APPENDIX 7-1

FLOOD RISK ASSESSSMENT

HYDRO ENVIRONMENTAL SERVICES

22 Lower Main St
Dungarvan
Co.Waterford
Ireland

tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

PROPOSED QUARRY EXTENSION AND RESTORATION, BALLYQUIN CO. CLARE

FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

Roadstone Limited

Prepared by:

HYDRO-ENVIRONMENTAL SERVICES

DOCUMENT INFORMATION

DOCUMENT TITLE:	**PROPOSED QUARRY EXTENSION AND RESTORATION, BALLYQUIN CO. CLARE** **FLOOD RISK ASSESSMENT (STAGE II)**
ISSUE DATE:	**8TH NOVEMBER 2024**
PROJECT NUMBER:	**P1623-1**
PROJECT REPORTING HISTORY:	-
CURRENT REVISION NO:	**P1623-1 FRA FINAL F0**
AUTHOR(S):	**MICHAEL GILL** **DAVID BROADRICK** **JOHN TWOMEY**
SIGNED:	 **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) was engaged by MKO, on behalf of Roadstone Ltd to undertake a Stage II Flood Risk Assessment (FRA) for proposed continuation of sand and gravel extraction as well as the infilling/restoration of the existing and proposed extraction areas including all related ancillary works at Roadstone Ballyquin, Co. Clare.

The Proposed Development being applied for under this planning application also includes for the construction of a soil inspection shed, refuelling area, settlement ponds, road improvements, drainage network and environmental berms.

A site location map is attached as **Figure A**.

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009).

1.2 STATEMENT OF QUALIFICATIONS

Hydro-Environmental Services ("HES") are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This FRA was prepared by Michael Gill and David Broderick.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of quarries and renewable projects in Ireland, as well as accompanying Flood Risk Assessments. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions.

David Broderick P.Geo (BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with 17 years environmental consultancy experience in Ireland. David has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. David has significant experience in surface water drainage issues, SUDs design, flood risk assessment and modelling.

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the site setting and details of the Proposed Development;
- Section 3 outlines the hydrological and geological characteristics of the site and downstream surface water catchments, and the existing and proposed site drainage;
- Section 4 presents a site-specific flood risk assessment (FRA) undertaken for the proposed development which was carried out in accordance with the above-mentioned guidelines;
- Section 5 reviews planning policy; and,
- Section 6 presents the FRA report conclusions.

As stated above, this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources:

- OPW Flood Studies Update (FSU) Web Portal;
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA/WFD hydrology maps;
- OPW National Indicative Fluvial Mapping (NIFM);
- Clare County Development Plan 2023 – 2029 (including Strategic Flood Risk Assessment); and,
- Site investigations and surveys conducted by HES on 27th October 2022 and on 9th February, 6th July, 27th September and 13th November 2023.

