guidelines indicates the following two criteria which must be met as part of the Justification Test for development management.

10.2.1 Justification Test – Item 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."

10.2.2 Justification Test – Item 2

"The proposal has been subject to an appropriate flood risk assessment that includes:

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."*

As the subject lands are currently not zoned for residential or commercial development it is necessary to complete the Development Plan Justification Test as set out below.

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

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) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];

(ii) Comprises significant previously developed and/or under-utilised lands;

(iii) Is within or adjoining the core[3] of an established or designated urban settlement;

(iv) Will be essential in achieving compact and sustainable urban growth; and

(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.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

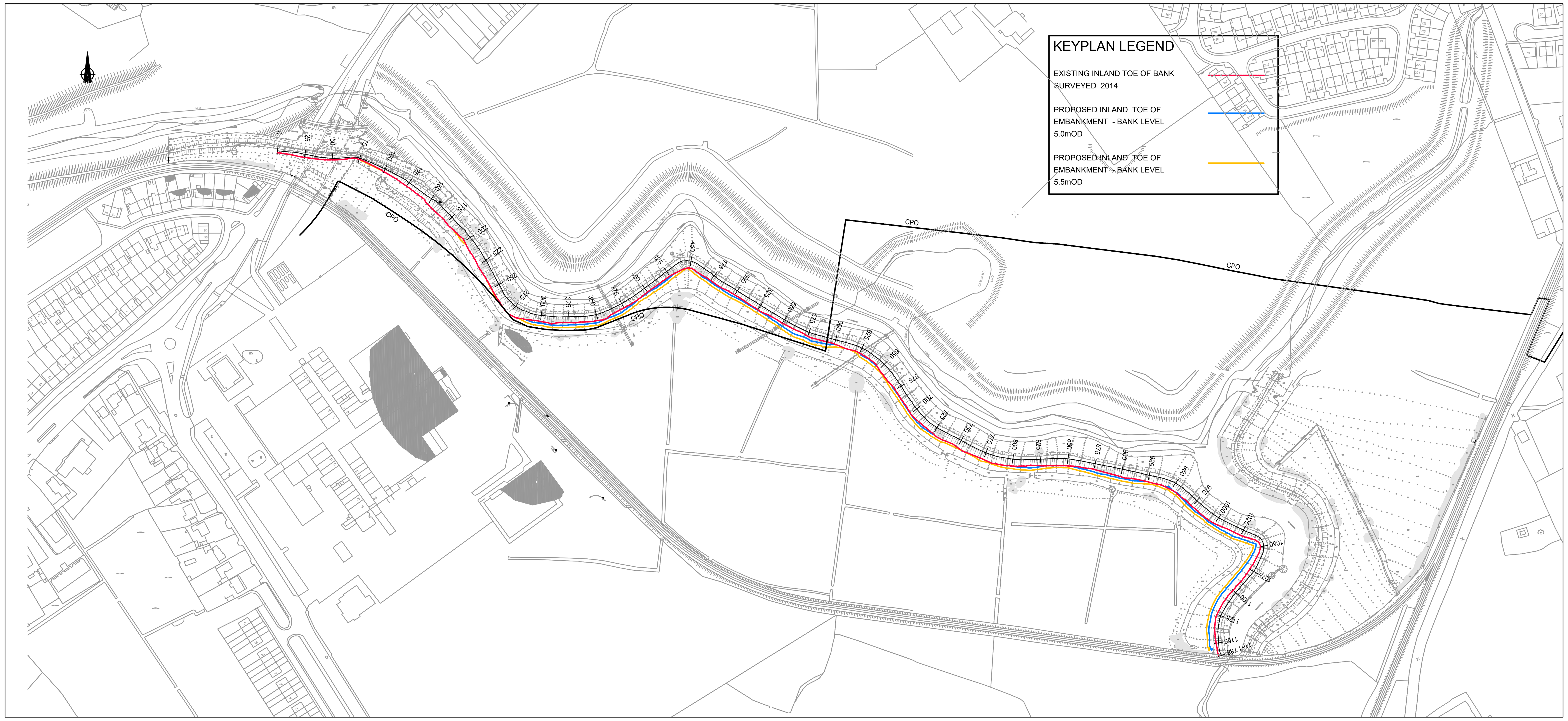
N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

This Report is provided to address Question 3 of the Justification Test.

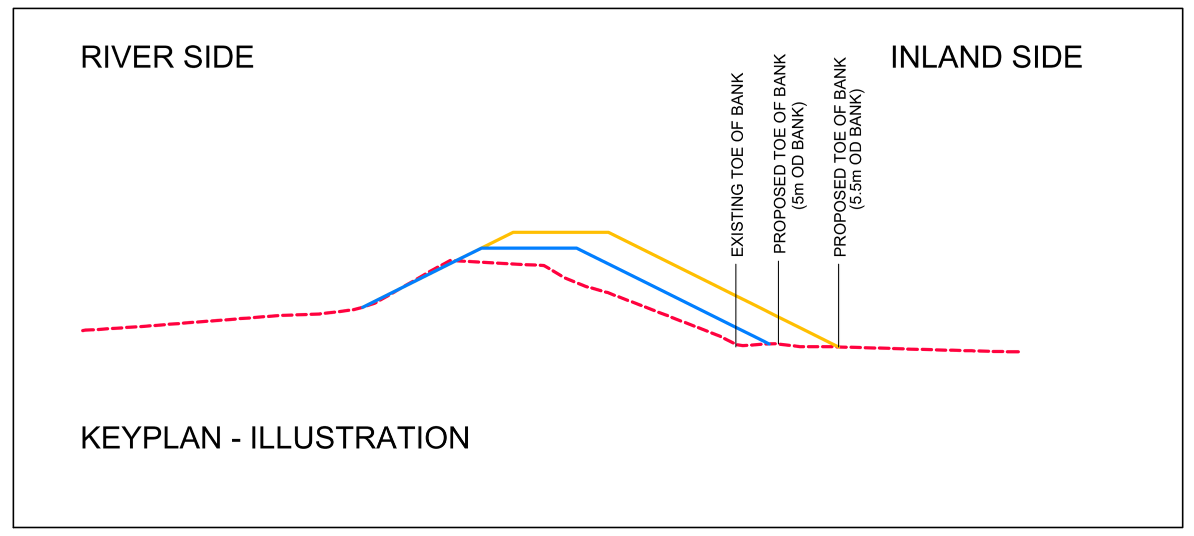
Clancourt's Response to Questions 1 and 2 has been prepared separately by John Spain and Associates Planning Consultants and is included in Appendix G to this report.

Appendix A

Long Section of OPW Embankment



Keyplan
SCALE 1:2500



NOTES

1. VERTICAL PROFILE SHOWN FOLLOWS INLAND TOP OF BANK AS SURVEYED 2014 SURVEY
2. FLOOD ZONE A (1v200) IS IN COSTAL FLOODING AREA.
3. REFER TO 131-373-010 AND 131-137-011 FOR SECTIONS THROUGH EMBANKMENT

TOPOGRAPHICAL SURVEY NOTES

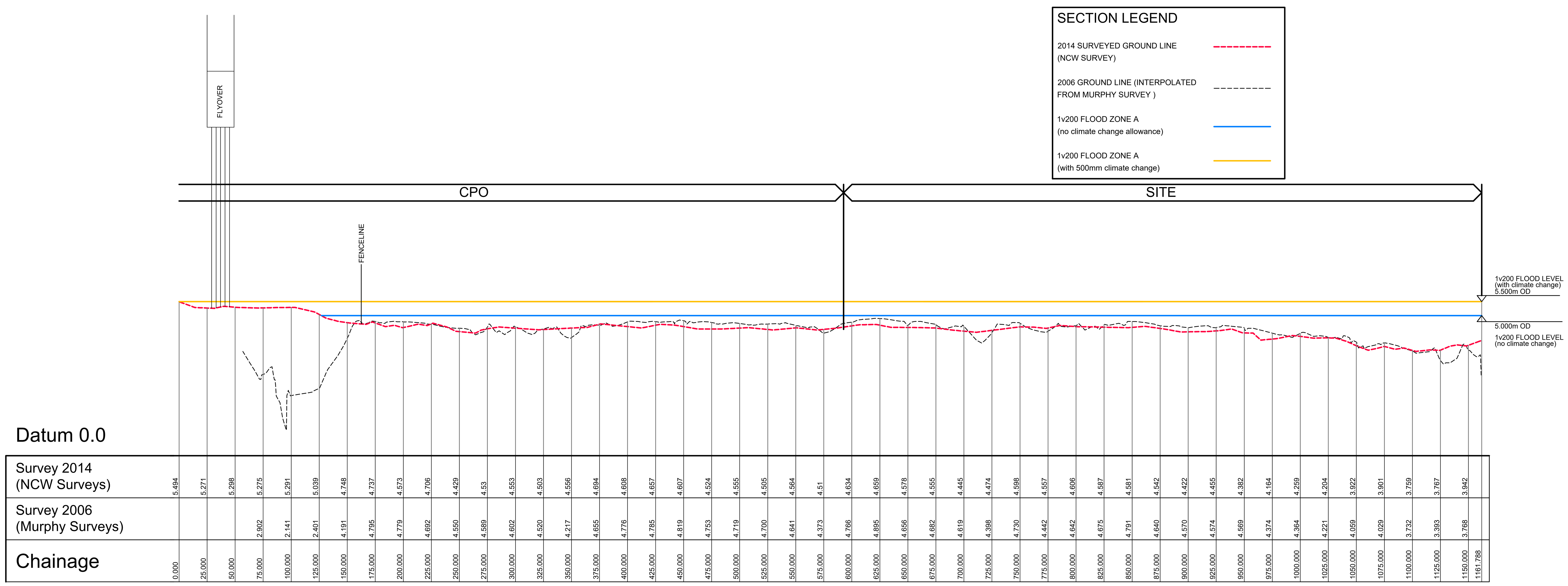
ALL LEVELS RELATE TO MAILN HEAD

2014 TOPOGRAPHICAL SURVEY CARRIED OUT BY NCW SURVEYS LTD. (BACKGROUND MAPPING SHOWN ON KEYPLAN)

DRAWING REFERENCES : 14-056-001-002-003

2006 TOPOGRAPHICAL SURVEY CARRIED OUT BY MURPHY SURVEYS

DRAWING REFERENCE : 05657C1



Vertical Profile
Scale Horizontal 1/2500, Vertical 1/100

Chainage	2006 Level	2014 Level	Level Difference
0		5.494	
25		5.271	
50		5.298	
75	2.902	5.275	2.4
100	2.141	5.291	3.2
125	2.401	5.039	2.6
150	4.191	4.748	0.6
175	4.795	4.737	-0.1
200	4.779	4.573	-0.2
225	4.692	4.706	0.0
250	4.55	4.429	-0.1
275	4.589	4.53	-0.1
300	4.602	4.553	0.0
325	4.52	4.503	0.0
350	4.217	4.556	0.3
375	4.655	4.694	0.0
400	4.776	4.608	-0.2
425	4.785	4.657	-0.1
450	4.819	4.607	-0.2
475	4.753	4.524	-0.2
500	4.719	4.555	-0.2
525	4.7	4.505	-0.2
550	4.641	4.564	-0.1
575	4.373	4.51	0.1
600	4.766	4.634	-0.1
625	4.895	4.659	-0.2
650	4.656	4.578	-0.1
675	4.682	4.555	-0.1
700	4.619	4.445	-0.2
725	4.398	4.474	0.1
750	4.73	4.598	-0.1
775	4.442	4.557	0.1
800	4.642	4.606	0.0
825	4.675	4.587	-0.1
850	4.791	4.581	-0.2
875	4.64	4.542	-0.1
900	4.57	4.422	-0.1
925	4.574	4.455	-0.1
950	4.569	4.382	-0.2
975	4.374	4.164	-0.2
1000	4.364	4.259	-0.1
1025	4.221	4.204	0.0
1050	4.059	3.922	-0.1
1075	4.029	3.901	-0.1
1100	3.732	3.759	0.0
1125	3.393	3.767	0.4
1150	3.768	3.942	0.2

Tech. Check:	KOBrien
Eng. Check:	EMcKendrick
Approved:	EMcKendrick

Figured dimension only to be taken from this drawing.
All dimensions to be checked on site.
Consultants to be informed immediately of any discrepancies before work proceeds.

REV.	AMENDMENT	BY	DATE

Job: WAYLEAVEMAP CYCLE WALKWAY CRESCENT LANDS CLANCOURT

Title: EMBANKMENT PLAN AND VERTICAL PROFILE

PUNCH consulting engineers
Dublin Limerick Cork
Carnegie House, Library Road, Dun Laoghaire, Co. Dublin, Ireland
t +353 1 271 2200 | f +353 1 271 220 | e dublin@punchconsulting.com
97 Henry Street, Limerick, Ireland
t +353 61 221 200 | f +353 61 221 201 | e limerick@punchconsulting.com
Copley Hall, Cotters Street, Cork, Ireland
t +353 21 462 4000 | f +353 21 462 4001 | e cork@punchconsulting.com
www.punchconsulting.com

Stage:	PRELIMINARY
Scale @A1:	AS SHOWN
Drawn:	KOBRIEN
Date:	2014-05-01
Drawing No: 121-373-009	Rev: PR0

Appendix B

Site Photos

B Site Walkover Photos – 18/07/2018

Figure 38: Site walkover photo locations

Photo 1: Location A – Crescent Shopping Centre drainage outlet

Photo 2: Location A – Crescent Shopping Centre drainage culvert under railway

Photo 3: Location A – Crescent Shopping Centre drainage outlet

Photo 4: Location A – Crescent Shopping Centre carpark

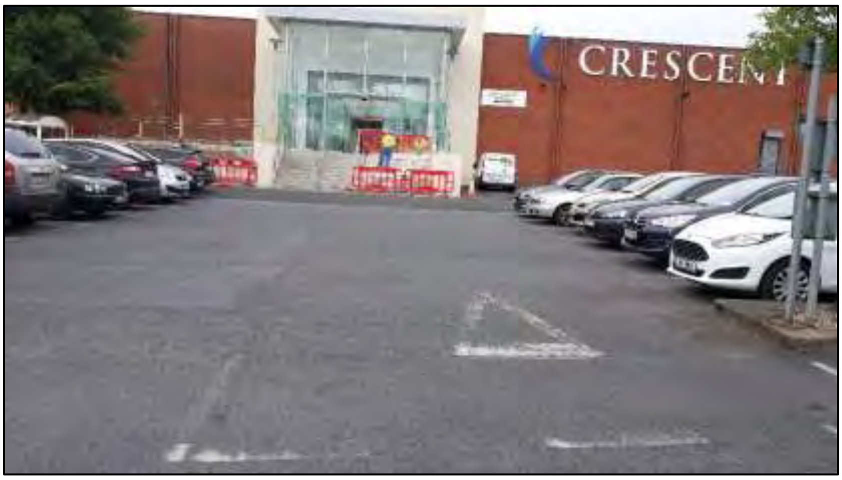


Photo 5: Location A – Railway embankment

Photo 6: Location A – Crescent Shopping Centre Carpark towards Ballinacurra Road

Photo 7: Location A – Crescent Shopping Centre Carpark towards Rosbrien Road

Photo 8: Location A – Railway embankment

Photo 9: Location B – Subject Site towards Rosbrien Road

Photo 10: Location B – Subject Site towards Ballinacurra Road

Photo 11: Location B – Subject Site OPW flood protection embankment

Photo 12: Location B – Drainage culvert exit

Photo 13: Location C – Road crossing (Structure 4315)

Photo 14: Location C – Road crossing (Structure 4315) facing downstream

Photo 15: Location D – Railway crossing (Structure 4200) towards downstream

Photo 16: Location D – Railway crossing (Structure 4200) facing upstream

Photo 17: Location E – Railway crossing (Structure 3965) facing downstream

Photo 18: Location F – Railway crossing (Structure 3965) facing upstream

Photo 19: Location F – OPW flood protection embankment towards subject site

Appendix C

Hydrological Flow Estimation

C Hydrological Flow Calculations

1. Institute of Hydrology Report 124

The rural index flood, $Q_{bar\ rural}$, was calculated using the method outlined in the IH124 Report.

$Q_{bar} = 0.00108 \cdot AREA^{0.89} \cdot SOIL^{2.17} \cdot SAAR^{1.17}$

A factorial standard error of 1.65 applies to this method.

Table 20 below summarises the results from the above analysis for the un-factored scenario as well as the 68% and 95% confidence intervals.

Table 20: IH124 Method - $Q_{bar\ urban}$ results

	Q_{bar} urban (m^3/s)		
Site	Un-factored	68% Confidence	95% Confidence
HEP 1	7.72	12.74	21.03
HEP 2	2.80	4.62	7.62
HEP 3	5.12	8.45	13.95

Flow for the 1 in 100-year return period (Q_{100}) was calculated by multiplying the results by the FSR Regional growth curve (1975) growth factor for the 100-year storm. The growth factor used for this event was 1.96. A summary of these results can be seen in Table 21.

Table 21: IH124 Method - Q_{100} results

	Q_{100} (m^3/s)		
Site	Un-factored	68% Confidence	95% Confidence
HEP 1	15.11	24.93	41.13
HEP 2	5.47	9.03	16.32
HEP 3	10.02	16.54	27.29

2. Flood Studies Report - Six variable equation

The rural index flood, $Q_{barrural}$, was calculated using Equation 8 (Cunnane & Lynn, 1975).

$$Q_{bar} = 0.00042 \cdot AREA^{0.95} \cdot Fs^{0.22} \cdot SOIL^{1.18} \cdot SAAR^{1.05} \cdot (1+LAKE)^{-0.85} \cdot S1085^{0.19}$$

A factorial standard error of 1.50 applies to this method.

Table 22 below summarises the results from the above analysis for the un-factored scenario as well as the 68% and 95% confidence intervals.

Table 22: FSR 6 Variable Method - $Q_{bar\ urban}$ results

	$Q_{bar\ urban}$ (m^3/s)		
Location	Un-factored	68% Confidence	95% Confidence
HEP 1	8.08	12.11	18.17
HEP 2	2.55	3.82	5.74
HEP 3	4.28	6.43	9.64

Flow for the 1 in 100-year return period (Q_{100}) was calculated by multiplying the results by the FSR regional growth curve; the growth factor for the 100-year storm is 1.96. A summary of these results can be seen in Table 23 below.

Table 23: FSR 6 Variable Method - Q_{100} results

	Q_{100} (m^3/s)		
Location	Un-factored	68% Confidence	95% Confidence
HEP 1	15.80	23.70	35.54
HEP 2	4.99	7.48	11.22
HEP 3	8.38	12.57	18.85

3. FSSR16 – Unit Hydrograph Method

The unit hydrograph method most widely used in Ireland for ungauged catchments is the FSR triangular unit hydrograph and design storm method. This method estimates the design flood hydrograph, describing the timing and magnitude of flood peak and flood volume (area beneath hydrograph). This method requires the catchment response characteristics (time to peak, tp), design rainstorm characteristics (return period, storm duration, rainfall depth and profile) and runoff/loss characteristics (percentage runoff and baseflow).

The FSSR16 Unit Hydrograph method is a rainfall-runoff model based on procedures set out in the Flood Studies Report (1975) and includes revisions contained in subsequent supplementary reports. The FSSR16 will generate flow hydrographs for design return period events or will simulate runoff during historic events using recorded rainfall and other input data.

A unit hydrograph was constructed using this method for the three HEP's along the watercourses, to determine the 100-year peak flow as well as the time to peak. The subsequent flow hydrographs are shown in Figure 37 to 39.

