



FLOOD RISK ASSESSMENT

RESIDENTIAL DEVELOPMENT AT GOLF COURSE RD., WESTPORT, CO. MAYO

MAYO COUNTY COUNCIL

19166-RP-2301-FL01 | MARCH 2020

**CIVIL
STRUCTURAL
ENVIRONMENTAL**

+353 (0) 98 68961 | info@langaneng.ie | www.langaneng.ie
Leeson Enterprise Centre, Altamont St, Westport, Co. Mayo F28 ET85
Galway Technology Centre, Mervue Business Park, Galway H91 D932

QUALITY CHECK SHEET

DOCUMENT TITLE: FLOOD RISK ASSESSMENT

PROJECT TITLE: RESIDENTIAL DEVELOPMENT AT GOLF COURSE RD., WESTPORT, CO. MAYO

CLIENT: MAYO COUNTY COUNCIL

DOCUMENT REF: 19166-RP-2301-FL01

REVISION	DESCRIPTION	ISSUE DATE	PREPARED BY	CHECKED BY	APPROVED BY
DR01	Draft Issue	12th March 2020	JMcC	TMcH	JL
FL01	Final Issue	15th February 2021	KD	TMcH	JL

AUTHOR, CHECKER AND APPROVER DETAILS		
NAME	ROLE	QUALIFICATIONS
Mr. John McCrudden (JMcC)	Project Engineer, Langan Consulting Engineers	MSc, BSc (Hons), MIEI
Mr. Kevin Donlon (KD)	Project Engineer, Langan Consulting Engineers	B.E. MIEI
Mr. Tim McHugh (TMcH)	Associate Director, Langan Consulting Engineers	B.E. CEng MIEI, CMarEng MIMarEST
Mr. James Langan (JL)	Director, Langan Consulting Engineers	B.E. CEng MIEI FConsEI

TABLE OF CONTENTS

1	PROJECT DETAILS	4
	1.1 INTRODUCTION.....	4
	1.2 PROPOSED DEVELOPMENT.....	5
	1.1 STUDY AREA	5
	1.2 SITE VISIT AND SURVEYS.....	5
	1.3 ASSUMPTIONS.....	5
	1.4 ABBREVIATIONS AND DEFINITIONS	6
2	SITE CHARACTERISTICS	7
	2.1 SITE TOPOGRAPHY	7
	2.2 HYDROLOGY	7
	2.3 GEOLOGY AND HYDROGEOLOGY.....	12
3	BACKGROUND INFORMATION.....	15
	3.1 HISTORICAL FLOODING	15
	3.2 OPW PFRA INDICATIVE FLOOD MAPS	18
	3.3 PREDICTIVE FLOOD MAPS PRODUCED UNDER THE CFRAM STUDIES	19
	3.4 RIVER BASIN MANAGEMENT PLANS AND REPORTS.....	20
	3.5 BENEFITTING LANDS	20
	3.6 NATIONAL COASTAL PROTECTION STRATEGY STUDY	21
	3.7 TOPOGRAPHICAL MAPS.....	21
	3.8 INFORMATION ON FLOOD DEFENCE	21
	3.9 NATIONAL, REGIONAL AND LOCAL SPATIAL PLANS	21
4	FLOOD RISK ASSESSMENT	23
	4.1 FLOOD SOURCES AT THE SITE	23
	4.2 FLOOD ZONES.....	23
	4.3 RESIDUAL RISK.....	24
	4.4 APPROPRIATENESS OF DEVELOPMENT.....	25
	4.5 IMPACT OF DEVELOPMENT OF FLOODING ELSEWHERE	25
5	CONCLUSIONS & GENERAL RECOMMENDATIONS	26
	5.1 CONCLUSION	26
	5.2 RECOMMENDATIONS.....	26