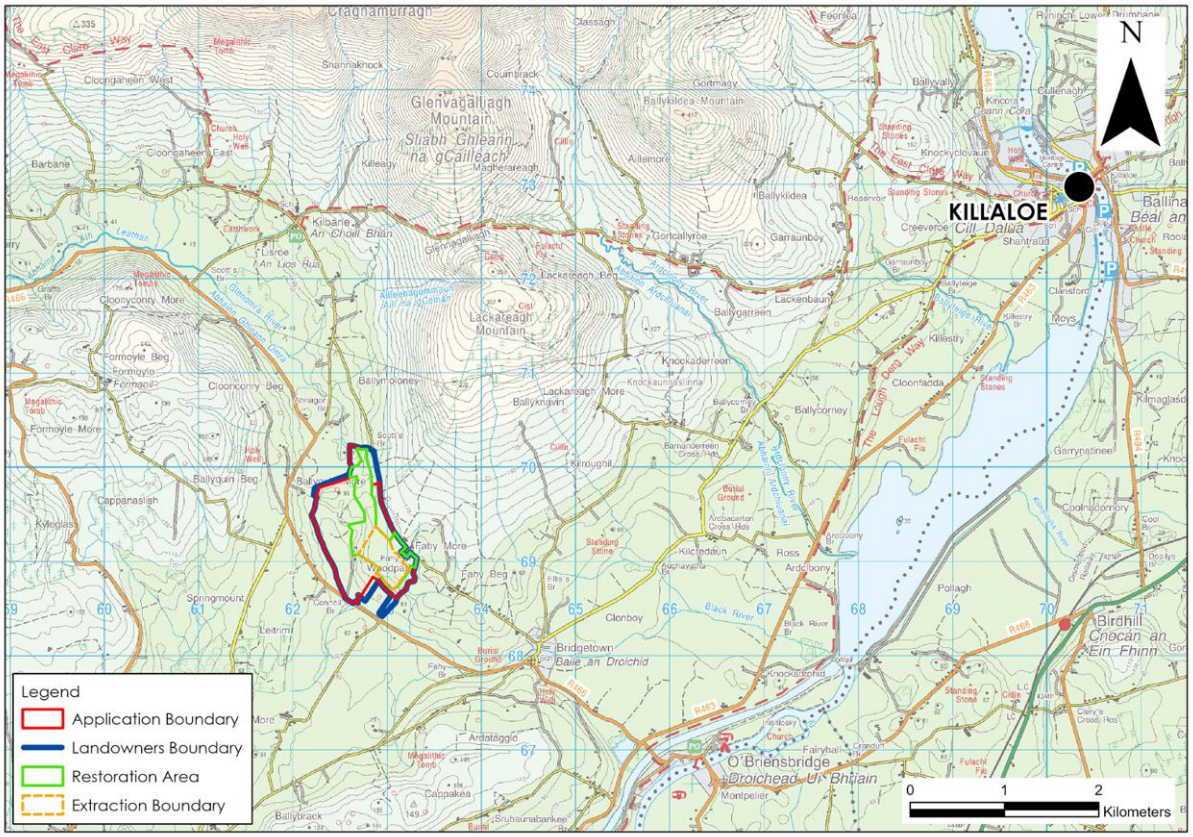

Figure A: Site Location Map

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting and description of the Proposed Development site.

2.2 SITE LOCATION AND TOPOGRAPHY

The Proposed Development site is located on the south-western facing foothills of the Lackareagh Mountains at Ballyquin (and surrounding townlands), approximately 1.5km to the northwest of Bridgetown, Co. Clare. Furthermore, it is situated 8km southwest of the town of Killaloe.

The Proposed Development site, which has an area of 97.5ha, is located within an existing sand and gravel pit which has a total landholding of 105ha. Previous extraction was focused along the more elevated eastern half of the Proposed Development site where natural ground levels are between 90 and 100 metres above Ordnance Datum (m OD) along the undisturbed eastern boundary.

The western half of the Proposed Development site, where natural ground levels reduce to 46m OD at the western boundary, is heavily vegetated with trees and scrub. There is a wetland area/fen at the southwestern corner of the Proposed Development site near the existing site entrance as well as some agricultural land at the far southeastern end of the Proposed Development site.

The existing extraction areas have floor levels of between 86m OD and 53m OD at the eastern and central areas of the site respectively.

A site location map is included as **Figure A** above.

2.3 PROPOSED DEVELOPMENT DETAILS

The proposal includes the concurrent extraction of sand and gravel and the importing of inert material for restoration.

The proposed continued extraction of sand and gravel will occur over a 16.3ha area. The majority of this area has previously been extracted with the exception of 1.8ha of agricultural located at the southeastern end of the Proposed Development site.

The depth of sand varies across the extraction area, as a result levels of excavation will vary from ~76m OD in the north of the site to ~57.5m OD in the south of the site. The layer of sand and gravel ranges from 7 to 14m in thickness. Extraction of sand will stop when rock is met.

It has been calculated that approximately (1,428,571 tonnes) of material will be extracted. The aggregate that will be extracted will be washed and processed on-site. The spoil/fines from the processing will be stored in cells constructed in in-situ sand and gravel deposits.

The proposed infilling/restoration of the existing and future pit voids covers an area of approximately 34 hectares. It is proposed to import approximately 4,471,200 tonnes of inert soil and stone material for the infilling purposes.

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics of the region and the Proposed Development site.

3.2 HYDROLOGY

3.2.1 Regional and Local Hydrology

On a regional scale, the Proposed Development site is located in the River Shannon catchment with the northern portion mapped in the Shannon Estuary North (Catchment ID 27) within the Owenogarney_SC_010 sub-catchment.

The southern portion of the Proposed Development site is located in the Lower Shannon (Catchment ID 25A) within the Shannon[Lower]_SC_080 sub-catchment.

The proposed extraction area is only located in the Lower Shannon Catchment while the proposed restoration/infill area is located in both.

In the Owenogarney_SC_010 sub-catchment., the Proposed Development site drains locally to the Broadford River (Broadford_010 river waterbody).

In the Shannon[Lower]_SC_080 sub-catchment, the Proposed Development site drains locally to the Bridgetown(Clare)_010 river waterbody.