Figure 39: HEP 1 FSSR16 Q_{100} Hydrograph

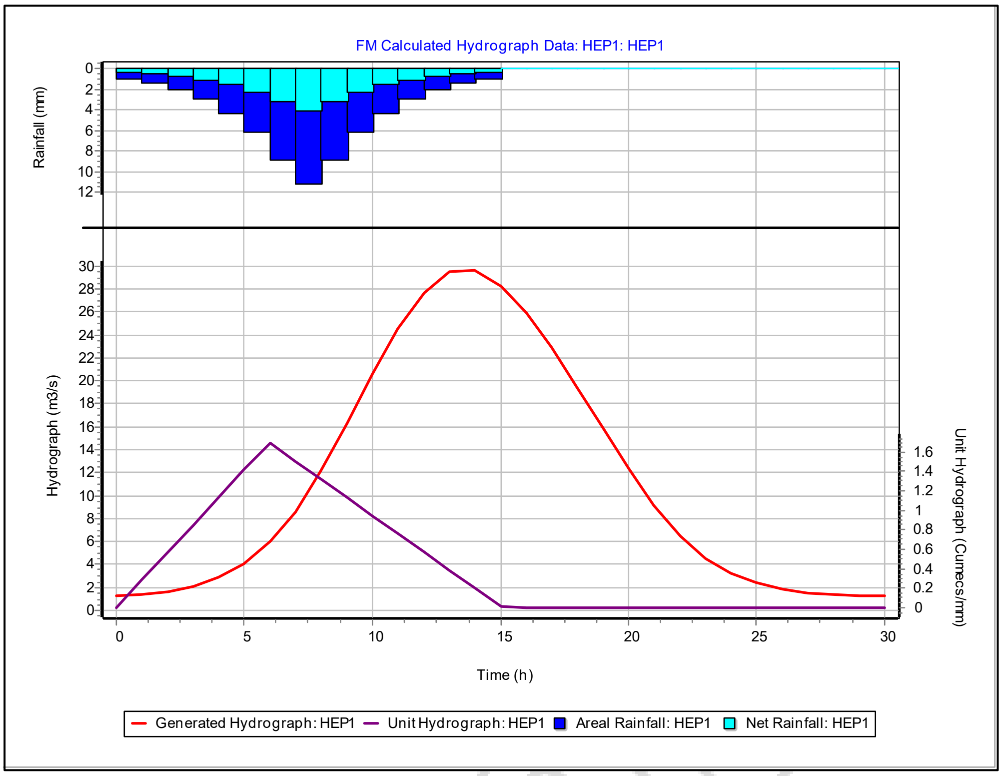


Figure 40: HEP 2 FSSR16 Q_{100} Hydrograph

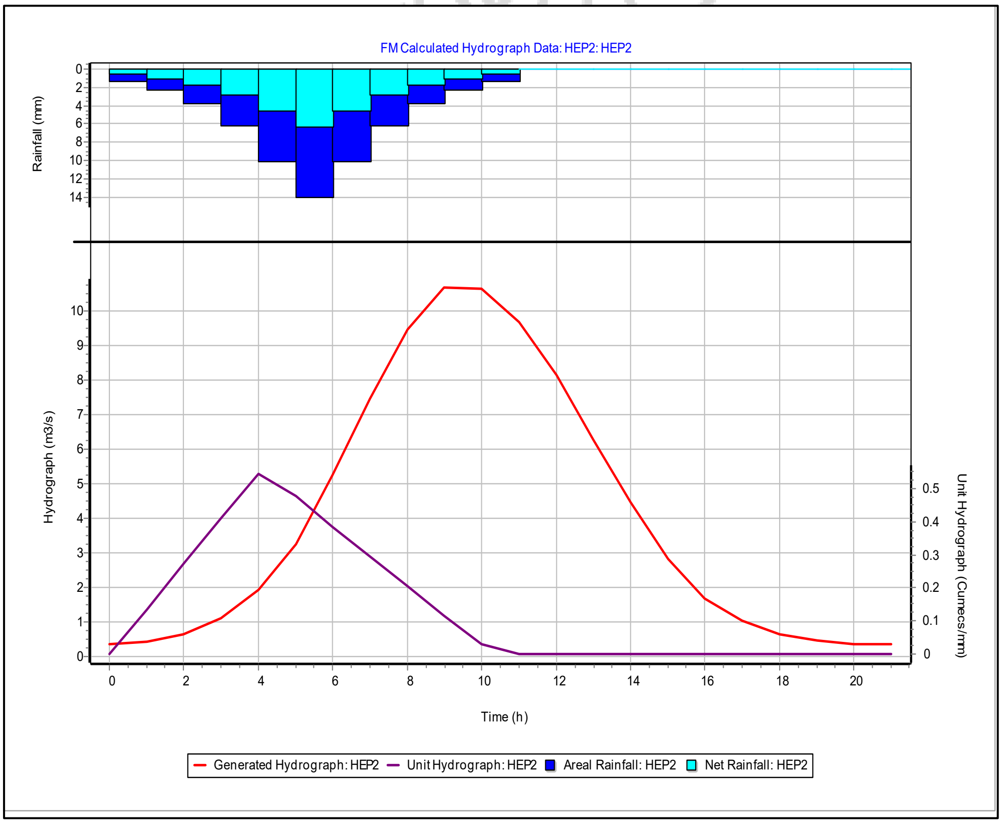
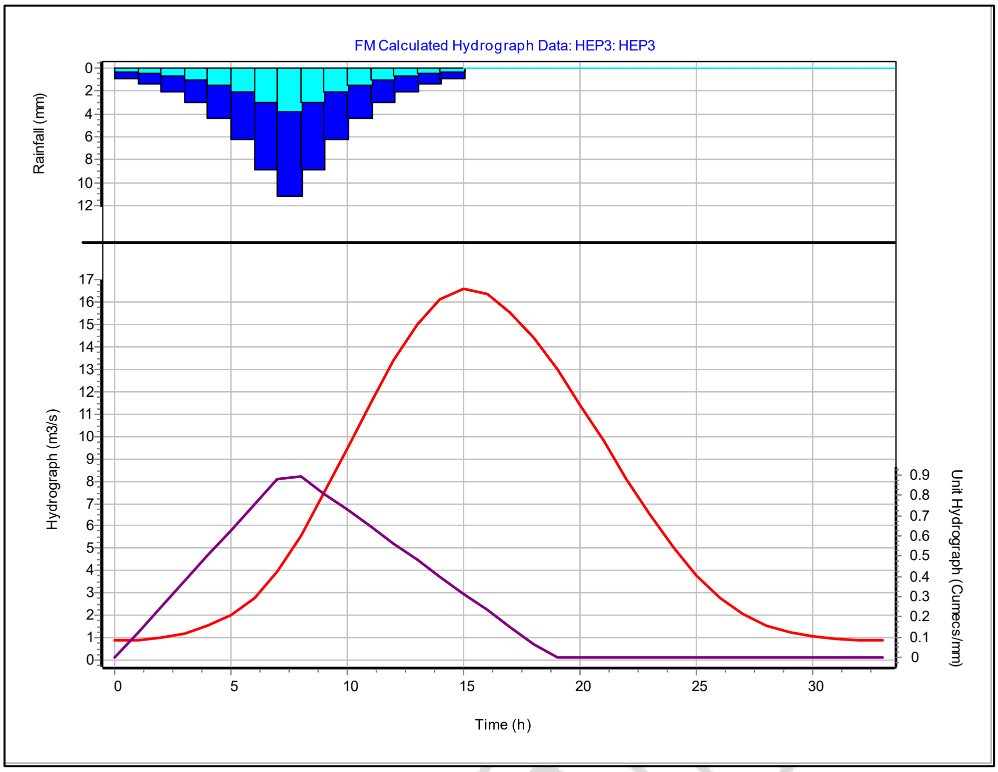


Figure 41: HEP 3 FSSR16 Q100 Hydrograph



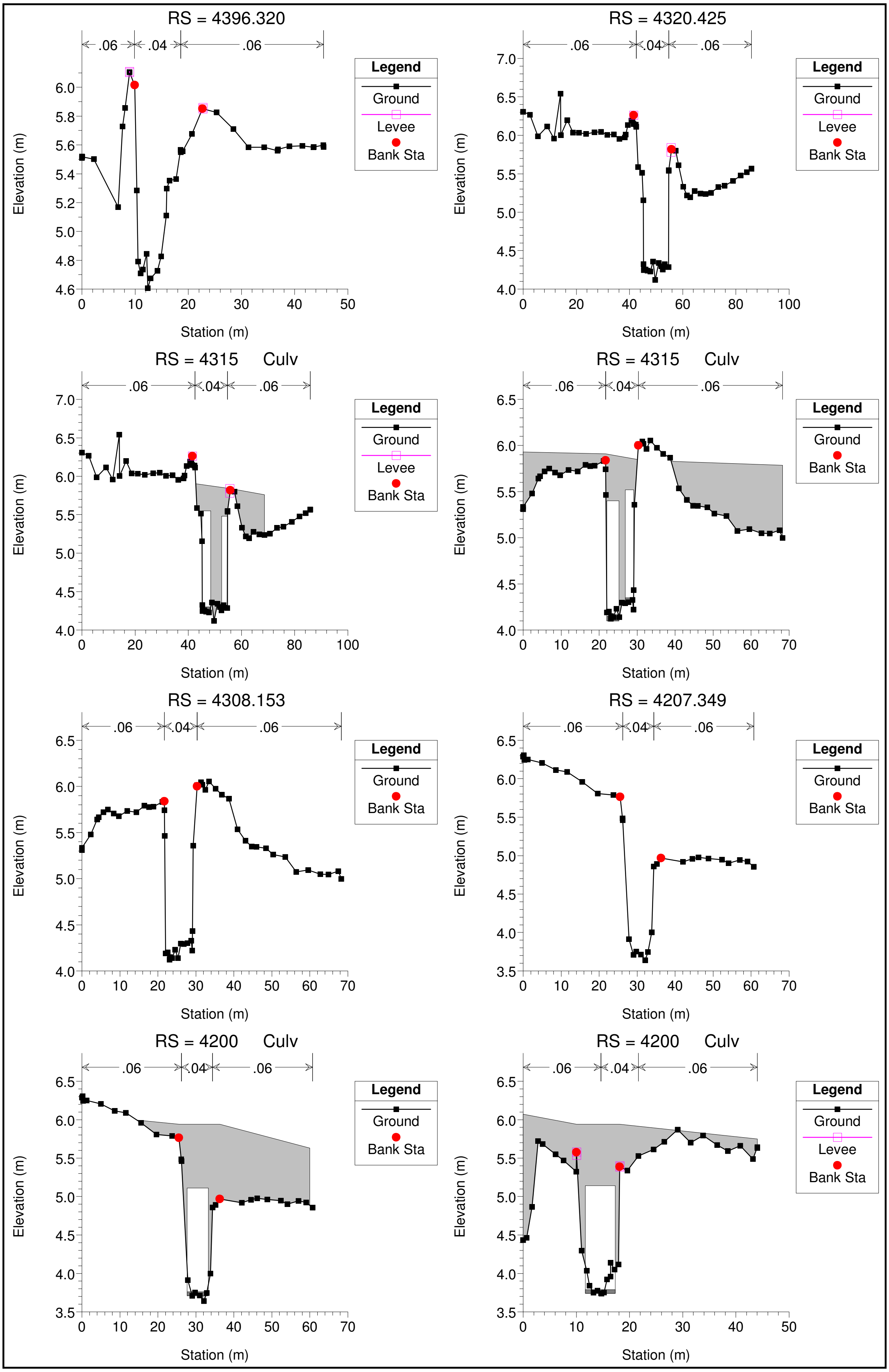
A summary of the peak flows from the FSSR16 Unit Hydrograph method can be seen in Table 24.

Table 24: Q_{100} results

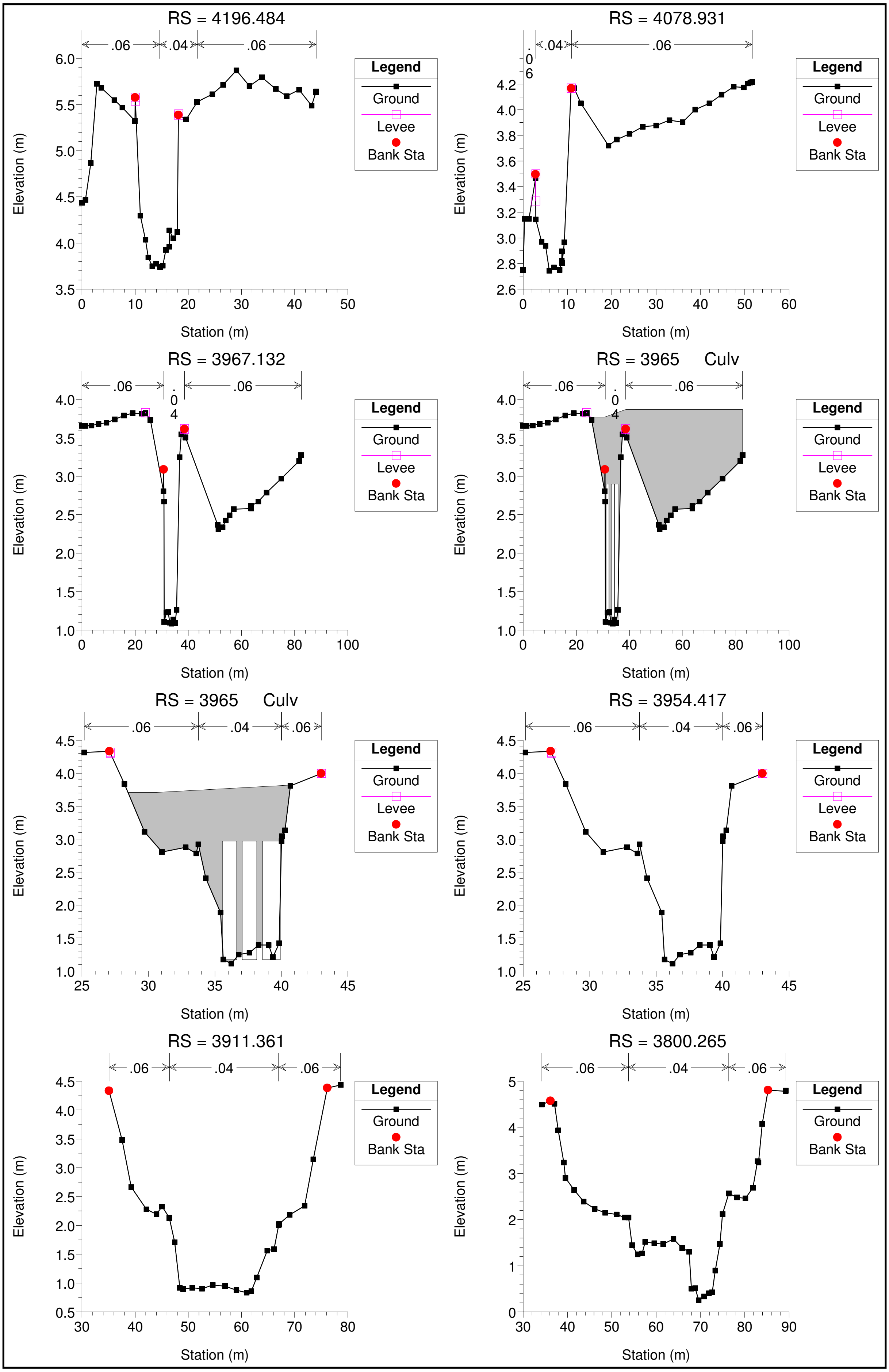
	Q_{100} (m^3/s)
HEP 1	29.62
HEP 2	10.69
HEP 3	16.60