APPENDIX A:	PROPOSED SITE LAYOUT	
APPENDIX B:	FLOOD RISK ASSESSMENT – ZONING	

LIST OF FIGURES

Figure 1.1 Location of the proposed development lands	4
Figure 1.2 Location of the proposed development lands	5
Figure 2.1 View of the proposed development lands (facing south)	7
Figure 2.2 Regional drainage network overview	9
Figure 2.3 Local drainage network overview	9
Figure 2.4 View of bridge no. 1 (facing downstream) 21 st Feb 2020.	10
Figure 2.5 View of bridge no. 2 (facing upstream) 20 th Jan 2020.	10
Figure 2.6 View of unnamed watercourse, catchment no.1 (facing downstream) 20 th Jan 2020.	11
Figure 2.7 View of historical drainage feature (catchment no.2) 20 th Jan 2020	11
Figure 2.8 View of ponding at localised depression (catchment no.2) 15 th Feb 2020.	12
Figure 2.9 GSI soils mapping	13
Figure 2.10 GSI bedrock mapping	14
Figure 2.11 GSI groundwater aquifer mapping	14
Figure 3.1 OSI Historical 25-Inch (1888-1913).....	15
Figure 3.2 OSI Historical 6-Inch colour (1837-1842).....	16
Figure 3.3 Floodmaps.ie – flood report	17
Figure 3.4 Floodinfo.ie – flood report	17
Figure 3.5 PFRA mapping	19
Figure 3.6 CFRAM Fluvial flood map (current scenario).....	20

Figure 3.7 OPW benefiting lands21
Figure 3.8 Westport land zoning map22

LIST OF TABLES

Table 3.1 CFRAM AFA Fluvial flood level 19
Table 4.1 Flood zone levels.....24

1 PROJECT DETAILS

1.1 INTRODUCTION

A residential development is being considered at the above address. Langan Consulting Engineers (LCE) was appointed to carry out a Flood Risk Assessment (FRA) to support the feasibility study.

This FRA comprises of:

- a desk study.
- a site visit and survey.
- a detailed assessment based on the Office of Public Works (OPW) “Planning System and Flood Risk Management Guidelines” as published in November 2009 by the Department of the Environment, Heritage and Local Government¹;

The location of the proposed development is shown in Figure 1.1. and Figure 1.2 below.