A regional hydrology map is shown as **Figure B.**

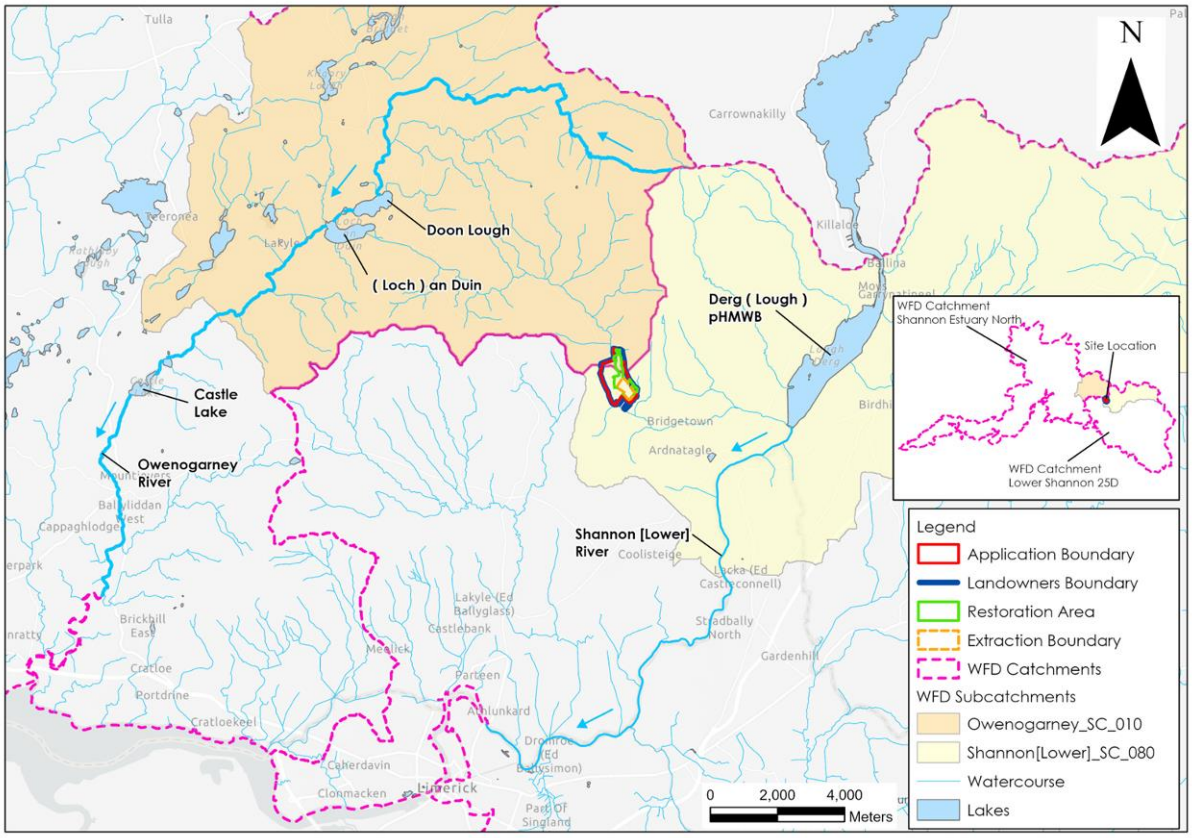

Figure B: Regional Hydrology Map

3.2.2 Rainfall and Evaporation

The SAAR (Standard Average Annual Rainfall) recorded at Ardnacrusha station, Co. Clare ~8km southwest of the proposed development site, is 1128mm (www.met.ie).

The average potential evapotranspiration (PE) at Shannon Airport, ~15km southwest of the site, is taken to be 543mm (www.met.ie). The actual evapotranspiration (AE) is calculated to be 516mm (95% PE). Using the above values the effective rainfall (ER)[1] for the area is calculated to be (ER = SAAR – AE) ~612mm/yr.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. A summary of rainfall depths for various return periods and durations for the proposed development site are presented in **Table A**.

Table A. – Return Period Rainfall Depths (mm)

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.7	5.9	9.4	12.6
15 mins	6.1	9.6	15.4	20.7
30 mins	7.9	12.3	19.2	25.4
1 hour	10.3	15.6	24	31.2
6 hours	20.5	29.4	42.4	53.2
12 hours	26.8	37.5	52.9	65.4
24 hours	35	47.8	65.9	80.4
2 days	43.8	58.4	78.5	94.3

3.3 GEOLOGY

The published soils map (www.epa.ie) for the area shows that the majority of the Proposed Development site is mapped mainly as acidic well drained mineral soils (AminDW). There are also pockets of Fen Peat mapped at the northwestern and southwestern corners of the Proposed Development site.