Appendix D

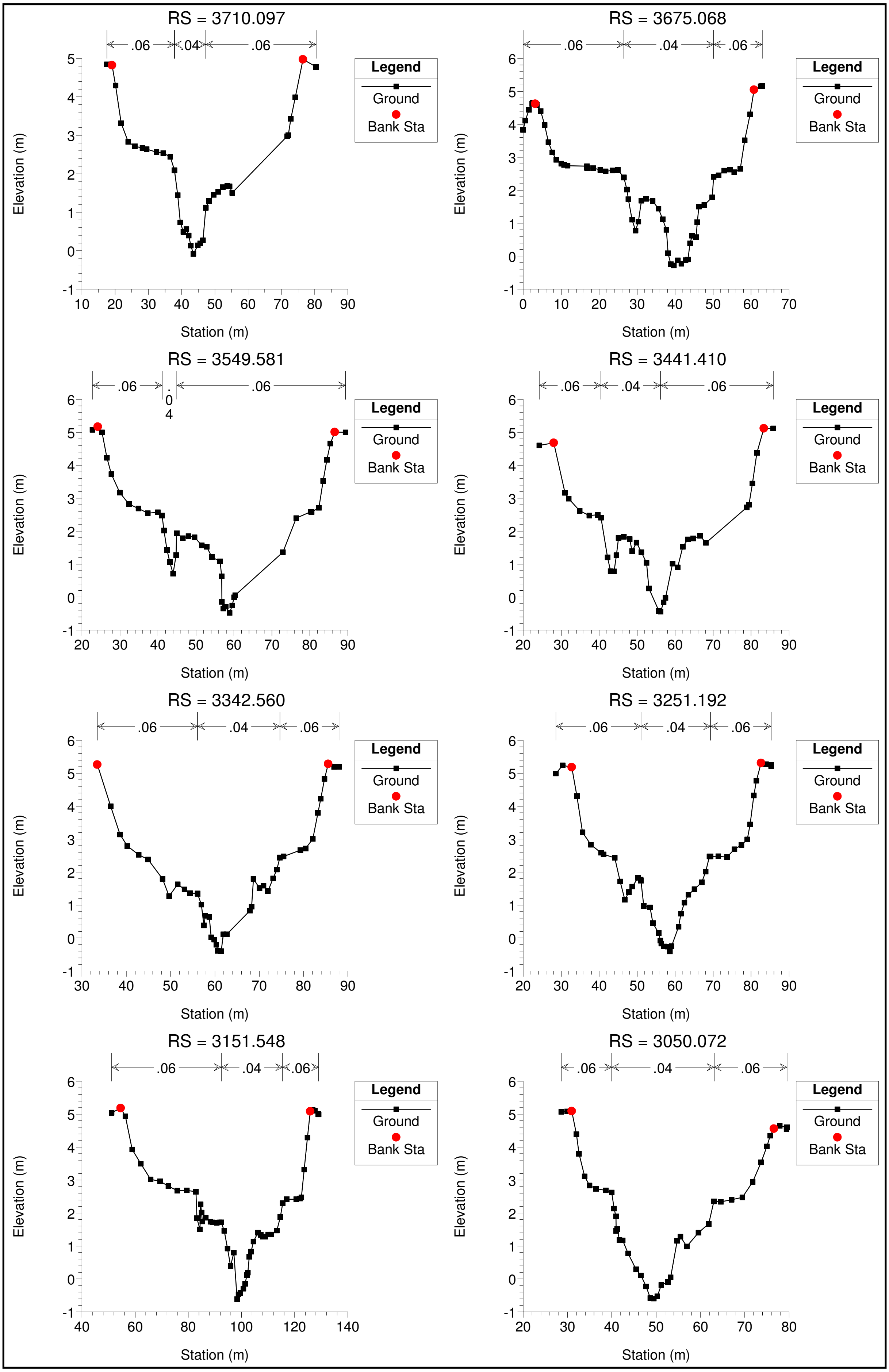
River Cross Sections

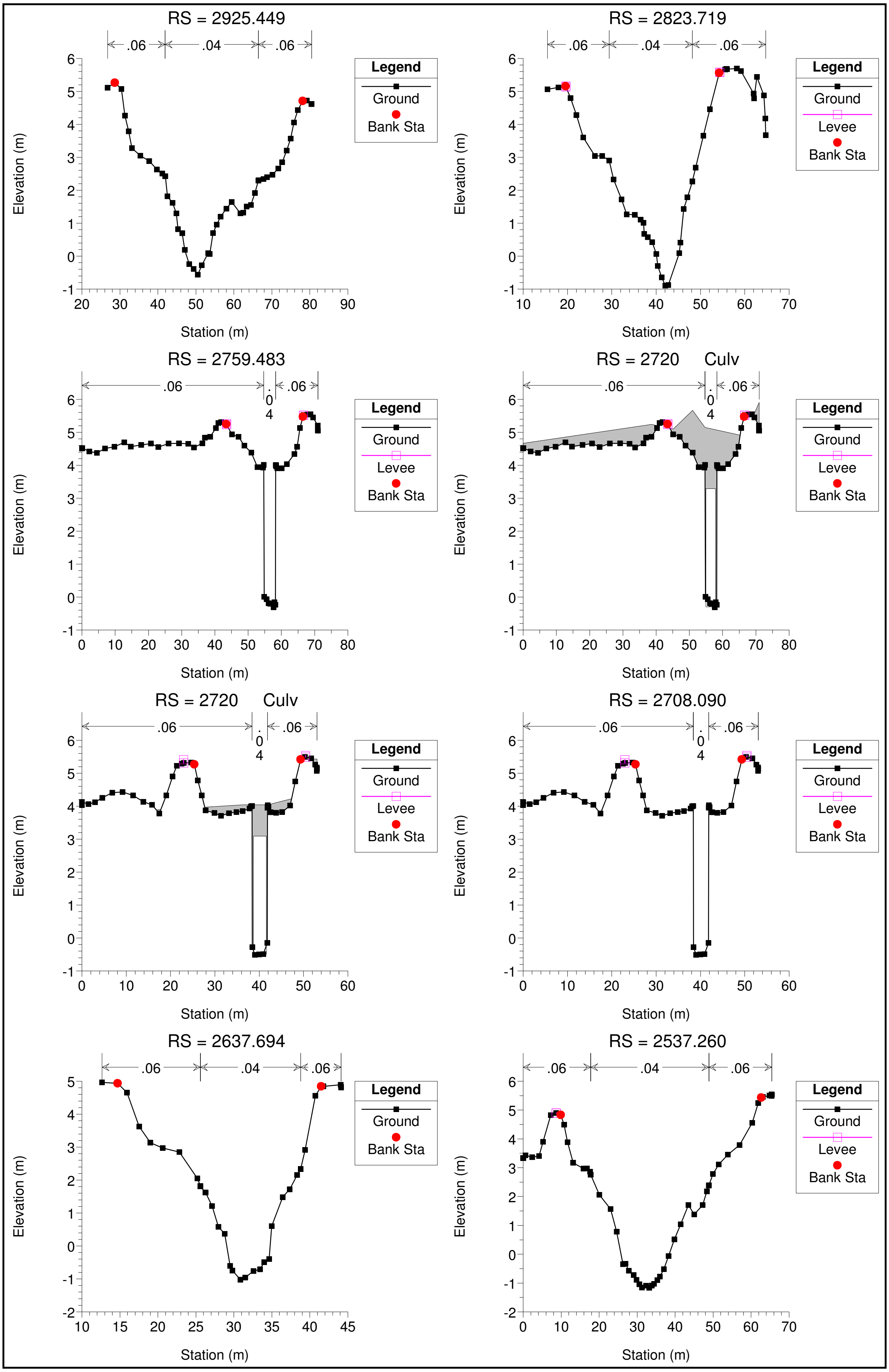


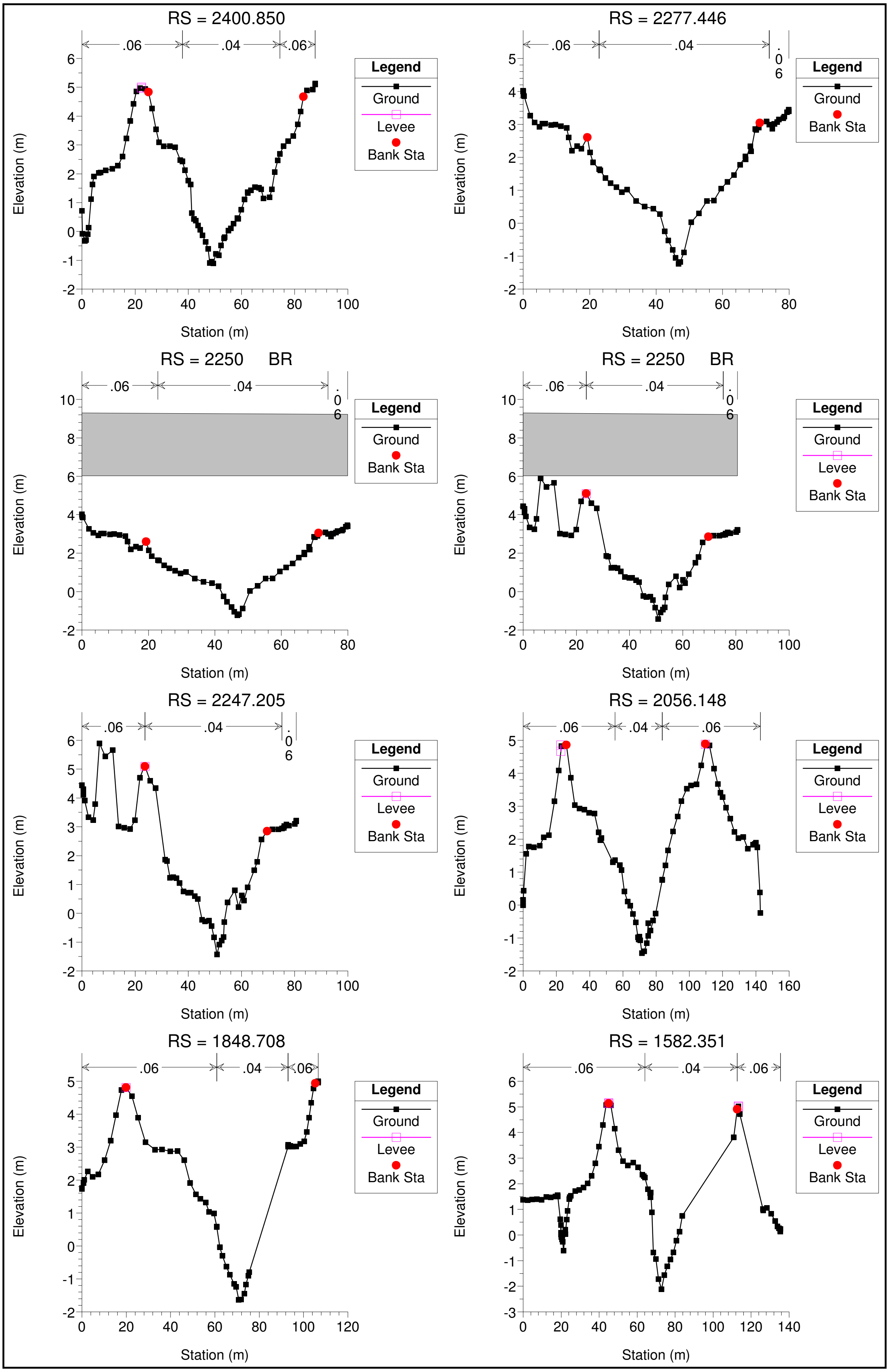
RS = 4396.320
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 4320.425
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 4315 Culv
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 4315 Culv
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 4308.153
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 4207.349
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 4200 Culv
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 4200 Culv
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)

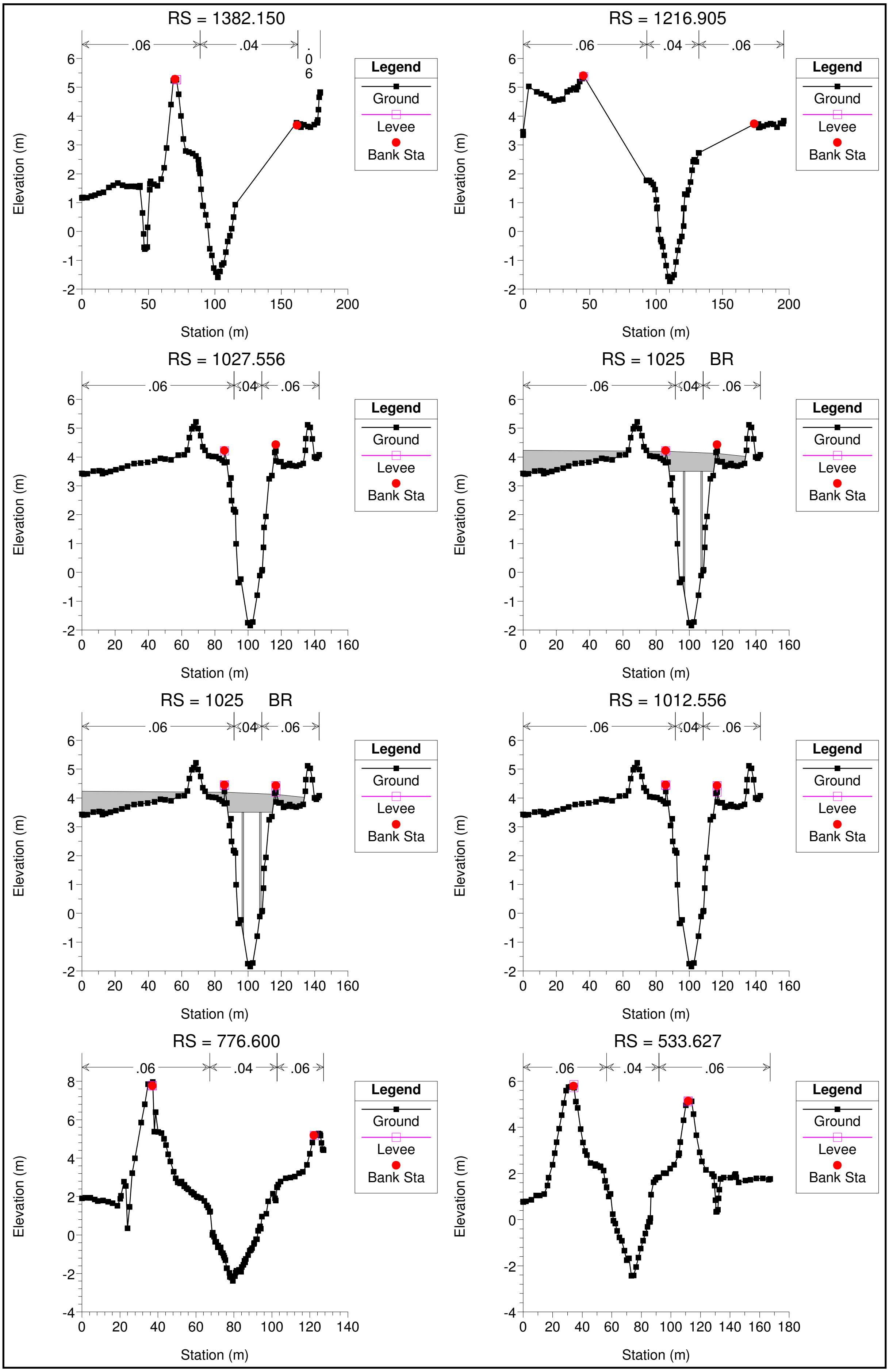


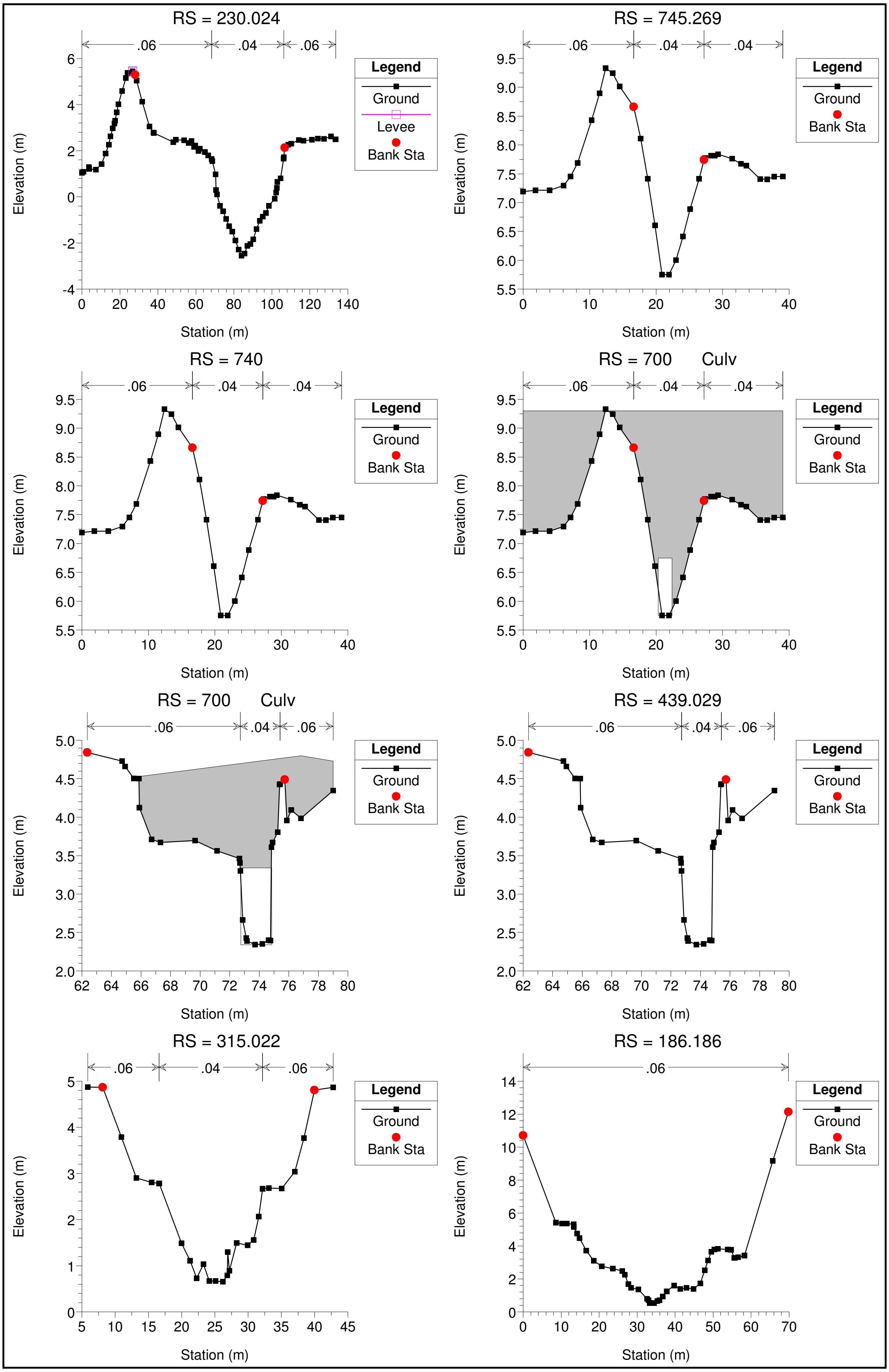
RS = 4196.484
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 4078.931
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 3967.132
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 3965 Culv
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 3965 Culv
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 3954.417
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 3911.361
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3800.265
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

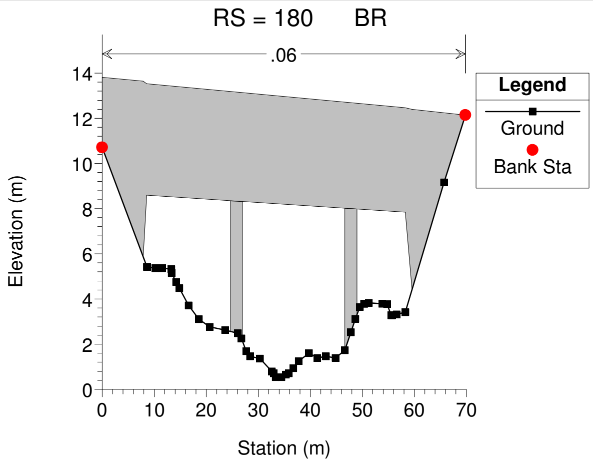

RS = 3710.097
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3675.068
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3549.581
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3441.410
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3342.560
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3251.192
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3151.548
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 3050.072
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)

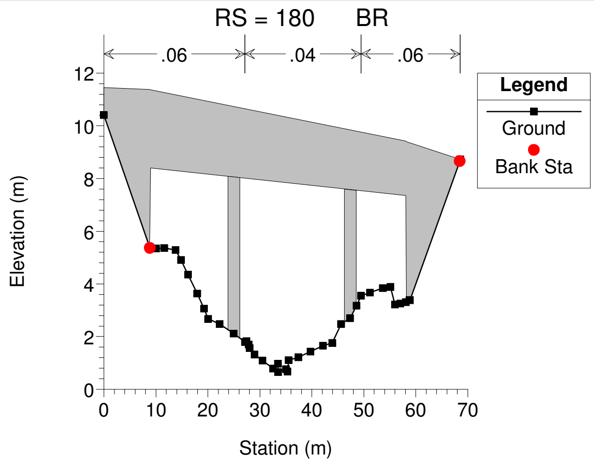

RS = 2925.449
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 2823.719
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2759.483
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2720 Culv
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2720 Culv
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2708.090
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2637.694
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 2537.260
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)

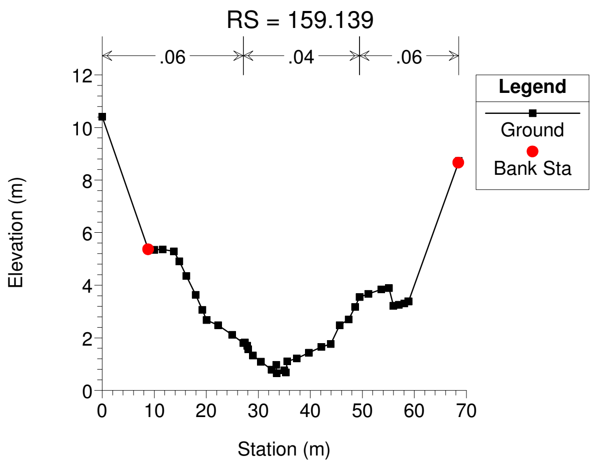

RS = 2400.850
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2277.446
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 2250 BR
.06 .04 .06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 2250 BR
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2247.205
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 2056.148
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1848.708
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1582.351
.06 .04 .06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)

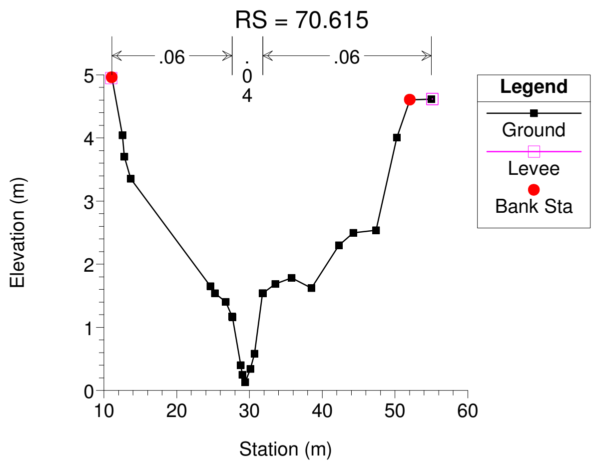

RS = 1382.150
.06
.04
0
6
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1216.905
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1027.556
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1025 BR
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1025 BR
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 1012.556
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 776.600
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 533.627
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)

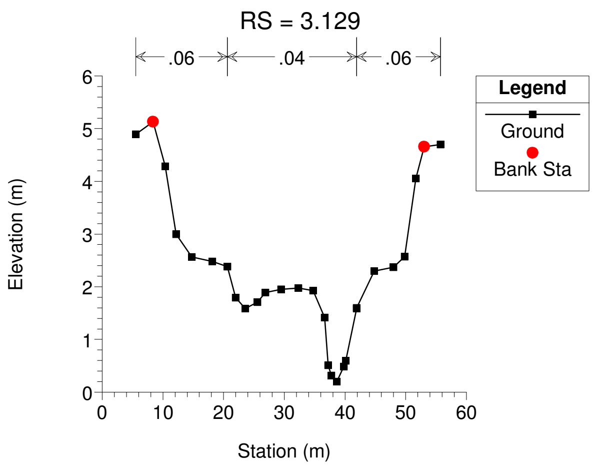

RS = 230.024
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
RS = 745.269
.06
.04
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 740
.06
.04
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 700 Culv
.06
.04
.04
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 700 Culv
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 439.029
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 315.022
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
RS = 186.186
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)


RS = 180 BR
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
0
10
20
30
40
50
60
70
0
2
4
6
8
10
12
14


RS = 180 BR
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
0
10
20
30
40
50
60
70
0
2
4
6
8
10
12


RS = 159.139
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
0
10
20
30
40
50
60
70
0
2
4
6
8
10
12


RS = 70.615
.06
.04
.06
Legend
Ground
Levee
Bank Sta
Elevation (m)
Station (m)
10
20
30
40
50
60
0
1
2
3
4
5


RS = 3.129
.06
.04
.06
Legend
Ground
Bank Sta
Elevation (m)
Station (m)
0
10
20
30
40
50
60
0
1
2
3
4
5
6

Appendix E

Comparison with CFRAM Model

E Site-Specific Model

4. Fluvially Dominant Scenario

In order to assess the fluvially dominant scenarios, peak flows corresponding to the 0.1%, 1% and 10% Annual Exceedance Probability (AEP) events were combined with an annual tidal flood event.

Target flows from Shannon CFRAM Study HEP locations 24_1580_5 and 24_1718_4 were initially used to scale the existing hydrographs and set peak inflows for the model. Figures 40 and 41 show the inflow values adopted.