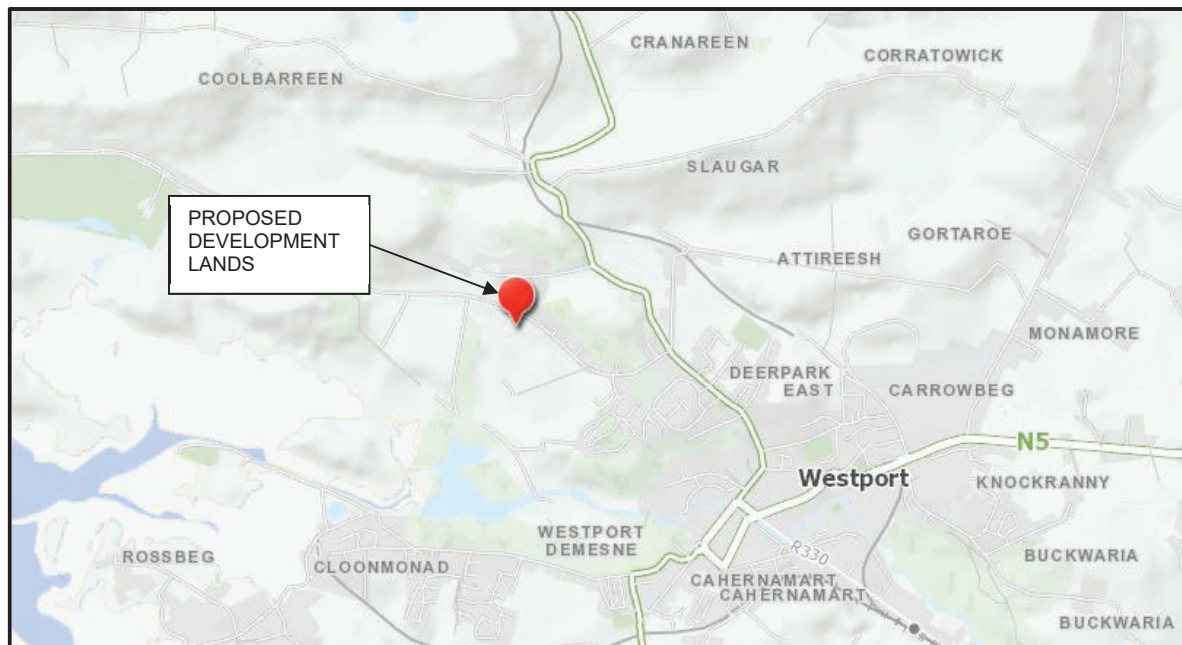


Figure 1.1 Location of the proposed development lands

¹ “Planning System and Flood Risk Management Guidelines” published in November 2009 by the Department of the Environment, Heritage and Local Government, including the Technical Appendices.



Figure 1.2 Location of the proposed development lands

1.2 PROPOSED DEVELOPMENT

The proposed development comprises of a new residential development with associated ancillary works. The proposed site layout plan is included in Appendix A of this report. **[HOLD]**

1.1 STUDY AREA

The study area considered for this report focus' on:

- The proposed development lands, within the red line boundary; and
- The primary access to the proposed development lands.

1.2 SITE VISIT AND SURVEYS

The proposed development lands were visited on the 3rd of December 2019. A topographical survey of hydraulic features in the vicinity of the proposed development lands was carried out by LCE. The survey is relative to Irish Transverse Mercator (ITM) and Ordnance Datum Malin Head [Geoid: OSGM02]. A second site walkover was carried out on the 21st of February 2020 during an extreme weather event.

1.3 ASSUMPTIONS

This report is based on the following assumptions:

- All development information is based on a data provided by Client.
- It is assumed all 3rd party information is current and accurate.
- Prediction of future flood levels is based on available historical records.
- The impact climate change will have on future trends is accounted for, however there remains a residual uncertainty in the prediction of the impact of climate change on flooding.
- The findings are subject to adequate design and maintenance of drainage networks and flood defences.
- River slopes are based on water levels.
- It is assumed that CFRAM Ordnance Datum levels are provided based on the OSGM02 Geoid.

1.4 ABBREVIATIONS AND DEFINITIONS

1.4.1 ABBREVIATIONS

AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
CFRAM	Catchment Flood Risk Assessment and Management
CIRIA	Construction Industry Research and Information Association
EPA	Environmental Protection Agency
FRA	Flood Risk Assessment
FSU	Flood Studies Update
GSI	Geological Survey of Ireland
ha	hectares
ITM	Irish Transverse Mercator
LAP	Local Area Plan
LCE	Langan Consulting Engineers Ltd
mOD	Meters Ordnance Datum (Malin, unless otherwise noted)
MRFS	Mid-range Future Scenario
OPW	Office of Public Works
PFRA	Preliminary Flood Risk Assessment
RBMP	River Basin Management Plans
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems

1.4.2 KEY DEFINITIONS

<i>Alluvium</i>	<i>A deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.</i>
<i>Fluvial flooding</i>	<i>Riverine flooding, where excessive flooding over an extended period of time causes a river to exceed its capacity.</i>
<i>Pluvial flooding</i>	<i>Surface water flooding caused directly from heavy rainfall events (rather than over-flowing rivers).</i>

2 SITE CHARACTERISTICS²

2.1 SITE TOPOGRAPHY

The proposed development land is a green-field site in an urban area. Ground levels within the proposed development land range between +5.20mOD to +18.60mOD.