The existing site entrance road passes through the southwestern pocket of Fen Peat. Alluvium is mapped along the course of a watercourse that flows southerly along the western boundary of the Proposed Development site. AminDW soils are also mapped in the wider area.

The GSI subsoils map (**www.gsi.ie**) show glaciofluvial sands and gravel derived from sandstones are dominant within Proposed Development site. Till derived from Lower Palaeozoic sandstones and shales and Devonian sandstones are mapped in the wider area.

Site investigations reveal sand/gravel depths of between 4m and >10m. The deepest sand and gravels were found to on the northwest (>10m) and west (10.5m) of the site.

The shallowest sand/gravel deposits (~4m) were found on the southeast and south of the site. The sand/gravels are typically underlain by sandy gravelly CLAY.

According to the GSI Bedrock Geology 100K map (www.gsi.ie), the majority of the Proposed Development site is underlain by undifferentiated Old Red Sandstone (ORS) which comprises of red conglomerate, sandstone and mudstone.

The northern edge of the Proposed Development site is mapped to be underlain by the Broadford Formation which comprises of fine to conglomeratic greywacke.

[1] ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.

3.4 SITE DRAINAGE

3.4.1 Existing Site Drainage

Headwater streams of the Bridgetown River flow along the southwestern and southeastern boundaries of the Proposed Development site while a headwater stream of the Broadford River flows along the northern boundary of the site.

However, due to the presence of the underlying high permeability sand and gravel deposits, there is limited runoff from the site towards these rivers due to high groundwater recharge rates. Runoff rates are likely to be highest at the southwestern corner of the site (near site entrance) where a wetland/fen exists. The wetland/fen is drained by the western tributary of the Bridgetown River.

There is some runoff generated from the processing /yard areas (former concrete plant area) to the north of the reception building and this flows westerly under gravity towards an existing settlement pond/lagoon system located close to the western boundary where it percolates to ground. This discharge to ground is permitted by an existing discharge licence (WP 170). The discharge rate is limited to 113m^3/hour.

There is no overflow to the headwater stream of the Bridgetown River which flows immediately to the west of the settlement pond/lagoon system.

There is also manmade pond located on the west of the Proposed Development site that was previously used as a source of wash water for aggregate processing.

Water from the manmade pond was previously recycled/pumped back to the washing plant via pumps and a pipe network. The settlement ponds/lagoons and manmade pond is a closed system as there is no overflow to local watercourses. The pond is also receiving localised runoff from nearby access roads and previous processing areas located upslope to the east.