Figure 42: Inflow hydrograph – Ballysheedy River, Reach 2 (Shannon CFRAM Study Hydrology Report)

HEP Reference	Annual Exceedance Probability							
	50%	20%	10%	5%	2%	1%	0.5%	0.1%
24_121_8	0.81	1.1	1.2	1.4	1.6	1.7	1.9	2.2
24_121_9	0.14	0.18	0.21	0.24	0.27	0.30	0.32	0.38
24_1580_5a	2.7	3.5	4.0	4.5	5.2	5.7	6.2	7.4
24_1580_5	0.10	0.13	0.15	0.17	0.19	0.21	0.23	0.27
24_1718_1	0.07	0.09	0.11	0.12	0.14	0.15	0.16	0.19
24_1720_3a	1.9	2.4	2.8	3.1	3.6	4.0	4.3	5.1

Table B16.18 Preliminary Design Hydrograph Peak Inflows (m^3/s) at HEP Locations on the N16 Model Extent (Ballincurra and its tributary Ballynaclogh, and Ballysheedy)

Figure 43: Inflow hydrograph – Ballinacurra Creek, Reach 1 (Shannon CFRAM Study Hydrology Report)

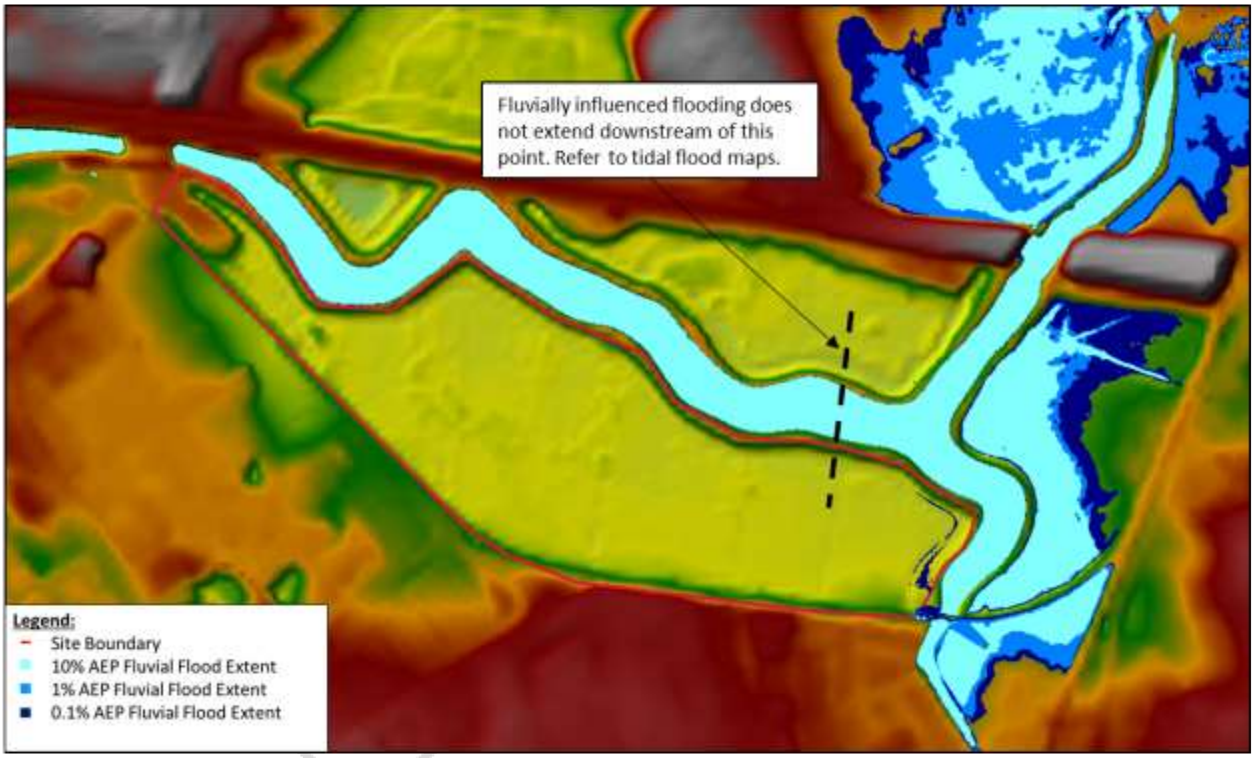
HEP Reference	Annual Exceedance Probability							
	50%	20%	10%	5%	2%	1%	0.5%	0.1%
24_121_9	0.81	1.1	1.2	1.4	1.6	1.7	1.9	2.2
24_121_12	0.95	1.2	1.4	1.6	1.9	2.0	2.2	2.6
24_1580_5	2.7	3.5	4.0	4.5	5.2	5.7	6.2	7.4
24_1580_6	2.8	3.6	4.2	4.7	5.4	5.9	6.4	7.6
24_1718_1	3.5	4.6	5.3	6.0	6.9	7.6	8.2	9.8
24_1718_3	3.7	4.9	5.6	6.4	7.3	8.0	8.7	10.3
24_1718_4	3.8	4.9	5.7	6.4	7.4	8.1	8.8	10.4
24_1720_4	1.9	2.4	2.8	3.1	3.6	4.0	4.3	5.1

Table B16.9 Target Flows (m^3/s) at HEP Locations on the N16 Model Extent (Ballincurra, its tributary Ballynaclogh, and Ballysheedy) – Reach 29, 30 and 31

As can be seen from the flood extents in Figure 42 below, the results of the site-specific model have a strong correlation to those of the Shannon CFRAM Study found in Section 6.4.

The flood extents for the 1% and 10% AEP events show a slight deviation within Storage Area B due to the overtopping of the hydraulic structure on the Ballinacurra Creek, Reach 1 at River Station 3965. Furthermore, due to the above a slight deviation can be seen in the flood extent for the 0.1% AEP within the site along the eastern boundary.

Figure 44: Site Specific Model - Fluvial Flood Extents



Water levels are comparable and slightly higher to those recorded in the Shannon CFRAM Study; this is evident in the long sections in Figures 43-45 below.

Figure 45: Fluvial events - Site-Specific Model vs CFRAM WL- Long Section Reach 1 - 1

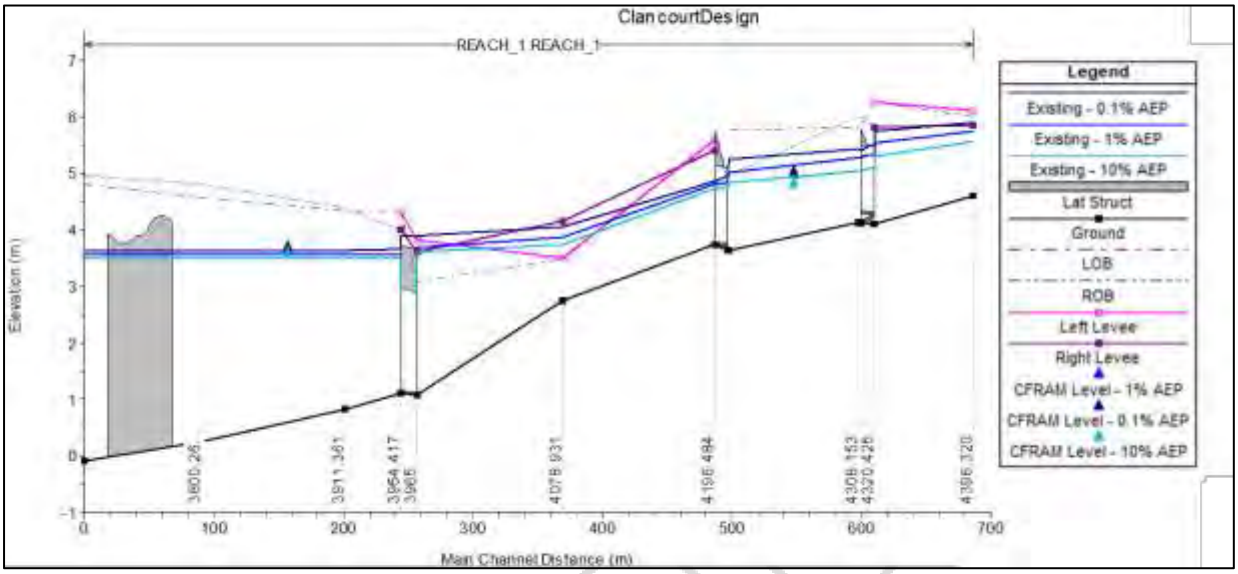


Figure 46: Fluvial events - Site-Specific Model vs CFRAM WL - Long Section Reach 2-2

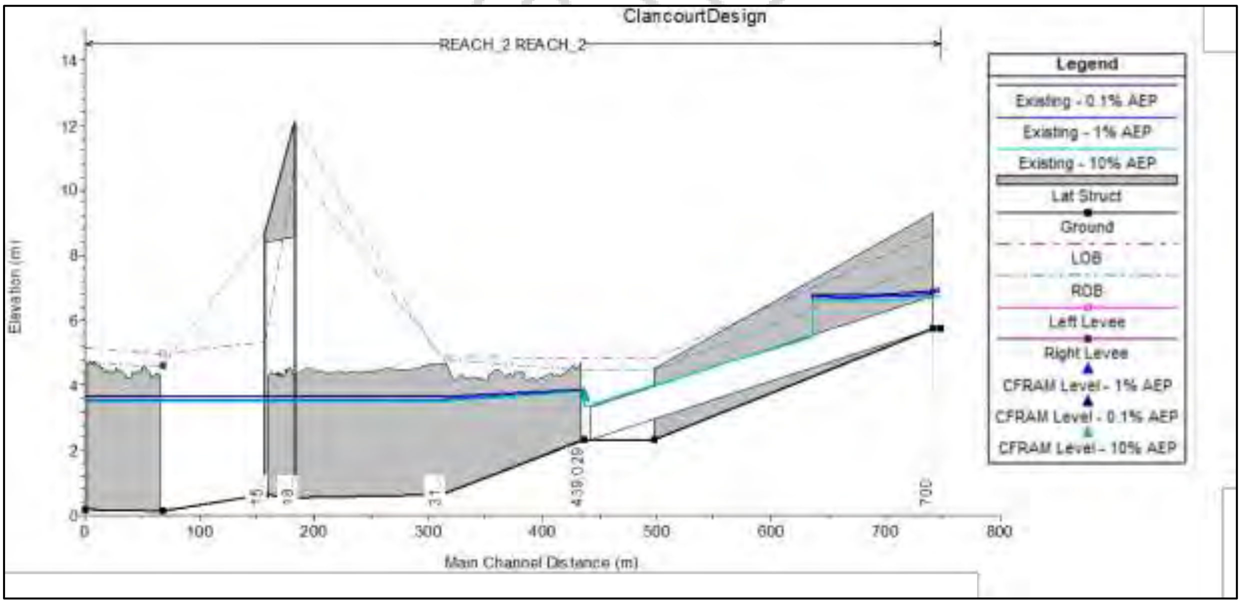


Figure 47: Fluvial events - Site-Specific Model vs CFRAM WL Long Section Reach 1-3

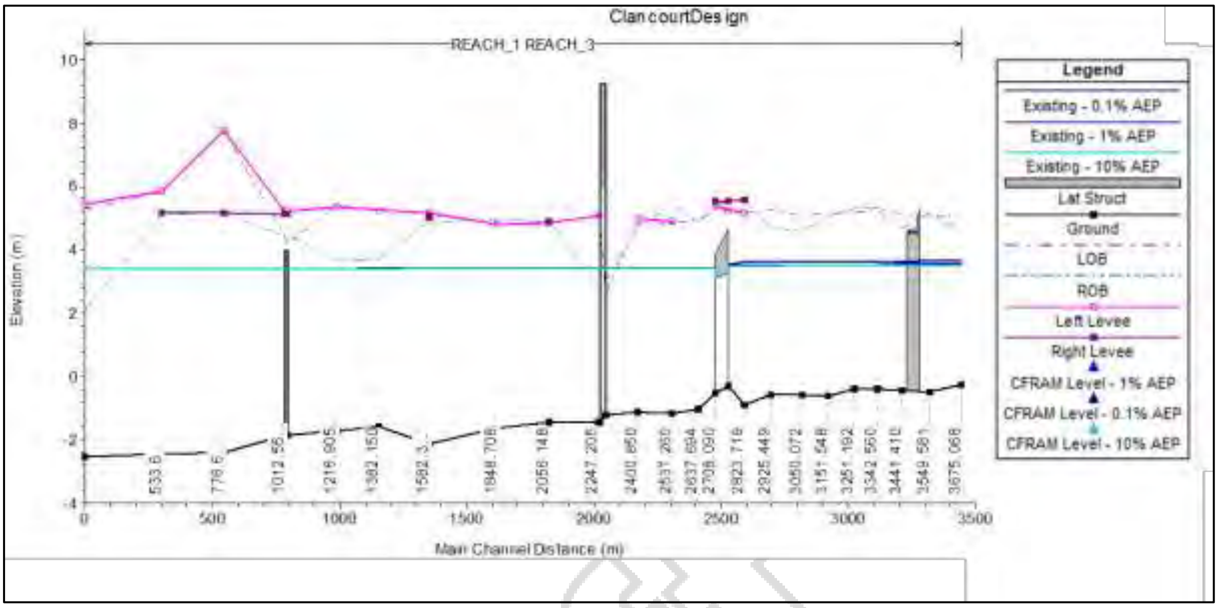


Table 25 shows the comparison of these observed water levels between the site-specific model and the Shannon CFRAM Study. The point closest to the site along Reach 1-1 at main channel distance 156.26m (highlighted below) produced the closest correlation to the CFRAM Study with an average percentage difference of 1.65%. The largest variation compared to the CFRAM Study occurred at the start of Reach 1-1 at main channel distance 548.06, this may be due to model instabilities which occurred at the start of the run.

Table 25: Water level comparison

Location	**Water Levels (mOD)**								
Main Channel Distance (m)	10% AEP			0.5% AEP			0.1% AEP		
	Site Specific Model	CFRAM	% Diff.	Site Specific Model	CFRAM	% Diff.	Site Specific Model	CFRAM	% Diff.
Reach 1-1									
156.26	3.52	3.59	1.95	3.56	3.64	2.20	3.65	3.68	0.82
548.06	4.94	4.82	2.49	5.15	4.97	3.62	5.36	5.03	6.56
Reach 2-2									
435.90	3.61	3.61	0.00	3.66	3.66	0.00	3.69	3.69	0.00

5. Tidally Dominant Scenario

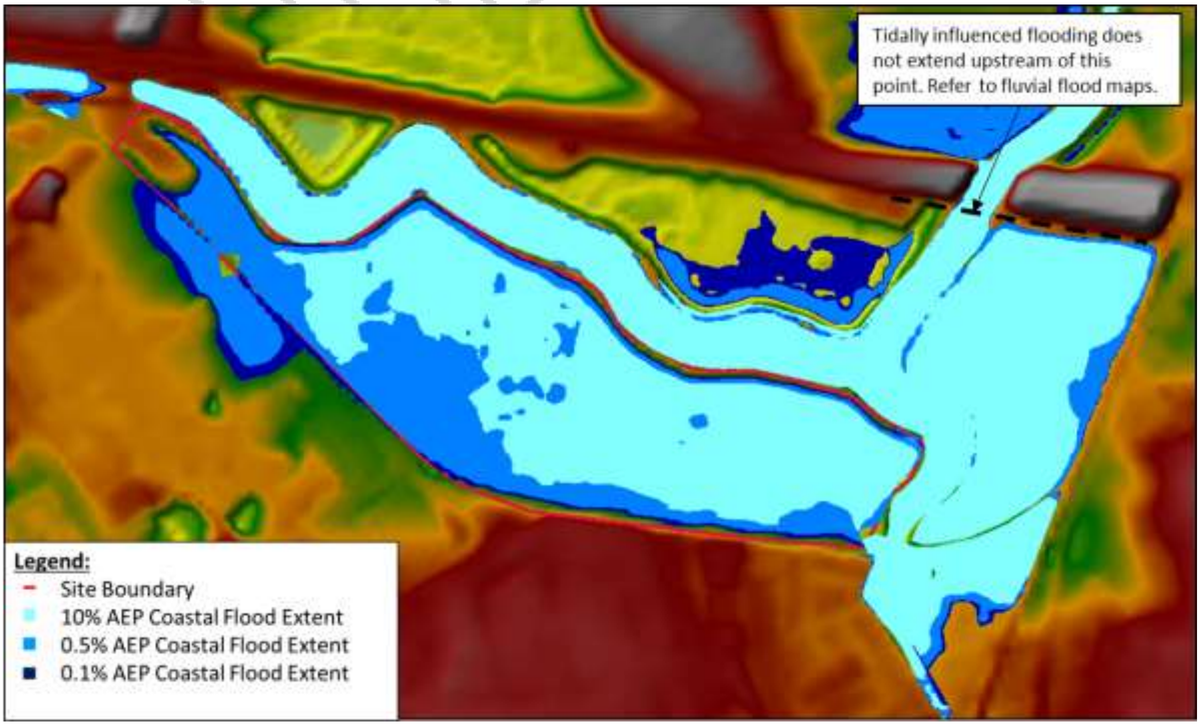
In order to compare the tidally dominant scenario the peak flows corresponding to the 0.1%, 0.5% and 10% Annual Exceedance Probability (AEP) events were combined with an annual fluvial flood event.
Downstream tidal levels at Node Label 01BLN00413 of the Shannon CFRAM Study were used to scale the existing tidal stage hydrographs.

As can be seen from the flood extents in Figure 46 below, the results of the site-specific model have a strong correlation to those of the Shannon CFRAM Study found in Section 6.4.

The flood extents for the 1% and 10% AEP events show a slight deviation in the following two areas of interest;

- Within the site boundary – the site-specific model indicates a larger flood extent within the site boundary for the 10% AEP. This may be as result of the embankment survey results being provided in 25m intervals which was subsequently used for the weir connection between the watercourse and the site within the model.
- Within the Crescent Shopping Centre carpark - the site-specific model indicates a larger flood extent within the site boundary for both the 10% and 1% AEP's. This is may be as a result of the connection between the site and the carpark by means of a culvert discovered during the site walkover. This connection was subsequently included in the model and thus increasing the extent of flooding within the ca

Figure 48: Site Specific Model - Tidal Flood Extents



Predicted water levels for the site-specific model are slightly lower than those estimated in the Shannon CFRAM Study, this is evident in the long sections in Figures 47-49.

Figure 49: Tidal events - Site-Specific Model vs CFRAM WL - Long Section Reach 1-1

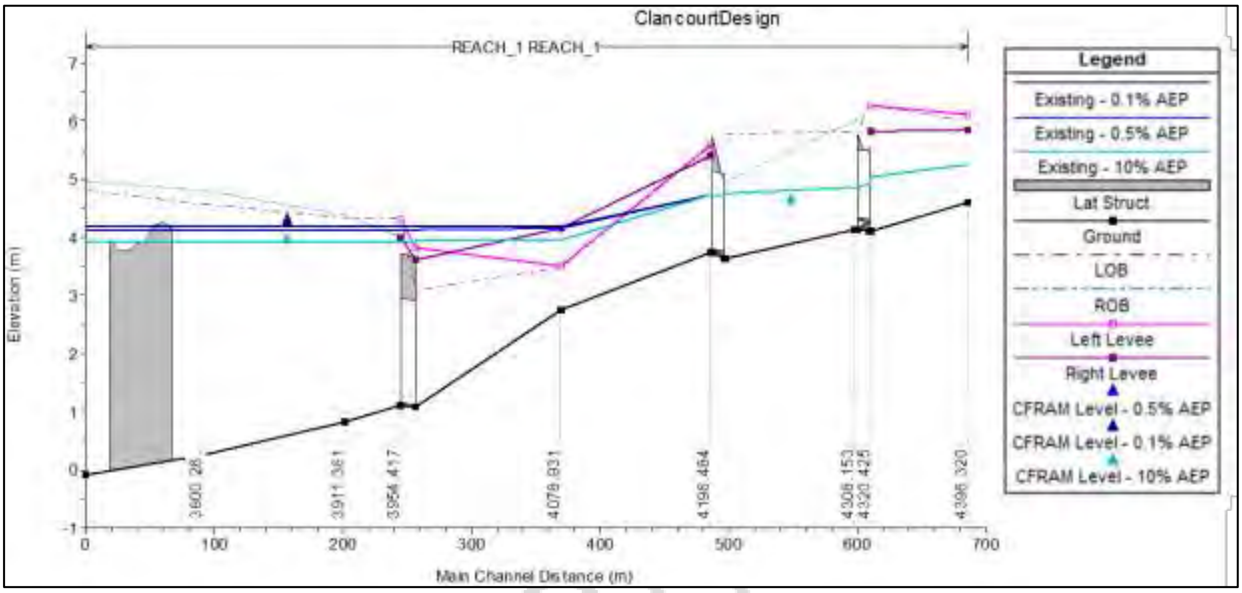


Figure 50: Tidal events - Site-Specific Model vs CFRAM WL - Long Section Reach 2-2

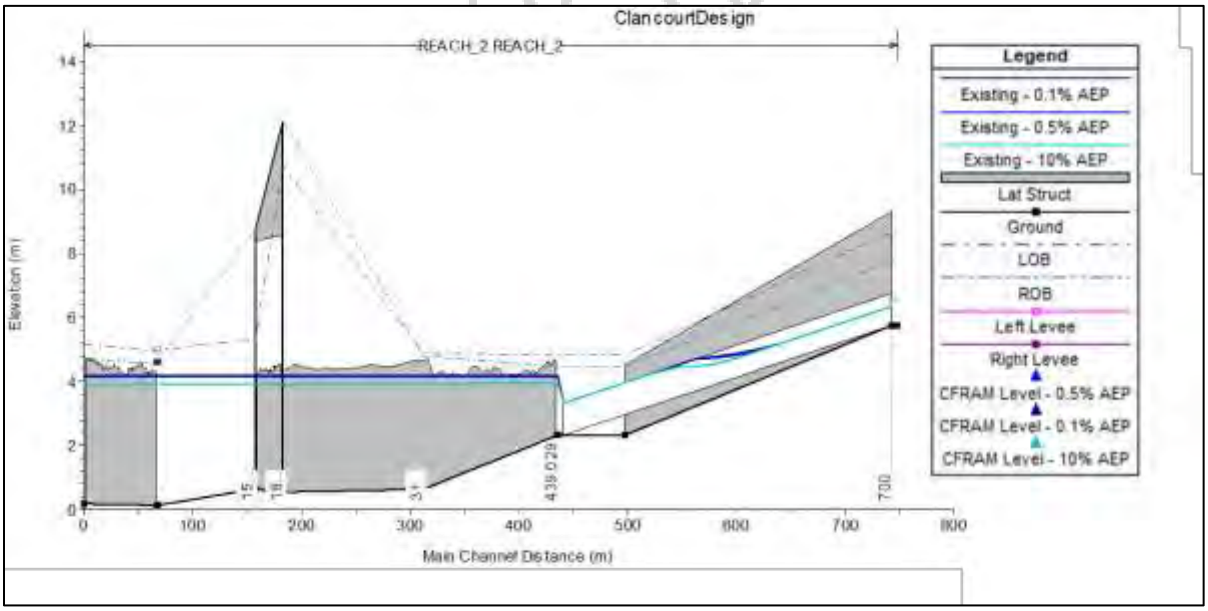


Figure 51: Tidal events - Site-Specific Model vs CFRAM WL - Long Section Reach 1-3

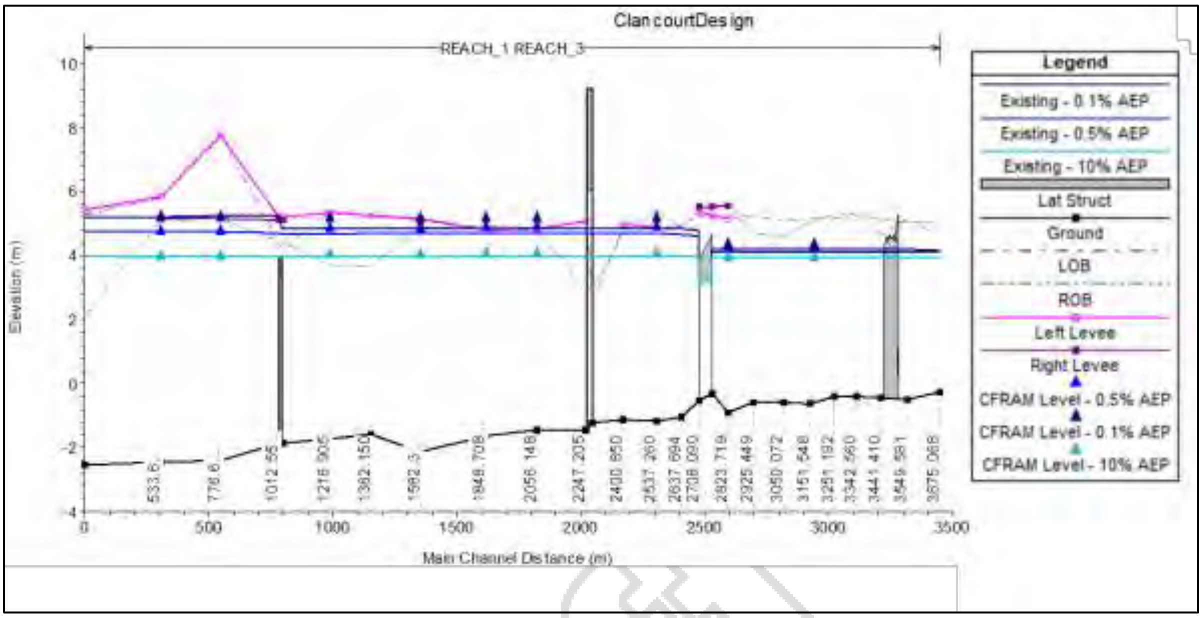


Table 26 shows the comparison of these observed water levels between the site-specific model and those given in the Shannon CFRAM Study. The points closest to the site (highlighted below) produced an average percentage difference of 1.92% when compared to those estimated in the Shannon CFRAM Study.