The north-eastern boundary of the proposed development lands is formed by a national secondary road, 'The Golf Course Road'. The levels on this road in the vicinity of the proposed development lands vary from +8.30mOD to +13.60mOD. The west, south and east of the proposed development lands are bounded by lands historically part of the Estate of Westport House. These lands now service agricultural lands, private access roads, a public road and amenity facilities. Levels on the eastern access road vary from +13.40mOD to +13.1mOD in the vicinity of the proposed development lands. Levels on the western private road in the vicinity of the proposed development lands vary from +13.30mOD to +13.50mOD. Levels on the southern public road in the vicinity of the proposed development lands vary from +6.10mOD to +7.9mOD.

Archaeology works were on-going at the time the lands were visited.

The view of the entrance to the proposed development lands looking south is shown in Figure 2.1 below.



Figure 2.1 View of the proposed development lands (facing south)

2.2 HYDROLOGY

2.2.1 RAINFALL

The standard annual average rainfall (SAAR) for the area is estimated as 1709.15mm³.

² www.gsi.ie

³ Flood Studies Update (FSU) Programme, OPW 2014

2.2.2 CATCHMENT CHARACTERISTICS

The proposed development land has 2 no. distinct drainage catchments, defined by central localised elevated lands. Catchments and drainage characteristics of the proposed development lands are shown in drawing ref 19166-DG-2301 in appendix B of this report.

2.2.3 SURFACE HYDROLOGY

2.2.3.1 REGIONAL HYDROLOGY

Regionally the proposed development lands are located within the Western Basin District. A description of the drainage features and surface hydrology is included in section 2.2.3.2 below.

2.2.3.2 DRAINAGE CHARACTERISTICS

An overview of the regional drainage network is outlined in Figure 2.2. An overview of the local drainage network is outlined in Figure 2.3.

Photography of adjacent hydraulic features are shown in Figure 2.4 to Figure 2.8 below.

DRAINAGE CATCHMENT NO. 1

This catchment comprises of approximately 40% of the development lands, the north-western portion of the proposed development lands. The majority of stormwater in this catchment is drained towards a local depression along the southwestern boundary. A one-off type residential development is located immediately downstream of this depression. The remainder of the catchment drains to an unnamed watercourse within the north-west boundary of the proposed development lands. This watercourse enters the proposed development lands under a bridge (bridge no. 1), which services *'The Golf Course Road'*. This bridge comprises of a combination of concrete pipes and channels, approximately 13m in length and 15m in width. The recorded deck, soffit and water levels at this bridge were +13.60mOD, +12.20mOD and +11.80mOD, respectively. Evidence of debris was noted at the inlet side of the bridge on the day of inspection. There was limited freeboard noted during an extreme weather event in February. The stream exits the proposed development lands via a second bridge (bridge no. 2) which services a local private access road. This bridge comprises of two concrete pipes. The bridge is approximately 6m and 4m in length and width, respectively. Deck, soffit, and water levels at this bridge were recorded at +13.40mOD, +12.40mOD and +11.20mOD, respectively. The watercourse then continues to flow in a south-westerly direction away from the proposed development lands for approximately 0.8km before discharging into Westport Bay.

DRAINAGE CATCHMENT NO. 2

This catchment comprises of approximately 60% of the development lands, the south-eastern-western portion of the proposed development lands. Stormwater in this catchment drains to a localised depression located close to the southwestern boundary of the proposed development lands. No watercourses were recorded within this catchment. 2 no. historical drainage features were noted centrally in this catchment. Some stormwater/groundwater was noted in both features; however, it was not possible to determine the direction, type or condition of outfalls servicing these features. 2 no. public drainage services were noted on the south-eastern side of the public road, flowing in a westerly direction. It appears that soil infiltration and these drainage services provide an outfall for stormwater in catchment no.2. No ponding was noted on the lower lands during the December walkover. Some stormwater ponding was noted during the February walkover, see Figure 2.8 below.