The existing site drainage is shown on **Figure C.**

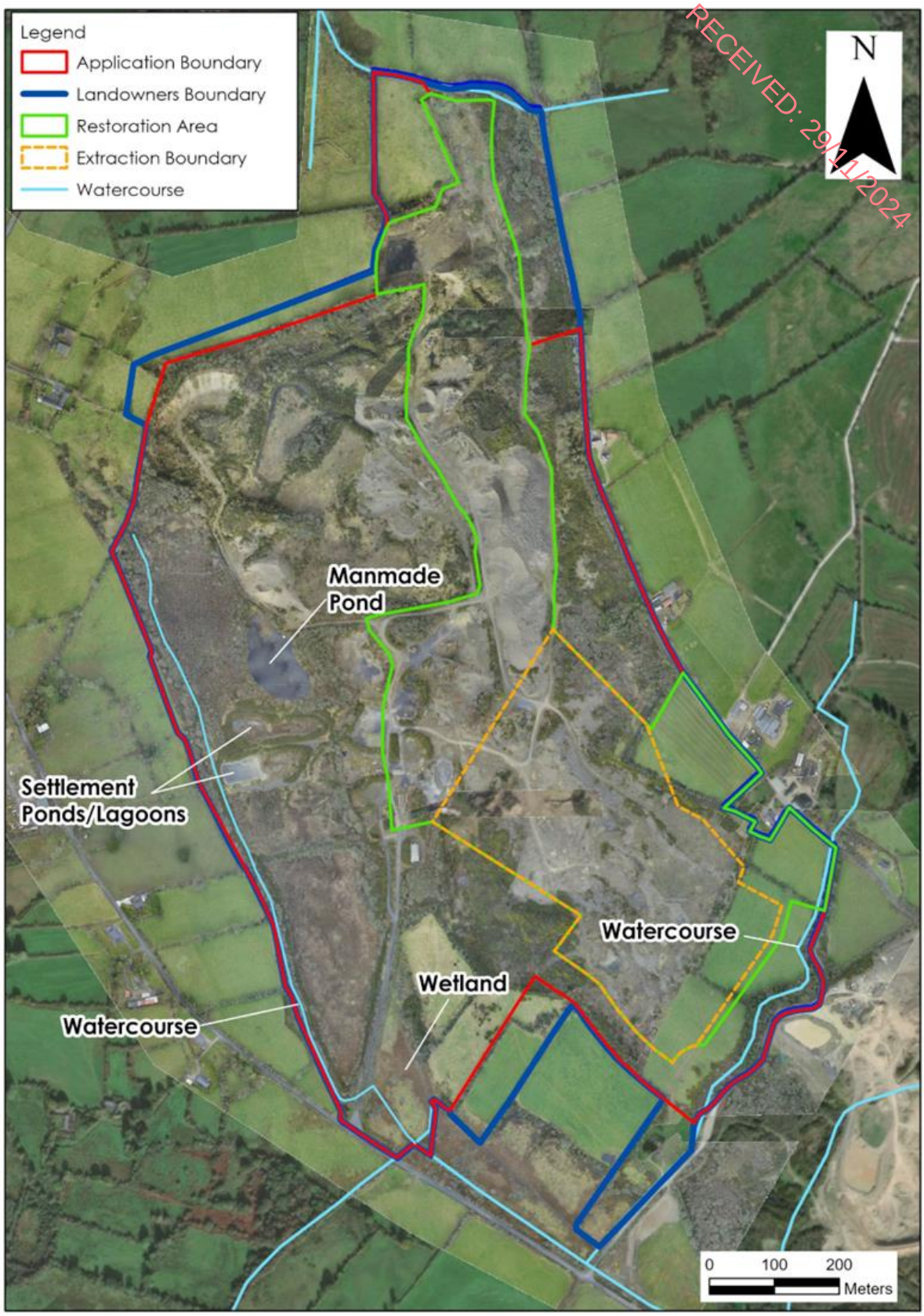

Figure C: Site Drainage Map

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the development. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a Proposed Development; and,
- *Detailed flood risk assessment* – quantitative appraisal of potential risk to a Proposed Development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;
- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,
- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Coastal Flooding is not applicable due to the inland location of the Proposed Development site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows

and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity and the system becomes blocked, and / or cannot discharge due to a high-water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- 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 interactions of site-specific factors such as tidal variations. While water level may rise slowly, it may be in place for extended periods of time. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e. interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea tending to increase water levels inland, which may flood over river banks.

The Flood Risk Management Guidelines provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

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.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for

through the application of a Justification Test, where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and 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. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site specific level, such as for this FRA assessment, if a Justification Test is required.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 OPW Past Flood Event Mapping

OPW's Past Flood Event mapping (https://www.floodinfo.ie/map/floodmaps/ were consulted to identify locations potentially being at risk of fluvial, pluvial and surface water flooding (Refer to **Figure D)**.

No recurring flood incidents within the Proposed Development site boundary were identified from OPW's Past Flood Event Mapping.

The closest mapped recurring flood event is on the Bridgetown River immediately to the south and downstream of the Proposed Development site (Flood ID: 4696) where the R466 road is affected. According to the OPW Flood Hazard Mapping area engineer notes "*The R466 is flooded and impassable once every two years. Maximum depth of up to 300mm. Surrounding land is also flooded. Cause is rainfall/runoff and back up of stream due to poor maintenance of stream downstream*".

There is also a recurring flood event on the Broadford River approximately 3.5km to the northwest and downstream of the Proposed Development site (Flood ID: 4695) that's also affects the R466. "*Land on North side of R466 floods over an extensive area on average twice per year. Cause is rainfall/runoff causes stream running by road to overflow. Stream is in need of maintenance. Problem has only occurred in last 10 to 15 years since maintenance work on the stream was discontinued*".