The site-specific model provides a greater level of accuracy and detail, given the higher level of accuracy of topographical survey data that has been acquired as part of this study. However, overall a very good match to the CFRAM study was achieved.

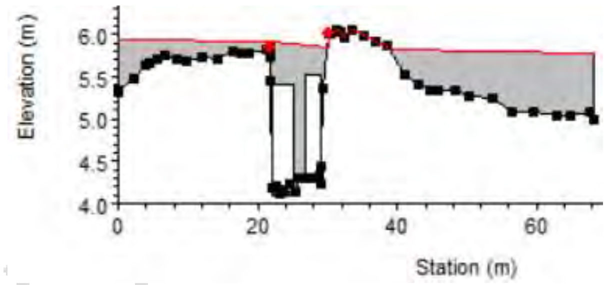
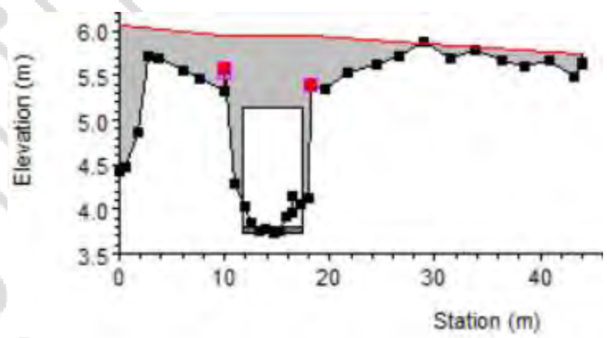
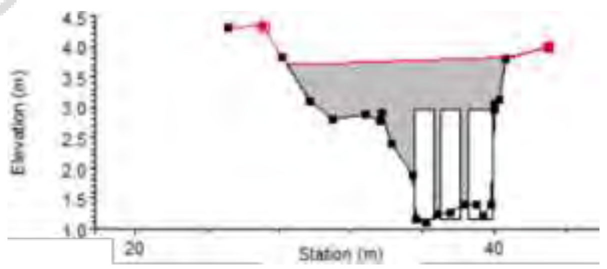
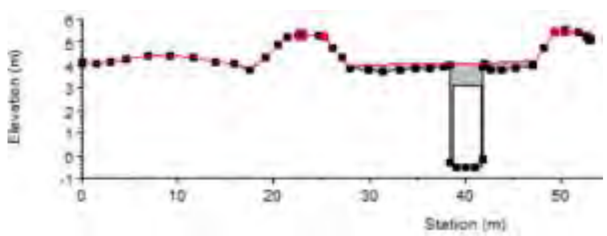
Table 26: Water level comparison between Shannon CFRAM and Site-Specific Model

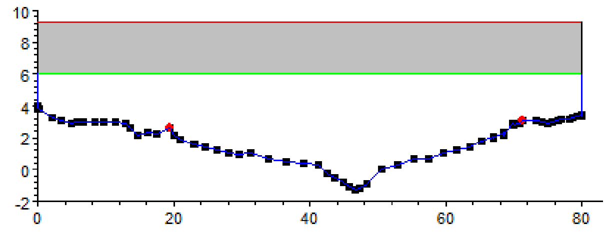
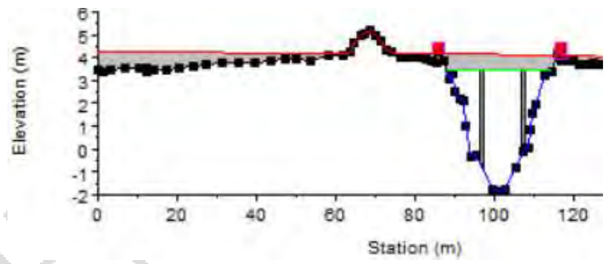
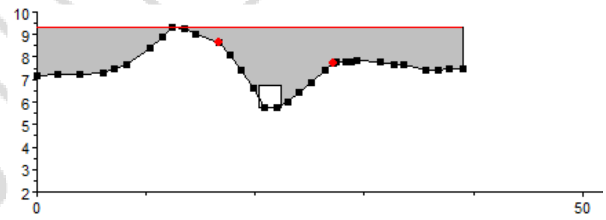
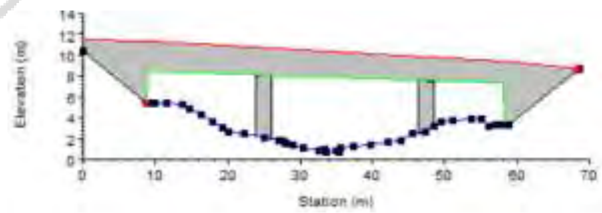
Location	**Water Levels (mOD)**								
Main Channel Distance (m)	10% AEP			0.5% AEP			0.1% AEP		
	Site Specific Model	CFRAM	% Diff.	Site Specific Model	CFRAM	% Diff.	Site Specific Model	CFRAM	% Diff.
Reach 1-1									
156.26	3.93	3.95	0.51	4.15	4.23	1.89	4.19	4.28	2.10
548.06	4.81	4.64	3.66	4.82	4.64	3.88	4.81	4.64	3.66
Reach 1-3									
303.6	3.97	3.97	0.00	4.87	4.74	2.74	5.23	5.22	0.19
546.58	3.97	3.99	0.50	4.87	4.74	2.74	5.24	5.22	0.38
986.88	3.97	4.02	1.24	4.74	4.85	2.27	4.84	5.16	6.20
1352.33	3.97	4.04	1.73	4.74	4.86	2.47	4.84	5.16	6.20
1618.69	3.97	4.06	2.22	4.74	4.87	2.67	4.84	5.15	6.02
1826.13	3.97	4.07	2.46	4.74	4.87	2.67	4.84	5.16	6.20
2307.24	3.98	4.07	2.21	4.74	4.87	2.67	4.85	5.15	5.83
2593.69	3.93	3.93	0.00	4.16	4.27	2.58	4.2	4.36	3.67
2941.17	3.93	3.94	0.25	4.16	4.25	2.12	4.2	4.33	3.00

Appendix F

Details of Hydraulic Structures

F Summary of Hydraulics Structures

River Station	Type	Approx. Opening Dimensions (m)	Width (m)	Cross Section
• River: Ballinacurra Creek; Reach: Reach 1				
4315	Culvert	2 x Box Culvert B x h = 3.2 x 1.3 B x h = 2.2 x 1.2	9.8	
4200	Culvert	Box Culvert B x h = 3.2 x 1.3	9.3	
3965	Culvert	3 x Box Culvert B x h = 1.1 x 1.8 B x h = 1.1 x 1.8 B x h = 1.2 x 1.8	12.5	
• River: Ballinacurra Creek; Reach: Reach 3				
2720	Culvert	Box Culvert B x h = 3.2 x 1.3	51.3	

River Station	Type	Approx. Opening Dimensions (m)	Width (m)	Cross Section
2250	Bridge	Clear opening, no piers	23.4	
1025	Bridge	2 x Piers Pier width = 0.9 Pier width = 0.9	13	
• River: Ballysheedy; Reach: Reach 2				
700	Culvert	Box Culvert B x h = 2.1 x 1.0	300	
180	Bridge	4 x Piers Pier width = 5.0 Pier width = 2.2 Pier width = 2.2 Pier width = 2.0	25	

Appendix G

Justification Test by John Spain and Associates

Technical Note

ARUP

One Albert Quay
Cork
T12 X8N6
Ireland
www.arup.com

t +353 21 422 3200

Project title	Clancourt, Dooradoyle	Job number	262009
cc	Conor Kenny	File reference	
Prepared by	John O'Connor	Date	5 October 2020
Subject	Geotechnical assessment of existing flood defence embankments at Dooradoyle		

1 Introduction

This technical note presents a preliminary geotechnical assessment of a site at Dooradoyle, Limerick, which was undertaken with the following objectives:

- Review the extent of existing geotechnical investigation (GI) data available for the site;
- Preliminary interpretation of ground conditions at the site;
- Consider the geotechnical issues relevant to the flood defence embankments at the site;
- Comment on the feasibility of upgrading the existing embankments in order to provide a robust flood defence.

The assessment has been undertaken based on a desk-study review of the available geotechnical information, together with relevant published material (geological mapping, aerial imagery, historic mapping). The location of the site is shown in Figure 1.

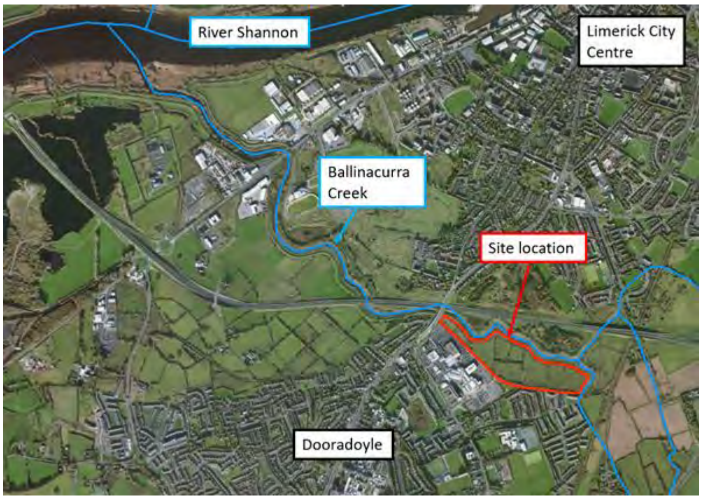


Figure 1: Site location, Google Maps (2020)

2 Ground Investigations

A number of ground investigations have previously been undertaken at the site. These are summarised in Table 1 and their locations shown in Figure 2.

Table 1: Available ground investigations

Title/Project	Contractor	Year	Scope
Report on a site investigation at Crescent Shopping Centre Limerick. Report No. 7978	IGSL	2002	7 No. cable percussion boreholes to a maximum depth of 10m and associated classification testing.
Proposed Gas Pipeline Mungret to Inchmore. Report No: 15289	IGSL	2012	6 No. trial pits 6 No. Cable percussion holes 2 No. rotary follow on to 15m 7 No. window samples to a maximum depth of 5m 10 No. Dynamic Probes to a maximum depth of 5.6m Associated classification, reusability and shear strength testing.
Limerick Southern Ring Road Phase II Site Investigation	Geotech	TBC	Partial data available, full report to be sourced. Included for completeness only, review and conclusions are based on 2002 and 2012 investigations.

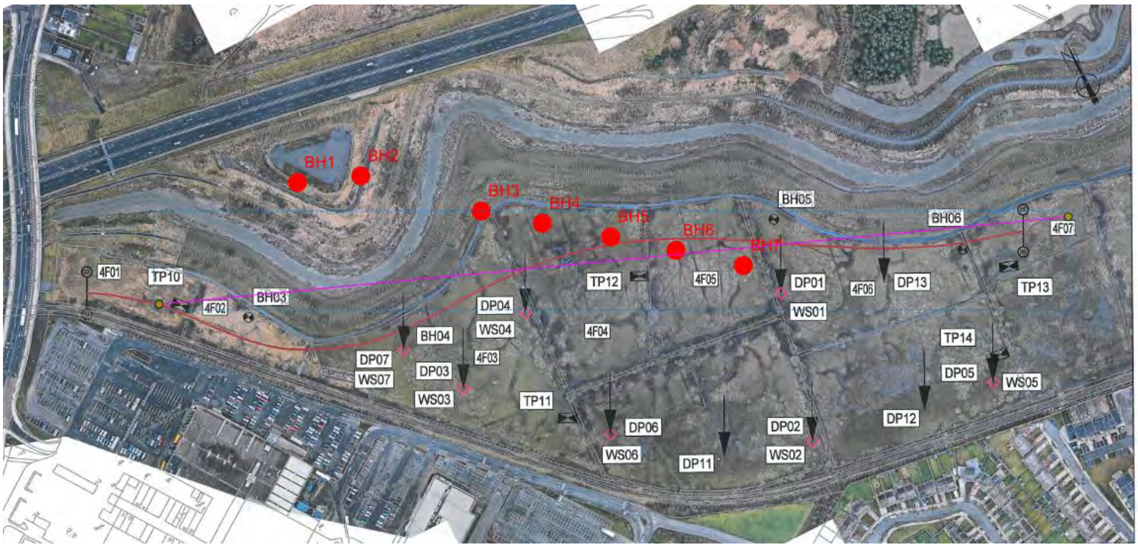


Figure 2: Overlay of approximate 2002 (red) and 2012 (white) exploratory location plan

The GI undertaken in 2002 and 2012 is considered adequate to undertake a geotechnical interpretation to inform a geotechnical assessment of the embankments. It provides a sufficient geographical spread of locations to establish ground conditions across the site. The nature of the field investigations and the associated laboratory testing are also appropriate for this purpose. The spacings of the GI locations is aligned with the recommendations of *EN 1997-2 Geotechnical design – ground investigations and testing*.

Further targeted ground investigations may be required at design stage in order to provide additional information for detailed design of future upgrades to the existing embankments or design of new flood defence measures, however the available information is sufficient for assessment of the feasibility of upgrading the existing embankments.

3 Ground Conditions

The investigation data shows ground conditions at the site to compromise topsoil, overlying up to 5m of very soft silts, clays and peats which is underlain by a firm to stiff grey-brown gravelly clay and medium dense to very dense gravel. This is then underlain by strong to very strong Limestone bedrock. Where encountered, rock was at 5m below ground level. These ground conditions are broadly consistent across the site.

Made ground was identified to a depth of 1.9m in TP10 (at the western extent of the site) in the 2012 investigation. Made ground associated with the backfilling of the gas pipeline and its associated haulage routes may be present on the site. Additionally, there may be remnants of historic flood defences on the wet side of the existing embankment based on the topography and historic mapping.

The 2002 and 2012 investigations are consistent in the ground conditions encountered. They are also aligned with the Geological Survey Ireland classification of the site.

4 Geotechnical Design Considerations

A range of issues will need to be considered in the design of either upgrades to the existing embankments, or construction of new embankments. Among the most critical issues will be:

- Stability;
- Settlement;
- Seepage.

These are discussed below.

4.1 Stability

Stability is a key issue in the design of embankments over soft soils, which are present at this site. Potential failure mechanisms include basal failure through the soft layers beneath the embankment, and slip surfaces through the embankment fill material.

For basal failures, undrained conditions are typically critical, with these being experienced during or shortly after construction, after which the factor of safety against instability tends to increase. Therefore, this is not considered a risk for the existing embankments in their current condition, given that they have been in place for a considerable period of time. If additional material is placed to raise the level of the embankments as part of upgrade works, this will impose additional loads, and stability against basal failures will need to be assessed. However, given the likely heights of additional fill, the risk of instability is likely to be low – as the soft soils beneath the existing embankment have consolidated over time, the relatively small applied load from additional fill is unlikely to result in failure.

Similar principles apply to new embankments, but the applied load would be considerably greater, as the full height of embankment would need to be taken into account when analysing undrained failures through the soft soils. The risk of this failure mechanism would therefore be higher compared to that for upgrade of the existing embankments.

For failures within the embankment slopes, appropriate slope angles will need to be determined to ensure stability. These will depend on the properties of the embankment material. While information on the material properties of the fill within the existing embankments is not available, it should be noted that the existing embankment slopes appear to be in line with typical slope angles for flood defence schemes. In the event of slopes being over-steep or stability issues being identified, solutions could consist of regrading of slopes, or construction of support berms.

4.2 Settlement

Settlement of embankments will require consideration in the design, given the soft soils at the site. This will apply both to the existing embankments if levels are raised, and to new embankments. However, settlements of new embankments can be expected to be greater than those due to raising of the existing embankment levels.

Given that the existing embankments have been in place for a considerable period of time, the underlying soils will have undergone consolidation, with settlement occurring at a decreasing rate over time. Hence settlement due to the loads from the existing fill material would be effectively complete (if embankments have been ‘topped up’ in recent years, some settlement may be ongoing, but this too would decease over time). Placement of fill material to raise the embankment height will impose an additional load, which will induce settlement. Given the likely fill heights however, this could be addressed by a number of design solutions, such as:

- Surcharging – temporary placement of additional fill to accelerate consolidation, thereby minimising post-construction settlement;
- Over-filling – constructing embankments to a higher level, to ensure future settlement does not compromise the design flood level.

For a new embankment, settlements would be significantly greater than for the upgrade of the existing embankments, as the soft soils would consolidate under the load from the entire embankment. While the above solutions would also apply in principle to a new embankment construction, ground improvement may be required or conjunction, or a longer period would need to be allowed for settlements to reduce to acceptable levels.

Note that given the thicknesses of the soft layers are relatively consistent across the site, locating a new embankment further from the river would not provide an advantage in terms of mitigating settlements.

4.3 Seepage

As the site is generally by layers of silts and clays, which are likely to have a low permeability, given the relatively short tidal flood events and the width of the embankments, the risk of seepage below the embankment is considered low. As ground conditions are consistent across the site, relocating the embankments further from the river would not provide a benefit in terms of seepage.

Seepage through the embankments would also need to be considered, but again, given the relatively short flood events, is not considered to present a significant risk. While the constituents of the existing embankments are not fully known, given that they have provided a flood defence function in the past, it is likely that they contain some low permeability material. If seepage through the embankment was determined to be an issue, this could be addressed as part of the upgrade works, by incorporating low-permeability fill into the embankment shoulders.

5 Conclusions

Based on a review of the available information, the following preliminary conclusions can be drawn:

- The existing geotechnical investigation data is adequate to assess the ground conditions of the in situ soils at the site for the purposes of geotechnical assessment of the embankments.
- Upgrading of the existing embankments in order to provide a robust flood defence is considered feasible in terms of the geotechnical aspects.
- Geotechnical issues at the site will include stability, settlement, and seepage. These can be addressed as part of a solution involving upgrade of the existing embankments.
- These issues will also be relevant for construction of new embankments. However, new embankments would present disadvantages in terms of stability and settlement, compared to upgrade of existing embankments.
- Construction costs of new embankments would be greater than those for upgrade of the existing embankments.