The adjacent Estate of Westport House was developed circa 1700. This assessment notes arterial drainage works were often carried out during the development of estates. Records of any historical drainage works may be useful in clarifying the existing drainage scenario. No records were available at the time of report writing.

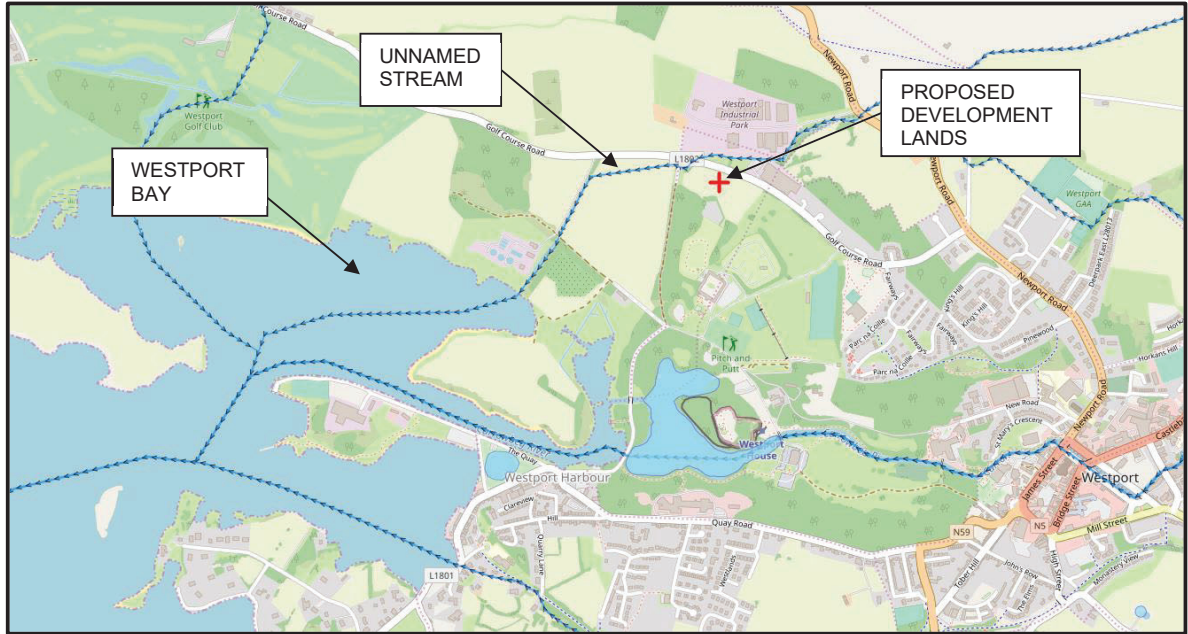


Figure 2.2 Regional drainage network overview⁴



Figure 2.3 Local drainage network overview

⁴ www.epa.ie



Figure 2.4 View of bridge no. 1 (facing downstream) 21st Feb 2020.



Figure 2.5 View of bridge no. 2 (facing upstream) 20th Jan 2020.



Figure 2.6 View of unnamed watercourse, catchment no.1 (facing downstream) 20th Jan 2020.



Figure 2.7 View of historical drainage feature (catchment no.2) 20th Jan 2020



Figure 2.8 View of ponding at localised depression (catchment no.2) 15th Feb 2020.

2.2.4 GROUNDWATER HYDROLOGY²

The proposed development lands are located within the Newport groundwater body. The flow regime is noted as “*Karstic*”. The groundwater vulnerability is noted as High. The recharge coefficient for the underlying aquifer 20% to 60%.

2.3 GEOLOGY AND HYDROGEOLOGY²

2.3.1 SOILS

GSI soil maps (see Figure 2.9) show soils in the vicinity of the proposed development lands are classed as “*Till derived from limestones*” and “*Urban*”.

There are no alluvium soils in the vicinity of the proposed development lands.