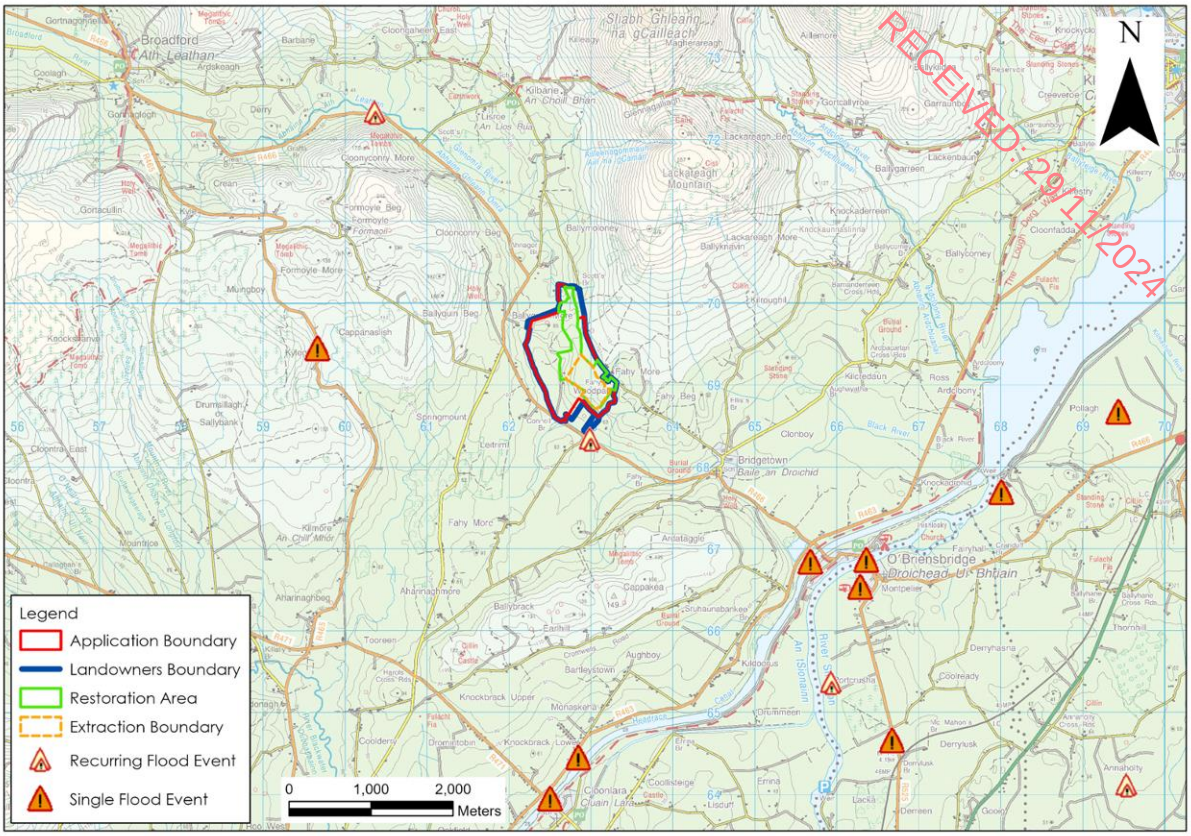

Figure D: OPW Past Flood Event Mapping (www.floodinfo.ie)

4.3.2 Soils Maps - Fluvial Maps

A review of the soil types in the vicinity of the site was undertaken as soils can be a good indicator of past flooding in an area.

Based on the EPA/GSI soil map for the Proposed Development site, the majority of the site is underlain glaciofluvial sands and gravels. A small and localised area of alluvium is mapped on the south of the site. Alluvium is associated with river overbank flooding. No proposed extraction areas of infill areas are underlain by alluvium.

4.3.3 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping (*i.e.* 6" and 25" base maps) were consulted. No such areas are recorded at the Proposed Development site, or on the local watercourses.

4.3.4 CFRAM Flood Extents Mapping

Catchment Flood Risk Assessment and Management (CFRAM)2 OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland.

CFRAM mapping has not been completed for the area of the Proposed Development site. The closest Flood Extents Mapping is located along the River Shannon.

[2] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

4.3.5 National Indicative Fluvial Mapping (NIFM)

The National Indicative Fluvial Flood Mapping (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present Day Scenario has been generated using methodologies based on historic flood data and does not take into account the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.7** below.).

For the Present Day Scenario medium (1 in 100) and low probability (1 in 1,000), fluvial flood zones have been mapped along the Bridgetown River and Broadford River but no fluvial flood zones are mapped in the upper catchment areas where the Proposed Development site is located. NIFM mapping is shown on **Figure E.**

Therefore, according to National Indicative Fluvial Mapping the Proposed Development site is located in Zone C, where the risk of fluvial flooding is low.