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	John O'Connor	Ken Leahy	Ken Leahy
Signature			

File Note

ARUP

50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

t +353 1 233 4455
f +353 1 668 3169

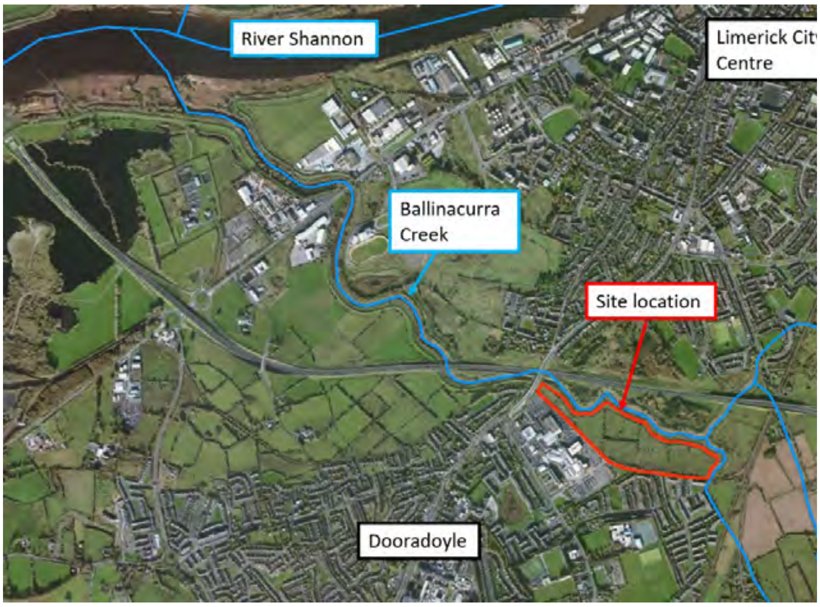
Project title	Dooradoyle Portland Urban Quarter	Job number	262009
cc		File reference	
Prepared by	Daniel Walsh	Date	2 October 2020
Subject	Downstream Breach Strategic Flood Risk Assessment		

1 Introduction

In response to concerns raised by LCCC in discussions regarding residual flood risk at the subject site, Arup has been commissioned by Clancourt Group to assess the risk of flooding to the subject site adjoining the Crescent Shopping Centre in Dooradoyle, Co. Limerick, from a downstream embankment breach. This file note sets out the methodology and findings of this assessment.

The subject lands, shown in Figure 1, are located in an underutilised area between the existing developed lands in Dooradoyle and the City Centre. The development of these lands is seen as critical in creating a stronger and sustainable linkage of the two areas.

Figure 1: Subject site location



The lands are already protected to a high standard by existing OPW embankments.

These embankment continue downstream of the site along the Ballinacurra Creek, which in turn join into embankments along the River Shannon.

Flood risk to the site has been analysed in detail in a separate Flood Risk Assessment report. The aim of this file note is to assess the vulnerability of the subject site to tidal flooding from an embankment breach downstream along the Ballinacurra Creek or River Shannon.

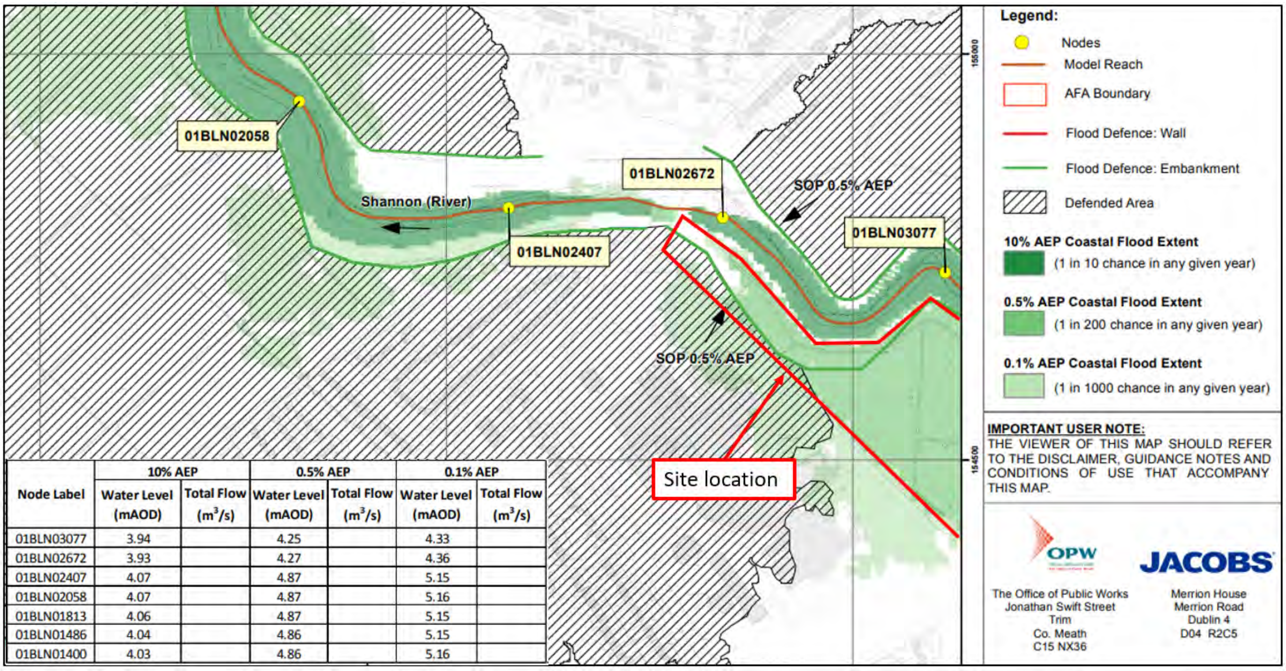
2 Assessment of Present-Day Risk

The following methodology has been undertaken to assess whether there is a flow path to the subject site in the unlikely event that a breach occurs downstream of the site:

1. Establish the relevant extreme tidal levels
2. Review existing intermediate topography to establish potential flow paths
3. Consider potential intermediate storage volumes and thresholds at which a breach could result in flood waters reaching the site.

Figure 2 below shows an extract from the Catchment Flood Risk Assessment and Management (CFRAM) study tidal flood extent map directly west of the site. The 0.5% Annual Exceedance Probability (AEP) tidal level is 4.87mOD at node 01BLN02407 just downstream of the R526 road and the subject site. This return period is the normal standard for flood relief design. It is noted that this level of 4.87mOD is higher than further upstream on the Ballinacurra Creek as the tidal flow is throttled by a culvert under the R526, resulting in lower water levels upstream immediately adjacent to the subject site where the equivalent 0.5% AEP flood level is 4.27mOD. Therefore, to assess the risk of downstream breach, it is appropriate to consider the higher level of 4.87mOD which dominates the downstream reach and could be a source to potential flow paths to the site from a downstream breach.

Figure 2: Extract from CFRAM Coastal Flood Extent Map (Map no. S2526LIK_EXCCD_F1_31)

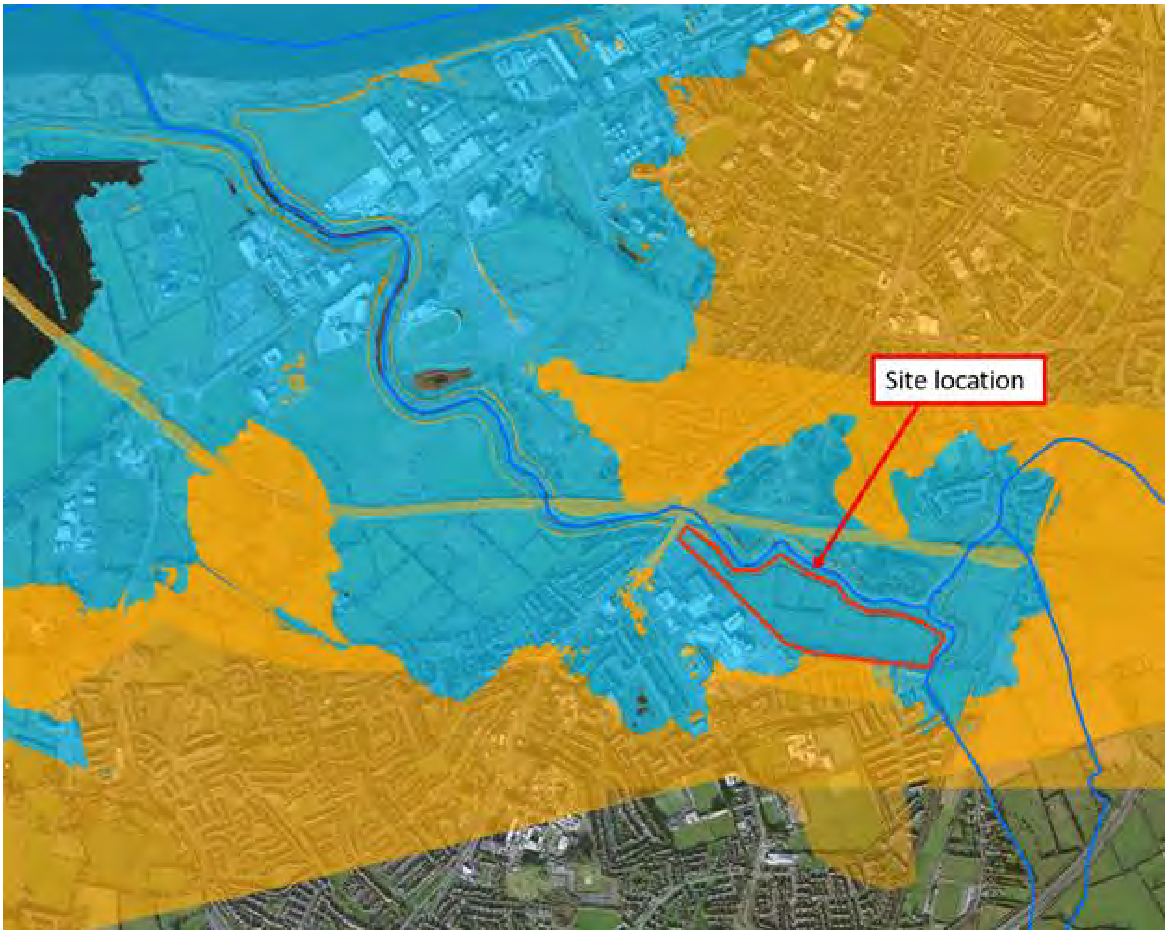


Node Label	10% AEP		0.5% AEP		0.1% AEP	
	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)	Water Level (mAOD)	Total Flow (m^3/s)
01BLN03077	3.94		4.25		4.33	
01BLN02672	3.93		4.27		4.36	
01BLN02407	4.07		4.87		5.15	
01BLN02058	4.07		4.87		5.16	
01BLN01813	4.06		4.87		5.15	
01BLN01486	4.04		4.86		5.15	
01BLN01400	4.03		4.86		5.16	

In order to assess potential flow paths to the subject site, the 0.5% AEP tidal level was projected onto topographic data. Publicly available Lidar data from the OPW and TII was obtained for this purpose.

Figure 3 below shows this Lidar data overlaying satellite imagery in the vicinity of the site. The symbology of the Lidar data has been edited so that any land below the 0.5% AEP (200-year return period) tidal level presents as blue, and any land above that level is identified in orange.

Figure 3: 0.5% AEP Tidal Flood Level topographic projection



As can be seen, naturally high ground to the south and east, together with the elevated N18 to the north act as barriers to overland flow and means that potential flow paths to site are limited to the western fringes only. Furthermore, any potential flow path from the Shannon to the southwest is prevented by higher ground further west.

Therefore, the only potential flow path from the west is limited to the scenario of a breach of the short section of the Ballinacurra Creek where it is south of the N18 and west of the R536. This is approximate 480m in length.

This stretch of embankment is highlighted pink in Figure 4 which provides a zoomed in view of this critical area to the west of the subject site.

File Note

262009 2 October 2020

Figure 4: Topography west of subject site

In this figure, the same Lidar data is shown graduated to demonstrated ground levels ranging from 1mOD to the 0.5% AEP tidal level of 4.87mOD. The higher N18 carriageway is highlighted in grey for emphasis.

Figure 4 shows that the topography here rises in the direction of the subject site. Therefore, if a breach were to occur, flood water would first flow westward to the lower lying fields. In order for flood water to reach the subject site, these fields would have to first fill to a depth of 2m before spilling into the site. Therefore, an embankment breach would have to occur in conjunction with a very extreme flood in order to generate sufficient volume and head for flood waters to reach the site, during the peak of the tidal cycle.

More detailed inspection of the Lidar data shows that there are only two locations were this could potentially occur; these are labelled Location A and B in Figure 4.

At Location A, the lowest level is 3.95mOD. The 10% AEP (10-year return period) CFRAMS tide level here is 4.07mOD. A level of 3.95mOD is interpolated to equate roughly to a 20% AEP (5-year return period) event. This means that flood flow could only beginning to reach the subject site if a breach coincided with the peak of at least a 5 year event. As this flow route is immediately adjacent to the subject site, some very minor regrading at the western boundary of the site would eliminate this flow path and would logically be done as part of any upgrade works to the embankment in this area.

This leaves Location B as the only other flow path to the subject site, which cannot be addressed through works on the subject site. The lowest level here through the Crescent Shopping Centre is 4.45mOD, which equates approximately to a 2% AEP (50-year return period) event. Therefore, for this mechanism to occur, a breach would need to occur with a tidal event sufficiently greater than a 1 in 50 year event to fill up all of the lower lying lands to the west.

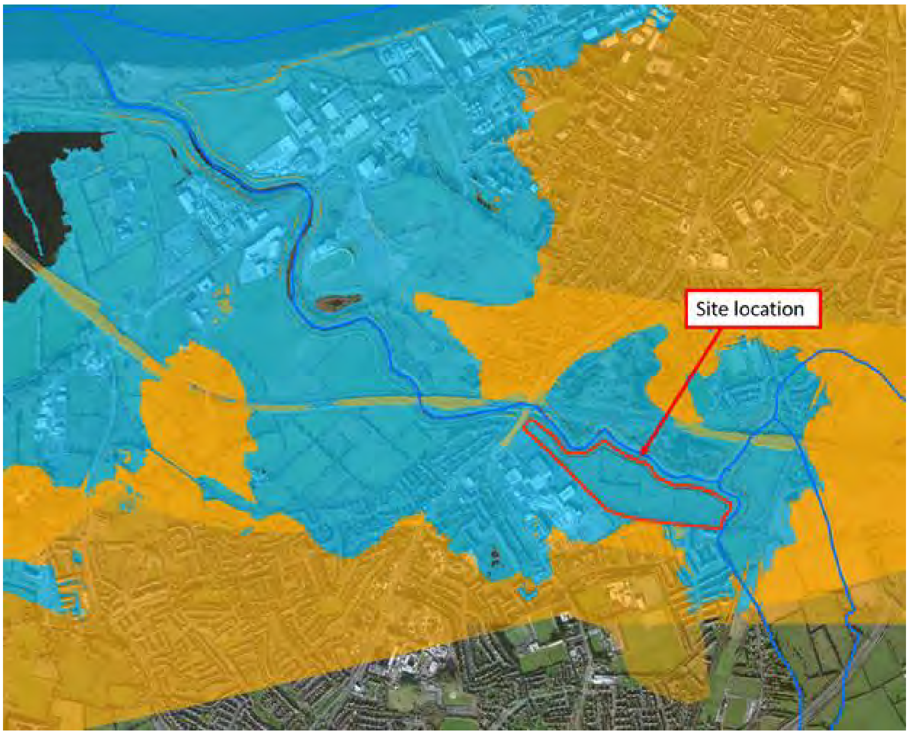
In summary, downstream breach risk to the site is limited to one 480m length of embankment and even then only in the most extreme and infrequent events. The downstream breach flood risk to the site is determined to very remote.

Whilst detailed breach analysis could be undertaken to further quantify such risk, this is not considered warranted at this stage given that evidence presented above is persuasive in demonstrating the remoteness of the risk.

3 Consideration of Climate Change Scenarios

In a future Climate Change scenario, the OPW recommends a 500mm sea level rise for the Mid-Range Future Scenario (MRFS). Figure 5 shows the Lidar data edited so that any land below the 0.5% AEP MRFS tidal level of 5.37mOD again presents as blue, and any land above that level presented as orange. It is evident that the only flow paths to the site from a downstream breach in this event are the same as those identified earlier, at the western boundary of the site. The only change is that a very short length of the N18 is below the MRFS, meaning that in the most extreme future events, a breach further downstream could weir over the N18. However, in this future scenario, so much property immediately adjacent to the Shannon would be at risk that either the existing embankments would need to be significantly raised upgraded (and thus reducing the breach risk) or a tidal barrier in the estuary would be needed. This scenario is sufficiently far in the future that it should not unduly influence any decision making at present.

Figure 5: 200yr MRFS Tidal Flood Level topographic projection



4 Conclusion

Using publicly available topographic data and information from the CFRAM study, it was possible to undertake a preliminary assessment of the risk to the site from a downstream breach in the flood defence embankments.

The downstream breach risk to the site is limited to one 480m length of embankment. If such a breach were to occur, the site is only susceptible to flooding in the most extreme and infrequent events, and even then, a number of low-lying fields to the west would first need to fill to a depth of over 2m before water could flow to the site. This is extremely unlikely. A small amount of regrading at the western boundary of the site would eliminate one of only two such overland flow paths. The other would require a tidal event in excess of a 50-year return period before water could enter the site.

Taking this all into account, the risk to the site from a downstream breach is very remote and does not warrant further detailed breach modelling.

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Daniel Walsh	Ken Leahy	Ken Leahy
Signature			

hw planning

Submission to Draft Limerick Development Plan 2022 - 2028

Provision for Enterprise & Employment Expansion to Accommodate Future Strategic Growth Opportunities

Client IDA Ireland

September 2021

Connecting people.
Connecting places.

Contents

01 Introduction

01.1 Submission Purpose

This submission has been prepared on behalf of IDA Ireland. It has been prepared in response to Limerick City and County Council's invitation for submissions to the Draft Limerick Development Plan 2022 -2028 (Draft DP). This submission is in response to the Council's draft employment policies and zoning objectives for the Limerick City and Environs area which will form part of the Limerick Development Plan 2022-2028.

Our client is currently actively seeking a new employment node for greenfield manufacturing FDI in the Limerick region arising from the fact that the established locations of Raheen Business Park and the National Technology Park (NTP), Castletroy have limited remaining capacity and potential to support new greenfield manufacturing. While this is acknowledged in Section 4.7.2 of the Draft DP and additional adjoining lands have been zoned for employment, our client has reviewed these and conclude that they are not suitable for their requirement for a campus style strategic employment hub based on a combination of constraints including size, flood risk, archaeological sites and extensive residential ribbon development as discussed in detail in Section 3.2 of this submission. While these lands may provide some opportunities for small to mid-scale projects, they will not address the longer-term strategic need for a significant landbank for larger scale manufacturing FDI of the type and scale required to provide sustainable and high value employment to underpin Limerick's projected future population growth as set out in the National Planning Framework (NPF) and Southern Regional Spatial and Economic Strategy (RSES).

Given this, IDA Ireland request that the Council acknowledges this strategic requirement in the employment policies and objectives of the Limerick Development Plan 2022-2028 by zoning lands of appropriate scale to cater for the future development of a new strategic employment location to meet the needs of the mid-west region. From their review IDA Ireland considers the strategic employment locations should be proximate to existing employment clusters, facilitate compact growth and sustainable travel and should be of a scale to support high tech manufacturing.

01.2 Submission Context

IDA Ireland previously made a submission to the Stage 1 Development Review highlighting the shortage of suitable employment zoned lands to meet their requirements. Our client welcomes the publication of the Draft DP and consider it represents a critical juncture in the future growth of Limerick City and Environs and would like to once again draw the Council's attention to this issue. The policy context for the area has evolved significantly since the merging of Limerick City and County in 2014, with the NPF targeting population growth for Limerick City and Suburbs of between 47,000 and 56,000 in the period to 2040 and the RSES identifying the Limerick City Metropolitan Area as a priority growth area and setting out to support growth of at least 50% for by 2040 to enable it to achieve its potential to become a city of scale. The Draft DP acknowledges that this future growth is dependent on a range of factors, central amongst which are indigenous enterprise, foreign direct investment and innovation.

IDA Ireland is the state agency with responsibility for winning Foreign Direct Investment (FDI) for Ireland. These investments cover a broad spectrum of activities including manufacturing, research development & innovation (RD &I). This is in addition to business services and results in significant capital investment and employment creation by multinational client companies in Ireland.

In 2019 IDA client company expenditure in the Irish economy included €15.1 bn on payroll, €7.4 bn on services, €2.7 bn on materials and €7.4 bn on capital investment. IDA's strategic focus is to maximise the impact of FDI across Ireland's economy and society. Having regard to this they propose to target 76 investments for the Mid-West region[1] in the period 2021 to 2024[2]. A number of factors are crucial in continuing to attract and grow this type of FDI, with access to suitable and cost-effective property solutions and a supportive business environment with associated infrastructure, being principal considerations. Based on the above the IDA plans to acquire additional strategic sites for future development in order to ensure a robust value proposition for clients.

The strategic location of Limerick at a mid-point on the Atlantic Economic Corridor and its gateway position to the south-west as well as its connections to Dublin, underpin its potential to attract a significant quantum of employment. Over the past decade, employment growth in the Limerick City region has been significantly underpinned by major FDI investments in the Lifesciences and large-scale manufacturing sectors. Limerick city is now recognised as a global cluster location of choice for advanced manufacturing including both Lifesciences and semiconductor manufacturing. Multinationals such Analog Devices, Johnson and Johnson Visioncare Ireland, Edwards Lifesciences Ireland, Cook Medical, Stryker Corporation and Regeneron Pharmaceuticals, employ in excess of 5,000 in the city region.