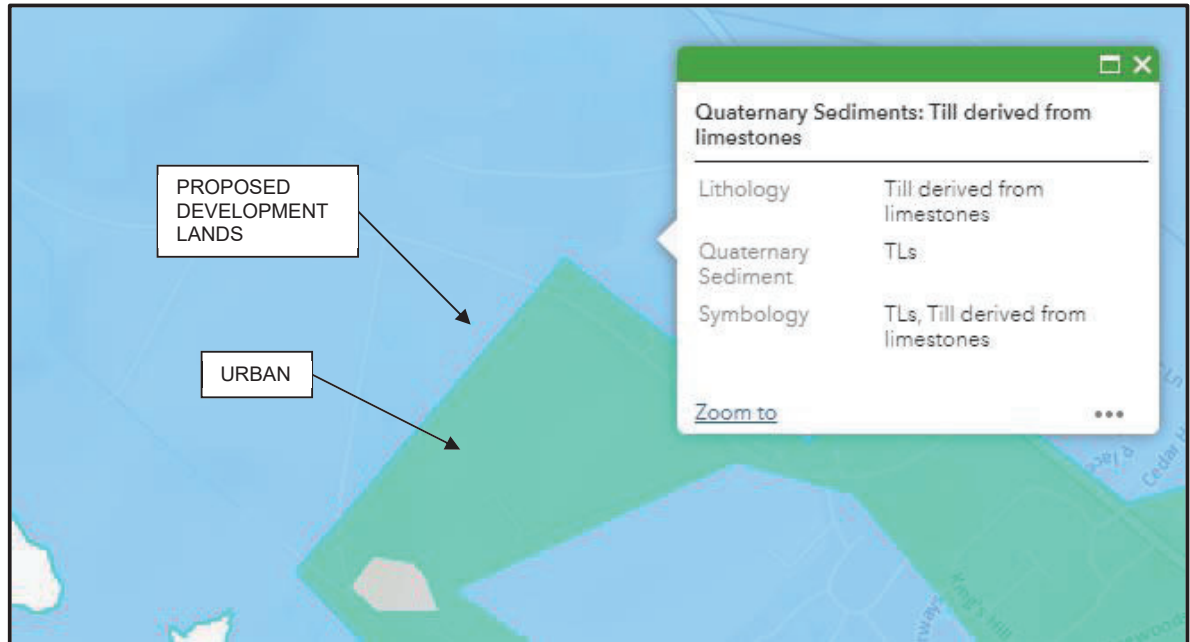


Figure 2.9 GSI soils mapping²

2.3.2 BEDROCK

The Geological Survey of Ireland (GSI) national bedrock map (1:1,000,000) shows the bedrock geology at the proposed development lands as, "*Visean limestone & calcareous shale*". The area is classified as a "*Regionally important Aquifer*" (see Figure 2.10 and Figure 2.11 below).

There are no karst features noted in the vicinity of the proposed development lands.