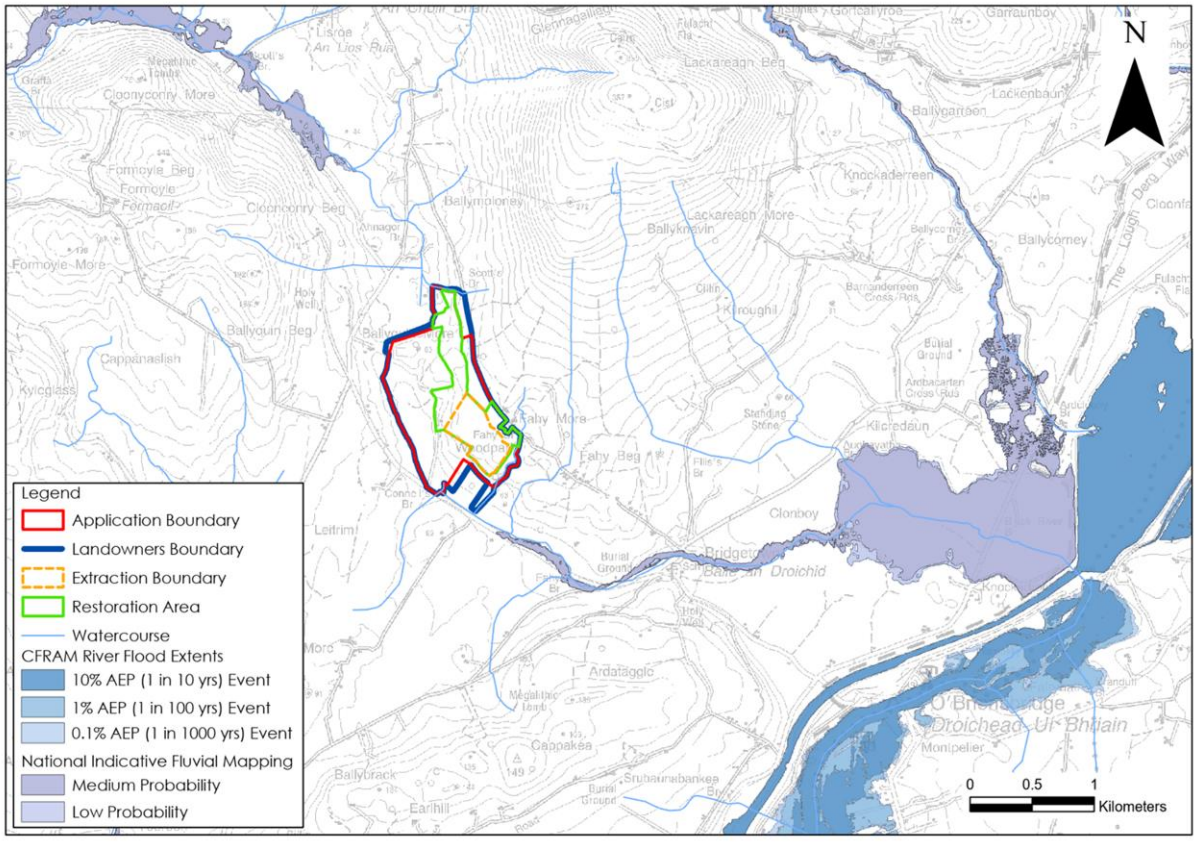

Figure E: OPW National Indicative Fluvial Mapping

4.3.6 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Proposed Development site or within the vicinity.

4.3.7 Climate Change

Fluvial flood modelling has also been completed to consider future climate scenarios where the potential effects of climate change can increase rainfall.

The National Indicative Fluvial Flood Mapping Mid-Range Future Scenario models flood extents based on a 20% increase in rainfall. Similarly, the National Indicative Fluvial Flood Mapping High-End Future Scenario models flood etens based on a 30% increase in rainfall.

Both of these modelled flood extents show similar flood zones to the Present Day Scenario as discussed above. Therefore, flood zones at the Proposed Development site are unlikely to be significantly impacted by future climate change.

4.3.8 Coastal Flooding

The Proposed Development site is located approximately 56km from the coast and therefore is not at risk of coastal flooding.

4.3.9 Summary – Flood Risk Identification

Based on the information gained through the flood identification process, no parts of the Proposed Development site are mapped within any fluvial flood zones (Flood Zones A - B).

All proposed infrastructure is located above the mapped 1000-year flood level and therefore all infrastructure is located in Flood Zone C (Low Risk).

The potential sources of flood risk for the proposed site are outlined in **Table B.**

Table B. S-P-R Assessment of Flood Sources for the Proposed Site.

Source	Pathway	Receptor	Comment
Fluvial	Overbank flooding of the Bridgetown (Clare) SWB	Land, People, property, infrastructure, and designated sites	No likely direct flooding of the Proposed Development site from rivers located adjacent to the site. The Proposed Development site is located in Fluvial Flood Zone C (low risk)
Pluvial	Ponding of rainwater on site	Land, People, property.	Not likely to occur due to well-draining sand and gravel deposits
Surface water	Surface ponding/ Overflow	Land, People, property.	Same as pluvial above.
Groundwater	Rising groundwater levels	Land, People, property	Based on local hydrogeological regime and GSI groundwater flood mapping, there is no apparent risk from groundwater flooding at the proposed development site
Coastal/tidal	Overbank flooding	Land, People, property	Not applicable.