It is clear that, to achieve the NPF targets for population growth, Limerick's future employment profile will rely heavily on its ability to capitalise on the success of the established cluster of Lifesciences and related manufacturing sectors and attract new greenfield manufacturing investment. Fundamental to achieving this will be the availability of sufficient zoned, serviced and accessible land in strategic locations that will ultimately provide a compelling location option for multinationals in the mobile FDI marketplace. The availability of land zoned for industrial and enterprise development in advance of demand is a key element of IDA's strategy to attract foreign direct investment to Ireland and to facilitate employment growth in Limerick and the Mid-West region commensurate with projected population increase. The development of identified lands can then be plan-led over a medium-term horizon in collaboration with national agencies and local planning authorities.

IDA Ireland have reviewed the Draft DP in the context of availability of suitable lands in the Limerick Metropolitan Area to address this requirement, in recognition of the fact that the established locations of Raheen Business Park and the National Technology Park (NTP), Castletroy have limited remaining capacity and potential to support new greenfield

[1] Including Limerick, Tipperary and Clare

[2] IDA 2021 Strategy, "Driving Recovery and Sustainable Growth 2021-2024"

manufacturing. We consider that the proposals in the Draft DP with the zoning of adjoining lands at these locations does not meet this strategic greenfield requirement, Based on this, our client requests that the Council zones more appropriate lands to make provision for strategic employment growth opportunities at appropriate sites.

01.3 Submission Request

- *IDA Ireland requests the support of Council to facilitate and support the development of a new, appropriately scaled, Strategic Employment Location.*

02 Summary of Policy Context

Appendix 1 provides a detailed review of relevant national and regional policies, as well as economic and employment strategies which are summarised below.

The planning policy context in Limerick has been rapidly evolving in recent years since the merging of Limerick City and County in 2014, with the publication of the National Planning Framework in 2018 and the release of The Regional Spatial and Economic Strategy (RSES) for the Southern Region, the draft Limerick Shannon Metropolitan Area Strategic Plan (MASP) and the Draft Limerick Shannon Metropolitan Area Transport Strategy (LSMATS). The NPF set the scene for a rapid expansion of the City's population over the coming two decades with a target of population growth of between 47,000 and 56,000. The NPF notes the need for ambition in the Limerick Metropolitan Area:

> *"This requires growing and diversifying the City's employment base and attracting more people to live in the City, both within the City Centre and in new, accessible green-field development areas".*

The RSES has further expanded on these growth objectives and outlines guiding principles in terms of strategic employment growth. MASP Objective 12 specifically refers to the sustainable development of specifically IDA initiatives such as the subject proposal in which it states that:

> *"It is an objective to seek investment in the sustainable development of initiatives of IDA Ireland and Enterprise Ireland in strengthening enterprise assets, fostering competitive locations and conditions for enterprise growth in the Limerick Shannon Metropolitan Area".*

A number of common themes have emerged among all policies namely:

- The need to ensure that there is a strong coordination between land use and transport planning, with significant job locations being located in proximity to public transport with provision for cycling and walking connectivity from existing residential areas.
- Ensuring that identified locations for strategic employment are infrastructure-led.
- That traditional models of delivering employment lands need to be revisited with an approach that is orientated towards placemaking and meeting the needs of the modern workforce.
- Areas for growth and smart specialization should be further explored, as well as the potential to partner with existing third level and healthcare institutions to achieve synergies.
- Encouraging the growth of clusters and co-location of Small and Medium size Enterprises (SMEs) with Multi National Corporations (MNCs) to enhance mutual benefits to both.

In its new strategy '*Driving Recovery and Sustainable Growth 2021 – 2024*', IDA Ireland sets out its plans to acquire additional strategic sites for future development in the Mid-West region, with an overall target of attracting 76 investments for the region.

03 Key Planning Considerations

03.1 IDA Ireland Strategic Site Requirements

IDA Ireland have been looking for some time to acquire a site to develop a new campus for the high-tech industrial sectors. Site selection criteria would focus on the availability of utilities such as electricity capacity, gas and broadband and transport infrastructure in terms of proximity to a Bus Connects high frequency route, park and ride facility, served by cycle and pedestrian infrastructure or benefitting from a rail link as indicated in the LSMATS to support a modal shift away from the increasingly car-based commuting pattern. The current IDA client organisations tend to be technology or Lifesciences based with relatively low levels of associated transport of goods. Most IDA client organisations develop mobility management plans with their employees and welcome the opportunity to encourage their staff to adopt sustainable travel modes.

Proximity to other strategic employment locations is also of key importance ie Raheen Business Park, the National Technology Park, Ballysimon Industrial Estate or Annacotty Industrial Estate and accessibility to the University of Limerick (UL). This contributes towards the attractiveness of the site as a potential new growth area in an employment cluster, that can benefit from the associated synergies, knowledge diffusion and capacity building between the various elements.

In addition to physical infrastructure the scale of the available landholding is a key consideration. The requisite size of the new campus is a function of the scale of land required by the prospective FDI clients that IDA Ireland are targeting. In general, these are projects of scale requiring extensive land areas. Accordingly, the current IDA requirement is for the identification of one or more landbanks, in the range of 50 to 100 hectares, capable of hosting a cluster of compatible large-scale industries of international scale in a low-density campus setting.

03.2 Existing and Proposed Employment Provision

03.2.1 EXISTING PROVISION

The RSES states in Table 3 that there is 71 hectares of capacity in the National Technological Park (NTP), 57.5 hectare of capacity in Raheen Business Park and c. 54.6 hectares of capacity in Ballysimon. On closer review we consider that there is more limited capacity remaining in the NTP to attract, host and sustain large scale industrial development investment [3], this is exacerbated by the Draft DP proposal to dezone 35 hectares of land in NTP due to flood risk and attenuation concerns in the southern section of the site (ref Econ 013). Furthermore, as outlined below there are limited remaining unreserved lands at Raheen Business Park and Ballysimon.

[3] The IDA also note that some of limited remaining NTP lands are prone to flooding and require mitigation works

In relation to Ballysimon, while the RSES considers 54.6 hectares of lands are available, significant lands have been subsequently dezoned due to flood risk. IDA Irelands review of the Draft DP concludes that of the existing zoned lands only c. 16 hectares remain in an unfragmented area, outside a flood zone, suitable for development as a strategic site. In addition we note that this is predominantly in the ownership of Irish Water who have been granted permission for the development of a National Laboratory on these lands, which represents phase 1 of their masterplan for the development of the site (planning ref 19/514). The lack of zoned capacity is underlined in the Castletroy Local Area Plan noted in 2019 that '*it is highly likely that there will be a significant pressure in this area for large-scale employment and residential growth during the lifetime of the new plan*'.

03.2.2 PROPOSED PROVISION - OVERVIEW:

While Figure 3.1 indicates that there is a range of areas zoned for employment use across 38 land parcels in the Draft DP, the vast majority of these are small, fragmented sites with only 4 sites with an area of 30 hectares or greater, of a scale that when aggregated could be able to meet the IDA Ireland size criteria of between 50 to 100 hectares. Two smaller sites in Ballysimon, comprising 16 hectares and 24 hectares have been added to this list as they are over 30 hectares when viewed in combination. These sites over 30 hectares in area are identified with a yellow circle in Figure 03.1 and listed in Table 03.1. They are located in lands to the west of Raheen Business Park (no. 35, 36 and 38), to the south of Dock Road (no. 20) and in Ballysimon (no. 13, 14) and are considered further below.

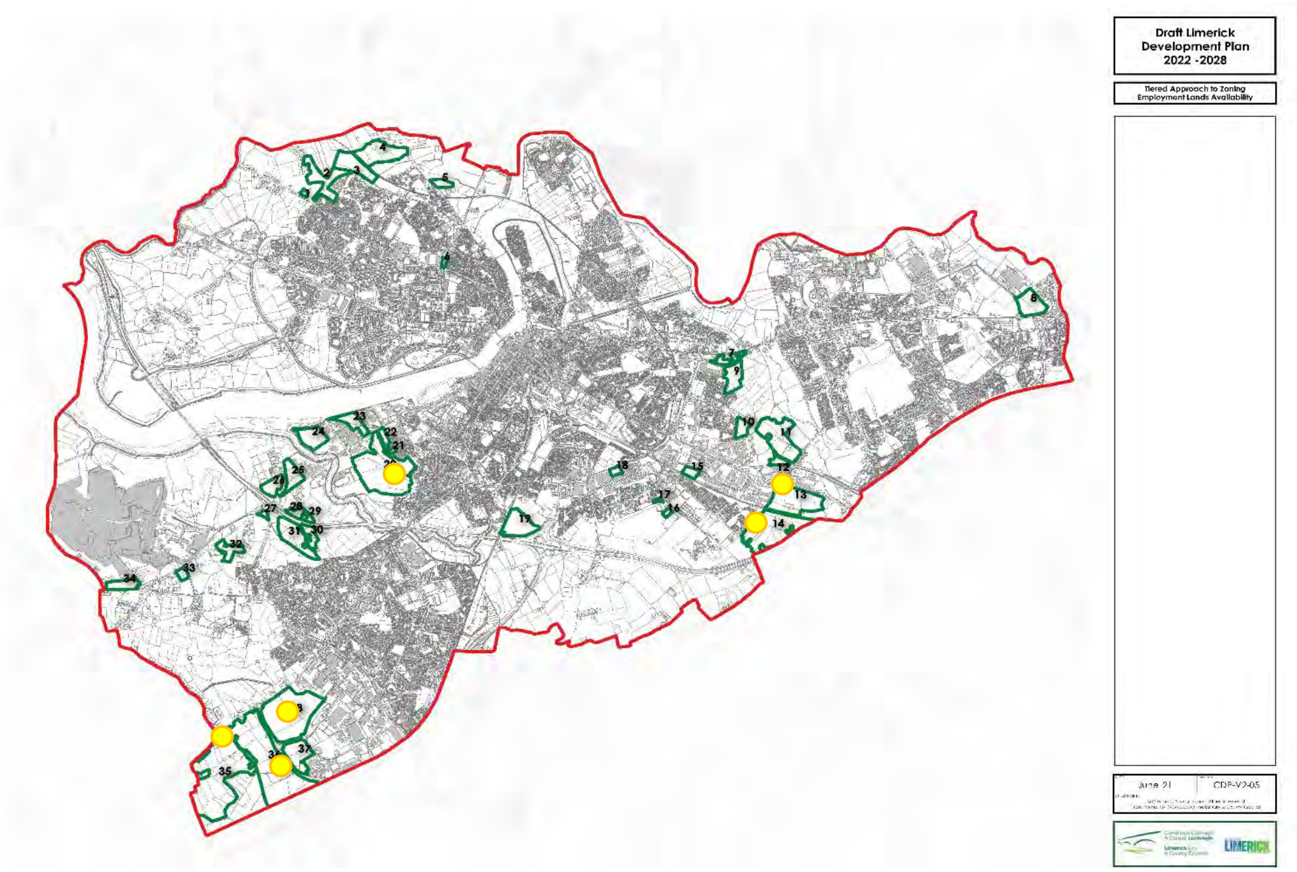


Figure 03.1 Draft DP Volume 2 Map 5 – Employment Land Zoning

Site No.	Zoning	Hectares	Comment	Location
13	Employment & Enterprise	16		Ballysimon
14	Employment & Enterprise	24	Extension of existing services required	Ballysimon
20	Employment & Enterprise	33.47	Objective for Site Specific Flood Risk Assessment	Dock Road
35	High Tech/ Manuf.	46.68	Extension of existing services required	West of Raheen Business Park
36	High Tech/ Manuf.	48.25	-Ancillary uses/ Attenuation areas in flood zone –Specific Objective for Flood Risk Assessment	West of Raheen Business Park
38	High Tech/ Manuf.	33.12		West of Raheen BP

Table 03.1 Larger Landparcels Identified for Potential Employment - Extract from Section 1.3.2 - Volume 2 Draft DP page 16

03.2.3 DOCK ROAD

The Dock Road land parcel (no. 20 in Figure 03.1), at 33.47 hectares falls below our client's 50 to 100 hectares requirement. Alongside this the suitability of the site is undermined by its location entirely within a Flood Zone A area, by the presence of a national monument site within the land and by the site being within 175m of the Lower River Shannon SAC.

Figure 03.2 Dock Road Enterprise and Employment Zoning

03.2.4 LANDS TO THE WEST OF RAHEEN BUSINESS PARK

The existing zoned greenfield lands to the west of the IDA Business Park are privately owned lands zoned for industry in the 2011 – 2017 South Environs Local Area Plan.

Figure 03.3 High tech and Manufacturing Campus Lands to the West of Raheen Business Park

The lands, identified by 36 in Figure 03.1, comprise an area of approximately 48 hectares. As part of IDA Ireland's review of the Draft DP they assessed the land available at this location. It is considered that as these lands are constrained by (i) flood risk (ii) archaeology/national monuments (iii) buffers required to established residential development, the estimated developable area is limited to about 15-20 hectares only, below the individual site area that IDA Ireland FDI clients generally seek.

Similarly, IDA Ireland have evaluated the proposed zoned lands in the vicinity of Raheen Business Park, identified by 35 in Figure 03.1, comprise an area of approximately 46 hectares in terms of viability to host new manufacturing FDI projects of the scale. Again, the local geography is constrained by flood risk, archaeology/national monuments and extensive residential ribbon development which precludes the identification of a viable landbank of sufficient size at this location.

03.2.5 BALLYSIMON

As noted in Section 3.2.1 above the existing 16 hectares (comprised of the 12 hectare and part of the 36 hectare parcel in Figure 03.4) of unfragmented zoned lands that are not within a flood zone (identified as 13 in Figure 03.1) are predominantly earmarked for development by Irish Water. The Draft DP proposes to zone an additional 24 hectares of lands for employment use (identified as 14 in Figure 03.1).

Figure 03.4 Ballysimon Enterprise and Employment Zoning

However, the development of these lands is also compromised by a number of factors including the permitted residential development for 52 no. housing units in adjacent land to the west. This in conjunction with the existing residential development to the south and east, a rail line to the north for which a buffer would be required and the national monument located within the site, in conjunction with its size limitation, all undermine the site's suitability for strategic employment development.

Based on our client's review they conclude there are no lands of a suitable scale zoned in the Draft DP that could support IDA Ireland's plans to acquire a 50 – 100 hectare site to develop a new campus for the high-tech industrial sectors.

03.2.6 ALTERNATIVE LOCATION

The Local Authority are asked to consider alternative locations with lands of a scale of 50-100 hectares to support a new campus for high tech industrial sectors that would support clustering and compact growth in proximity to existing employment hubs.

IDA would welcome the opportunity to work with TII and the Limerick City and County Council in preparing a more detailed Strategic Transport Assessment to address the specific development proposals, an approach that is recommended in the Spatial Planning and National Roads Guidelines for Planning Authorities.

OPR Criteria	Assessment
Regional Spatial and Economic Strategy	Section 19(2) of the Planning and Development Act 2000 (as amended) requires that a local area plan shall be consistent with any Regional Spatial and Economic Strategy (RSES) that applies to the area of the plan. As noted in Section 1.3.1 the RSES seeks to achieve sustained, resilient growth through inter alia the principles of clustering, knowledge diffusion and capacity building. The strategic employment location of Ballysimon offers the opportunity for cluster growth with the nearby existing Ballysimon strategic Employment areas, the NTP, and the University of Limerick (U.L.). Alongside this, it presents an opportunity to leverage knowledge diffusion and capacity building with U.L. Furthermore, the location is in line with the RSES guiding principles for Local Authorities in terms of identifying locations for strategic employment development based on the following: ▪ The location is in proximity to U.L. and the NTP – existing technology and innovation poles. ▪ It would allow the expansion of existing nearby enterprises located in the NTP (c. 3km) or Raheen Business Park (c. 5km) which are already at capacity or nearing capacity. ▪ It benefits from excellent infrastructure in the form of telecoms, electricity, gas and proximity to an international airport. ▪ It is adjacent to public transport and cycling routes and set to benefit from significant further investment in both (ref LSMATS). The Strategic Employment Location of Ballysimon is in line with the objectives of the MASP as it would adhere to the guiding principle to '*activate strategic employment locations to complement existing employment hubs in the city centre and near third level institutes*'. The sustainability of the location is in line with the MASP objectives 12 and 13 in relation to the sustainable development of IDA Ireland and Enterprise Ireland initiatives and strategic employment locations in general. Based on the above we consider that the proposal is consistent with the policy objectives of the RSES.
Transport & Accessibility	The strategic employment location is set to benefit from the proposed enhancements to sustainable transport in the draft LSMATS.

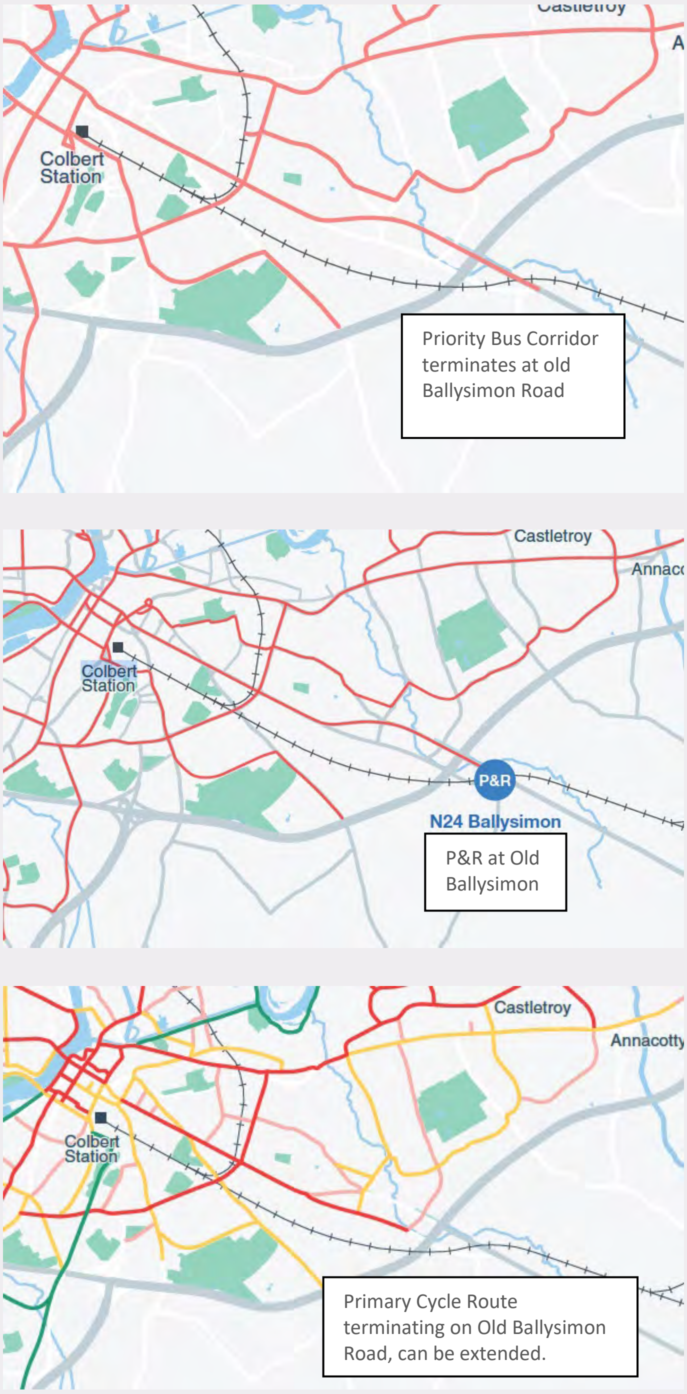


Figure 03.5 LSMATS Proposed Connectivity Enhancements

Planning authorities are required to have regard to the section 28 Spatial Planning and National Roads Guidelines (2012) (SPNRG) in the performance of their functions under the Planning Acts, Section 2.7 – 'Development at National Road Interchanges or Junctions' in relation to zoning changes from agriculture to enterprise and employment where such development could generate significant additional traffic with potential to impact on the national road.

A suite of sustainable travel measures have been proposed in the LSMATS to address current capacity constraints at the Ballysimon junction through modal shift. The proposed measures range from adjacent BusConnects routes, Park and Ride facilities, cycle lane and pedestrian route upgrades and the consideration of a future rail station.

	As identified in previous traffic studies the volume of traffic generated by IDA clients, predominantly modern technology and Lifesciences industries is relatively low in comparison with retail warehousing uses, with many IDA clients opting to develop Mobility Management Plans for their employees. The location is highly accessible by alternative modes of travel, with good pedestrian, cyclist and public transport links. The Ballysimon Strategic Employment Location is served by the 220KW Kilonan Substation and adjacent to the existing Strategic Employment area in Ballysimon and would represent a growth to this cluster, facilitating expansion of existing organisations located there and allowing continued FDI development the Limerick area. Alongside this, it would address the emerging trend with respect to planning for development of energy intensive industry. Therefore, the land is of strategic importance which would support its rezoning and be consistent with the criteria set out in section 2.7. Furthermore, MASP Policy Objective 8 includes the following as part of a list of strategic road infrastructure - to upgrade the Childer's Road/ Ballysimon Road in Limerick City to accommodate bus and cycle facilities and further enhance the public transport provision and sustainable travel options of the site. Thus, enhancing the existing public transport provision. The protection of a future alignment of a national road is not at issue in this case.
Climate Change & Flood Risk	While several of the alternative sites in the area are susceptible to flood risk, there are significant lands in the Ballysimon Strategic Employment Location which are not considered to be prone to flooding.