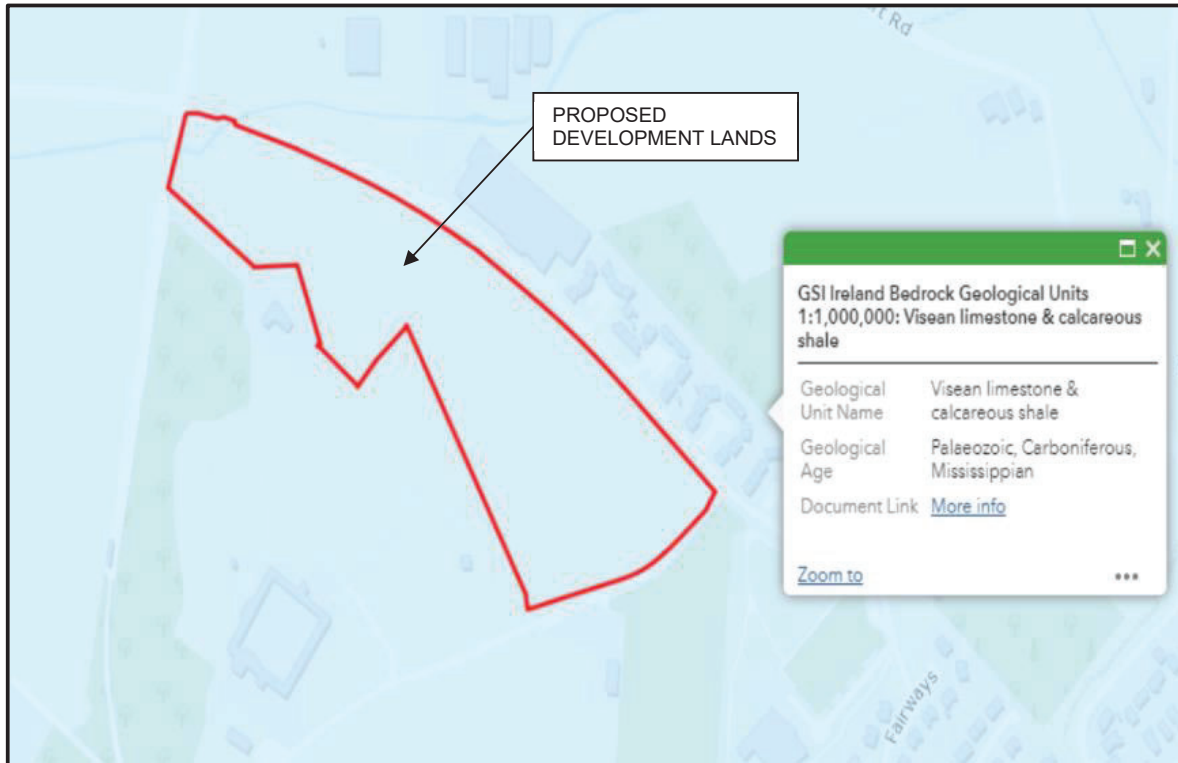


Figure 2.10 GSI bedrock mapping

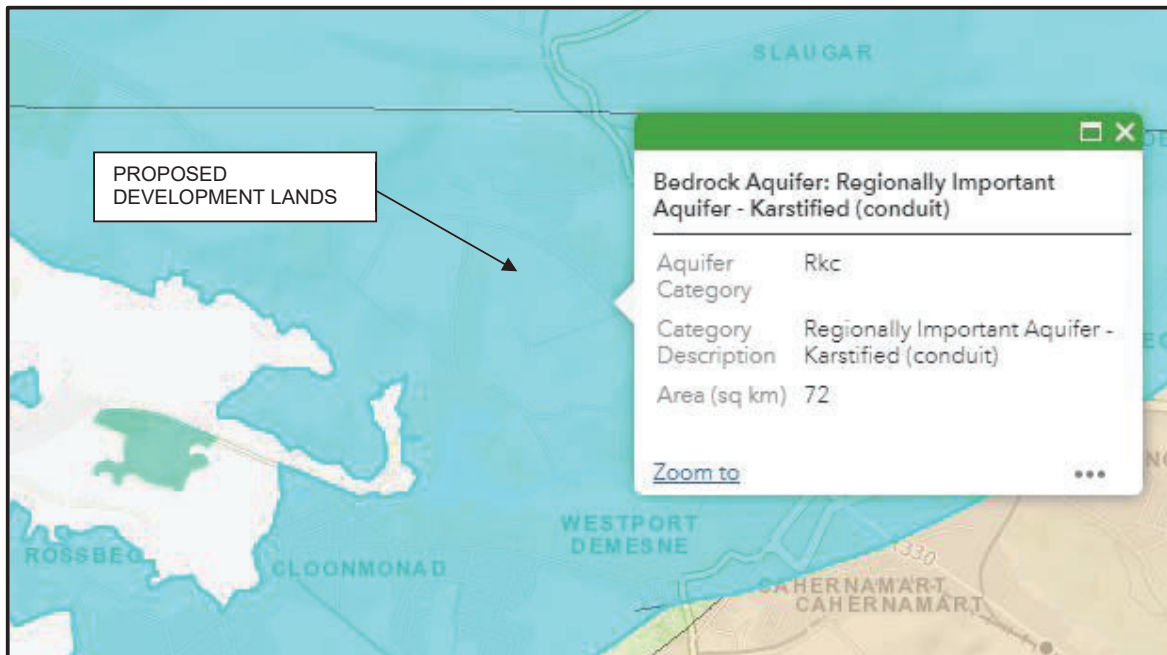


Figure 2.11 GSI groundwater aquifer mapping

3 BACKGROUND INFORMATION

In order to inform the assessment of flood risk at the proposed development lands, the following information sources were explored.

3.1 HISTORICAL FLOODING