4.4 PROPOSED DEVELOPMENT DRAINAGE

As stated above there is no history of fluvial (river), groundwater flooding or pluvial/surface water flooding at the site and therefore there is very low risk of any infill resulting in the displacement of flood water onto adjacent property.

The topography (contouring/slopes) of the infilled site will be very similar to the pre-development Greenfield scenario.

Any rain water landing on the site or surface water runoff intercepted by the infilled site will be managed by the proposed restoration plan and drainage network as outlined below:

- On infilling of the site area a perimeter toe drain / drainage ditch will be installed around the perimeter of the infill that will collect local surface water runoff intercepted by the infilled area and direct it to ground via soakaways in the underlying more permeable sand and gravel deposits;

- All rainfall landing on hardstanding surfaces (i.e. roofs and roads etc) will be directed to a roadside drainage system and attenuated at the site prior to discharge to ground at the existing ponds/lagoon. This water will therefore not be allowed to runoff the site in an uncontrolled manner that might cause localised flooding in adjacent properties; and,

- Finally, the infill ground surface will be topped with native (well-draining) topsoil, vegetated and planted with a suitable mix of woodland planting which will retain rainfall, increase infiltration and reduce the potential for runoff.

5. PLANNING POLICY AND JUSTIFICATION TEST

5.1 PLANNING POLICY AND CDP

The following policies (**Table C**) are defined in Clare County Council CDP 2023-2029 in respect of flooding, and we have outlined in the column to the right how these policies are provided for within the proposed development design:

Table C: Clare County Development Plan Objectives/Policies and Project Responses

CDP Policy Number:	Policy	Response
CDP 2.6	It is an objective of Clare County Council: To ensure development proposals have regard to the requirements of the SFRA and Flood Risk Management Guidelines; and where required are supported by an appropriately detailed hydrological assessment / flood risk assessment. To ensure that flood risk assessments include consideration of potential impacts of flooding arising from climate change including sea level rise and coastal erosion. To integrate sustainable water management solutions into development proposals.	This FRA has been prepared in accordance with The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The potential effects associated with Climate Change are addressed in Section 4.3.7. The proposed drainage system will ensure that runoff is attenuated and that volumes will be maintained at greenfield runoff rates.
CDP 2.8	It is an objective of Clare County Council: To support the implementation of the EU Floods Directive 2007/60/EC to manage flood risks; and, To implement the recommendation of the CFRAMS programme as it related to County Clare.	This FRA has been prepared in accordance with the EU Floods Directive 2007/6-/EC. The proposed development is not located within any mapped CFRAM Flood Zones.

5.2 REQUIREMENT FOR A JUSTIFICATION TEST

A matrix of vulnerability versus flood zone is shown in **Table D**. This table is used to illustrate appropriate development types or indicate when a Justification Test[3] is required.

The Proposed Development, which can be considered highly vulnerable, is located in fluvial Flood Zone C (low risk). Based on this a Justification Test is not required.

[3] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

Table D: Matrix of Vulnerability versus Flood Zone

	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

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this projec*

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6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed site at Ballyquin, Co. Clare. From this study:
  - No instances of historical flooding were identified in historic OS maps;
  - No instances of recurring flooding were identified on OPW maps within the Proposed Development site;
  - The GSI Groundwater Flood Mapping does not record any historic or predictive groundwater flood zones within the Proposed Development site; and;
  - No portion of the site was identified within the OPW CFRAM/NIFM Flood Zones A and B.
- As the Proposed Development will not discharge water from its site to surface waters, there is no potential of increased flood risk downstream of the site;
- All surface water runoff generated at the site will be managed in a sustainable manner; and,
- The overall risk of flooding posed by the Proposed Development and associated works within the site is negligible.

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7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
Natural Environment Research Council	1975	Flood Studies Report (& maps).
Cunnane & Lynn	1975	Flood Estimated Following the Flood Studies Report
CIRIA	2004	Development and Flood Risk – Guidance for the Construction Industry.
OPW	Not Dated	Construction, Replacement or Alteration of Bridges and Culverts. A Guide to Applying for Consent under Section 50 of the Arterial Act, 1945.
Institute of Hydrology	1994	Flood Estimation in Small Catchments (IH 124).
Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.

22 Lower Main Street, Dungarvan, Co. Waterford, X35 HK11
T: +353-(0)58-441 22 **F:** +353-(0)58-442 44 **E:** info@hydroenvironmental.ie

www.hydroenvironmental.ie