04 Conclusion

IDA Ireland welcomes this opportunity to make a submission on the employment policies and objectives contained within the Draft Limerick Development Plan 2022 -2028 (Draft DP). Our client and the Council are aligned in the goal to support the growth of employment and enterprise in the Limerick Metropolitan area. We concur with the Council's assessment that the future growth, resilience and competitiveness of Limerick's economy is dependent on, inter alia, indigenous enterprise and foreign direct investment.

However, based on our assessment we query the Council's opinion that

> *Elsewhere in the Environs, Raheen Business Park, the National Technology Park and the proposed Northside Business Campus are identified as Strategic Employment Locations under the MASP. These strategic locations offer the capacity to cater for investment that require greenfield or brownfield sites, access to an international airport and third level graduates.*

IDA Ireland proposes to target 76 investments for the Mid-West region[4] in the period 2021 to 2024[5]. Access to suitable and cost-effective property solutions and a supportive business environment with associated infrastructure will be fundamental to the realisation of this. However, IDA Ireland consider that the established strategic employment locations have limited remaining capacity and potential to support new greenfield manufacturing. They are therefore currently actively seeking a new employment node for greenfield manufacturing FDI in the Limerick region, of a scale between 50 and 100 hectares.

Having reviewed the proposed additional employment zoning contained within the Draft DP, our client concludes that none of the existing or proposed zoned sites are suitable for their requirements for a strategic employment campus based on size or the presence of constraints as discussed in detail in Section 3.2 of this submission.

In view of this IDA Ireland request that the Council acknowledges this strategic requirement in the employment policies and objectives of the Limerick Development Plan 2022-2028 by making provision for a new, suitably scaled, Strategic Employment Location.

[4] Including Limerick, Tipperary and Clare

[5] IDA 2021 Strategy, "Driving Recovery and Sustainable Growth 2021-2024"

05 Appendix 1 Policy Context

The following section examines the proposal in the context of relevant national and regional policies, as well as economic and employment strategies.

The planning policy context in Limerick has been rapidly evolving in recent years with the publication of the National Planning Framework in 2018 and the release of The Regional Spatial and Economic Strategy (RSES) for the Southern Region, the draft Limerick Shannon Metropolitan Area Strategic Plan (MASP) and the Draft Limerick Shannon Metropolitan Area Transport Strategy (LSMATS). The NPF set the scene for a rapid expansion of the City's population over the coming two decades. The RSES has further expanded on these growth objectives and outlines guiding principles in terms of strategic employment growth. A number of common themes have emerged among all policies namely:

- The need to ensure that there is a strong coordination between land use and transport planning.
- Ensuring that identified locations for strategic employment are infrastructure-led.
- That traditional models of delivering employment lands need to be revisited with an approach that is orientated towards placemaking and meeting the needs of the modern workforce.
- Areas for growth and smart specialization should be further explored, as well as the potential to partner with existing third level and healthcare institutions to achieve synergies.
- Encouraging the growth of clusters and co-location of Small and Medium size Enterprises (SMEs) with Multi National Corporations (MNCs) to enhance mutual benefits to both.

05.1 National Policy

05.1.1 PROJECT IRELAND 2040: NATIONAL PLANNING FRAMEWORK

The National Planning Framework (NPF) envisages that by 2040 there will be an extra 1 million people living in the country with the majority of this growth expected to occur within Ireland's five main cities. Table 4.1 in the NPF targets population growth for Limerick City and Suburbs of between 47,000 and 56,000. The proposed development is supported by a number of National Policy Objectives which relate to the establishment of strategic employment locations in the 5 main cities, these including NPO 10a and 10b.

National Policy Objective 10a

> *Regional and Local Authorities to identify and quantify locations for strategic employment development in the cities identified in Table 4.1.*

National Policy Objective 10b

> *Regional and Local Authorities to identify and quantify locations for strategic employment development, where suitable, in urban and rural areas generally.*

The NPF emphasizes that in considering jobs growth and economic development, Local Authorities should be agile in responding to new and unexpected opportunities for enterprise development to accommodate development prospects that emerge with strong locational drivers that do not apply to the same extent elsewhere.

The NPF also identifies several National Strategic Outcomes, which set out to secure the alignment of the NPF and the National Development Plan (NDP). These include:

- *National Strategic Outcome 4 - High-Quality International Connectivity:*
- *National Strategic Outcome 5 – Sustainable Mobility: This sets out to establish public transport and sustainable mobility choices at the at the core of employment creation.*
- *National Strategic Outcome 6 –A Strong Economy Supported by Enterprise, Innovation and Skills: Again, this sets out to support entrepreneurship and build competitive clusters, by "creating places that can foster enterprise and innovation and attract investment and talent. It can be achieved by building regional economic drivers"; the NPF notes that delivering this outcome will require the co-ordination of growth and place making with investment in world class infrastructure and digital connectivity.*

Section 3.4 of the NPF which considers that future growth in the Mid-West area of the Southern Region will be based on:

> *"Leveraging national and international connectivity, higher education capacity and quality of life to secure strategic investment. This must be underpinned by sustainable employment and housing development, focused on the broader Limerick-Shannon Metropolitan area."*

The NPF notes the need for ambition in the Limerick Metropolitan Area:

> *"This requires growing and diversifying the City's employment base and attracting more people to live in the City, both within the City Centre and in new, accessible green-field development areas".*

The importance of identifying sites for strategic employment is emphasized in with Section 4.4. of the NPF which recognizes that employment is driven by market forces including scale, accessibility, innovation supported by higher education institutions and quality of life.

> *"At an urban scale, in cities and towns generally, it is important to identify locations where enterprises can access competitively priced development lands, utilities and commercial properties to the highest standards available internationally."*

The Framework establishes that the approach to supporting strategic employment growth at regional, metropolitan and local level should include considerations of:

- *Current employment location, density of workers, land-take and resource/ infrastructure dependency, including town centres, business parks, industrial estates and significant single enterprises.*
- *Locations for expansion of existing enterprises.*
- *Locations for new enterprises, based on the extent to which they are people intensive (i.e. employees/ customers), space extensive (i.e. land), tied to resources, dependent on the availability of different types of infrastructure (e.g. telecoms, power, water, roads, airport, port etc.) or dependent on skills availability.*
- *Locations for potential relocation of enterprises that may be better suited to alternative locations and where such a move, if facilitated, would release urban land for more efficient purposes that would be of benefit to the regeneration and development of the urban area as a whole, particularly in metropolitan areas and large towns.*

05.1.2 FUTURE JOBS IRELAND 2019

The 2019 Government strategy is based around the recognition that policy requires a shift away from focusing simply on quantity of jobs to quality jobs that will be resilient into the future. The document outlines five pillars of emphasis in respect of this:

1. Embracing Innovation and Technological Change

2. Improving SME Productivity

3. Enhancing Skills and Developing and Attracting Talent

4. Increasing Participation in the Labour Force

5. Transitioning to a Low Carbon Economy

Among the deliverables included in Pillar 2, Improving SME Productivity include:

"Encourage the growth of clusters where enterprises can grow and help each other and deepen linkages between foreign and Irish owned businesses"

05.1.3 EIRGRID – SHAPING OUR ELECTRICITY FUTURE

Another key national policy document is the new Eirgrid strategy ('*Shaping our Electricity Future*' – currently out for consultation). One of the key emerging approaches is based on encouraging large energy demands (ie large industry & data centres) to regional locations where grid capacity exists (rather than the Dublin/eastern region where there is no capacity and major grid investment is required).

05.2 Regional Policy

05.2.1 REGIONAL SPATIAL AND ECONOMIC STRATEGY FOR THE SOUTHERN REGION 2020

The Economic Strategy outlined in the RSES is based around a vision for the region to enable sustainable, competitive, inclusive and resilient growth. In relation to global challenges such as Brexit, the strategy indicates that:

"it is important that the Region sustains what we have in the immediate term, transforms our enterprise base for longer term resilience while managing potential vulnerabilities."

The RSES seeks to achieve the above vision through the following economic principles:

- Smart Specialisation
- Clustering
- Placemaking for enterprise development
- Knowledge Diffusion, and
- Capacity Building

The RSES includes Guiding principles for Local Authorities in terms of identifying locations for strategic employment development including:

- Identifying location of technology and innovation poles (ICTs and universities) as key strategic sites for high-potential growth of economic activity.
- Identifying locations for expansion of existing enterprises.
- Securing locations for new enterprises, based on availability of employees/customers, land, tied to resources, dependent on the availability of different types of infrastructure (e.g. telecoms, power, water, roads, airport, port etc.) or dependent on skills availability.
- Exploring potential relocation of enterprises that may be better suited to alternative locations and where such a move, if facilitated, would release urban land for more efficient purposes that would be of benefit to the regeneration and development of the urban area as a whole, particularly in metropolitan areas and large towns.
- Within large urban areas locations, identifying where significant job location can be catered for through infrastructure servicing and proximity to transport interchanges, particularly public transport.
- An assessment of the phasing of development in association with the planned delivery of water and wastewater services, extension or provision of public bus services to the location and provision of new or improved cycling and walking connectivity from existing residential areas.
- Focus on areas that would address employment blackspots/legacies.
- Support existing sectoral and location-based strengths and synergies with existing employers

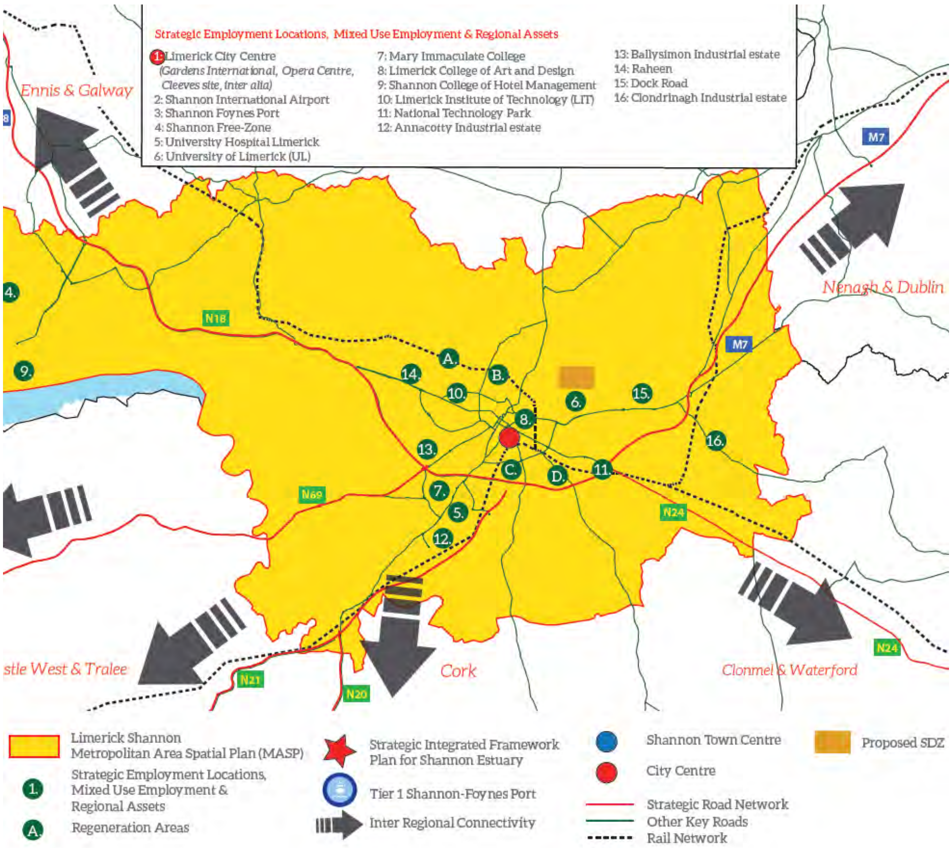
05.2.2 LIMERICK SHANNON METROPOLITAN AREA STRATEGIC PLAN (MASP)

The RSES contains the Limerick Shannon MASP which includes a section on Employment and Enterprise listing key employment locations. Limerick is described in the MASP as 'Ireland's most connected fulcrum, with strategic access to all other regional urban centres' [6]. Figure 2.1 is extracted from the MASP and indicates the strategic employment

[6] Section 8 of the Limerick Shannon MASP, RSES

locations. It should be noted that this figure appears to have been erroneously labelled, with the names in the legend not corresponding to the locations indicated in the map.

Figure 05.1 Strategic Employment Locations as Depicted in the Limerick Shannon MASP



The RSES states in Table 3 that there is 71 hectares of capacity in the NTP and 57.5 hectare of capacity in Raheen Business Park.

Section 3.2 of the Limerick Shannon MASP sets out a number of guiding principles to underpin future growth. These include:

> *"Employment density in the right places – Re-intensify employment in Limerick City and Shannon and activate strategic employment locations to complement existing employment hubs in the city centre and near third level institutes."*

MASP Objective 12 specifically refers to the sustainable development of specifically IDA initiatives such as the subject proposal in which it states that:

> *"It is an objective to seek investment in the sustainable development of initiatives of IDA Ireland and Enterprise Ireland in strengthening enterprise assets, fostering competitive locations and conditions for enterprise growth in the Limerick Shannon Metropolitan Area".*

Similarly, MASP objective 13 is supportive of the sustainable development of future strategic employment locations:

> *"It is an objective to support the sustainable development of identified and future Strategic Employment Locations and to ensure the delivery of associated infrastructural requirements subject to the outcome of environmental assessments and the planning process".*

05.2.3DRAFT LIMERICK /SHANNON METROPOLITAN AREA TRANSPORT STRATEGY (LSMATS) 2040

The LSMATS recognizes that there is localized congestion on the grade separated junction of the M7/M18 and the Ballysimon Interchange. The LSMATS acknowledges that traffic congestion and will inevitably rise with future growth if the current car dependence in the area is not addressed. The objective of the strategy is therefore to manage congestion to achieve an effective, sustainable and efficient transport system.

05.3 Other Strategies

05.3.1 DRIVING RECOVERY AND SUSTAINABLE GROWTH 2021 – 2024 (IDA IRELAND)

IDA Ireland's ambition, as outlined in its new strategy, is to capitalise on opportunities to provide multinational corporations (MNC) with solutions to the challenges they face in a difficult global environment, partnering with existing clients to safeguard and enhance their mandates in Ireland, while also attracting the next generation of leading-edge MNCs in their core sectors of focus. IDA has placed sustainable growth at the centre of its strategy, in line with Government policy, international consensus, clients' vision, and the demands of citizens. IDA will seek growth that meets the needs of the present without compromising the ability of future generations to meet their own needs, while fostering an inclusive, sustainable, and resilient economy and society. The strategy is framed through five interlinked pillars of Growth, Transformation, Regions, Sustainability and Impact, specifically:

1) *Win 800 total investments to support job creation of 50,000 and economic activity*

2) *Partner with clients for future growth through 170 RD&I and 130 training investments*

3) *Win 400 investments to advance regional development*

4) *Embrace a green recovery with 60 sustainability investments*

5) *Target a 20% increase in client expenditure in Ireland to maximise the impact of FDI*

The strategy refers to the importance of linkages between FDI clients and SMEs such as Value Chain linkages, strategic partnerships, labour mobility and demonstration effects. Geographic proximity is cited as one of the key enablers for developing these linkages or "diffusion channels" as they are referred to.

IDA Ireland will deliver an Advanced Building Solution in Limerick over 2021-2024, in addition to completing construction on an Advanced Manufacturing Centre in July 2021. Further upgrade works, and investment are planned for IDA Parks in the region to ensure a robust value proposition for clients, and IDA plans to acquire additional strategic sites for future development. Overall, a target of 76 investments for the region has been set over the lifetime of the strategy.

05.3.2 POWERING THE REGIONS: ENTERPRISE IRELAND REGIONAL PLAN 2019

Enterprise Ireland classifies Limerick, Tipperary and Clare as the Mid-West Region. Among the objectives for the Mid West region the following are specific to Limerick:

- *Develop Limerick's Digital Collaboration Centre for the film Industry and new product development for connected autonomous vehicles. Drive the Mid West to become Ireland's lead location for the autonomous mobility sector in Ireland creating 422 jobs.*

- *Foster engagement between the regions Higher Education Institutions (HEIs), SMEs and innovative start-ups.*

- *Support 900 co-working spaces in the Mid-West #Worksmartchallenge*

- *Leverage University of Limerick, Limerick IT, IT Tralee, the LEOs and key stakeholders in the Mid West to develop a robust pipeline of start-ups.*

PROPOSED MOTIONS

1) ***That the lands adjoining the Dooradoyle District Centre (incorporating the Crescent Shopping Centre) outlined in red on Figure 1 below be zoned as follows:***

Change site outlined in red from Zoning Objective: “Semi Natural Open Space” to Zoning Objective “Enterprise and Employment”

Figure 1: Lands adjoining the Crescent Shopping Centre

2) Add an objective to Chapter 4 (A Strong Economy) as follows:

Dooradoyle District Centre and Dooradoyle Urban Quarter:

- ***To promote the continued development of lands comprising Dooradoyle District Centre and adjoining lands as a Strategic Employment Location through the delivery of additional employment uses (primarily office) in a phased manner in conjunction with retail, retail services and supporting development.***
- ***To promote improvements to connectivity, signage and permeability within the wider area including pedestrian and cycle facilities linking to Portland Park and provide for the link road from Dooradoyle Road to Rosbrien Road***
- ***To promote the re-investment, upgrade and expansion of the retail and services provision at the Dooradoyle District Centre***
- ***To facilitate the early upgrading of the existing flood defence infrastructure, thus ensuring the long-term flood protection of the wider lands in Dooradoyle in a manner compatible with any future City Wide Flood Relief Scheme.***
- ***Any application on lands at risk of flooding to be accompanied by a Site Specific Flood Risk Assessment which shall demonstrate that any development does not result in additional significant flood risk in the area and does not impede the future delivery of a wider flood relief scheme for Limerick.***

- ***An overall framework plan / masterplan is to be prepared for the lands in advance or as part of any application for a portion of the currently undeveloped lands***

3) The Dooradoyle District Centre and the adjoining lands be designated in the Development Plan as a strategic employment location in Chapter 4 (A Strong Economy) with significant potential for expansion.

Rationale

The Dooradoyle area represents a strategically located parcel of lands providing a gateway to the city on an important public transport corridor within the built-up area of the southern suburbs of Limerick. The Dooradoyle District Centre and adjoining lands, extending to over 30 hectares, represent a strategically important large scale under-developed site within the inner suburbs with potential to be further developed at the heart of a comprehensive mixed-use Urban Quarter. The existing Crescent Shopping Centre alone already employs nearly 1,500 workers, and when fully built out the total site area has the capacity to accommodate in the order of 2,000 additional employees (additional jobs mainly in offices, technology and support services). Dooradoyle District Centre is therefore considered to be a Strategic Employment Location and has the potential for a significant intensification of employment. The designation as a Strategic Employment Location would ensure compliance with higher tier plans and Section 28 Guidelines.

The lands are sequentially favourable for development, being located on the transition of the City and Southern Environs and comprise a significant infill site, which will be in accordance with national planning objectives for consolidated compact urban growth. The river, N18 and disused rail line historically have provided a physical barrier to permeability in the area which may be addressed as part of the comprehensive development of the lands. Development of the lands on the old boundary of the City and County Council's would be representative of the new single Authority approach to the sustainable and appropriate development of Limerick.

The development of the lands would further utilise existing infrastructure such as public transport and services.

Additionally with reference to the submission on the draft Development Plan by Irish Rail to the provision of a commuter rail station at Dooradoyle and forthcoming publication of LSMATS setting out the future sustainable transport.

Therefore, these lands should be identified as a key opportunity site for Limerick City and to give effect to such a designation, there is a requirement to have the lands appropriately zoned.

The provision of *Enterprise and Employment* lands at this location will provide additional choice of land for companies and investment as an attraction to investment in Limerick in the short term having regard to the existing infrastructure including services, high quality bus services and pedestrian and cycle facilities.

Enterprise and Employment uses are classed as less vulnerable uses under the Flood Risk Guidelines and a suite of documentation is included as Appendices to this rationale, including:

- Appendix 1 – Dooradoyle Urban Quarter Strategic Flood Risk Assessment Summary Report
- Appendix 2 – Plan Making Justification Test
- Appendix 3 – Strategic Flood Risk Assessment

- Appendix 4 – Geotechnical Analysis
- Appendix 5 – Downstream Breach Assessment
- Appendix 6 – IDA Submission on Draft Development Plan

It is further noted that the IDA submission on the draft Development Plan contends sufficient employment lands to attract inward employment investment are not provided for by the draft Development Plan. The proposed amendments will help address this concern.

The IDA has indicated in its submission it is targeting 76 investments for the mid west region between now and 2024. Thus, more lands are needed immediately and not at the next development plan in a number of years time, or there is risk of lost investment in the County.