3.1.1 HISTORICAL ORDNANCE SURVEY MAPPING⁵

Available historical maps were researched. The historical mapping for the proposed development land is shown in Figure 3.1 and Figure 3.2. There is no reference to any flooding in the vicinity of the proposed development lands.

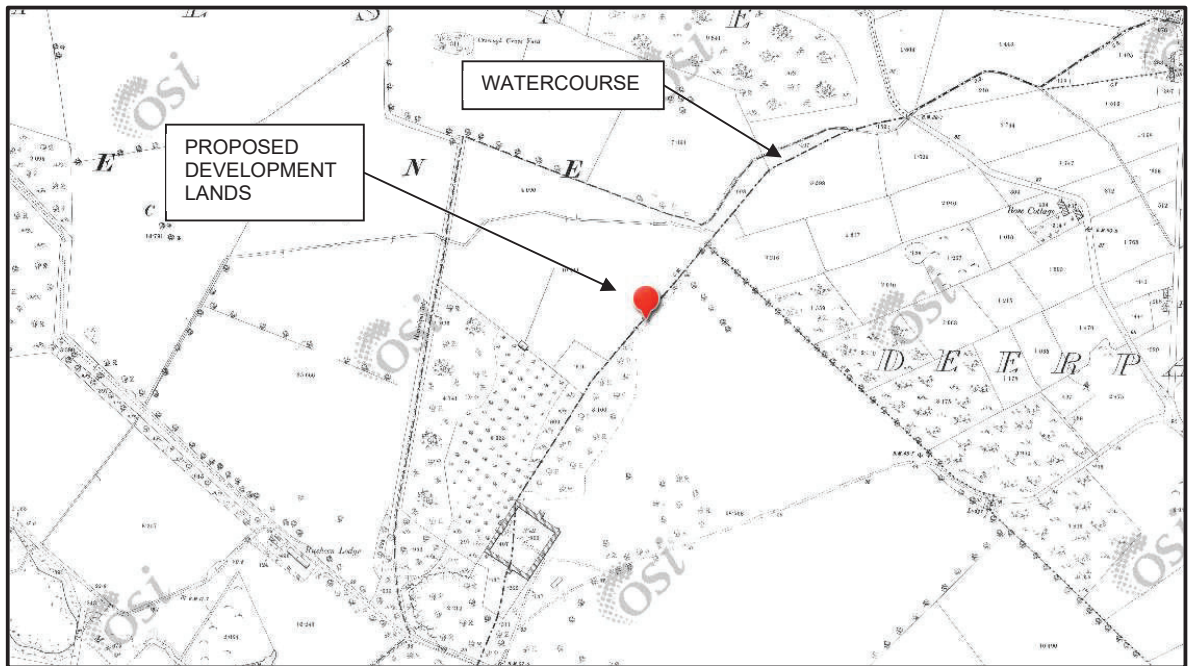


Figure 3.1 OSI Historical 25-Inch (1888-1913)

⁵ www.osi.ie

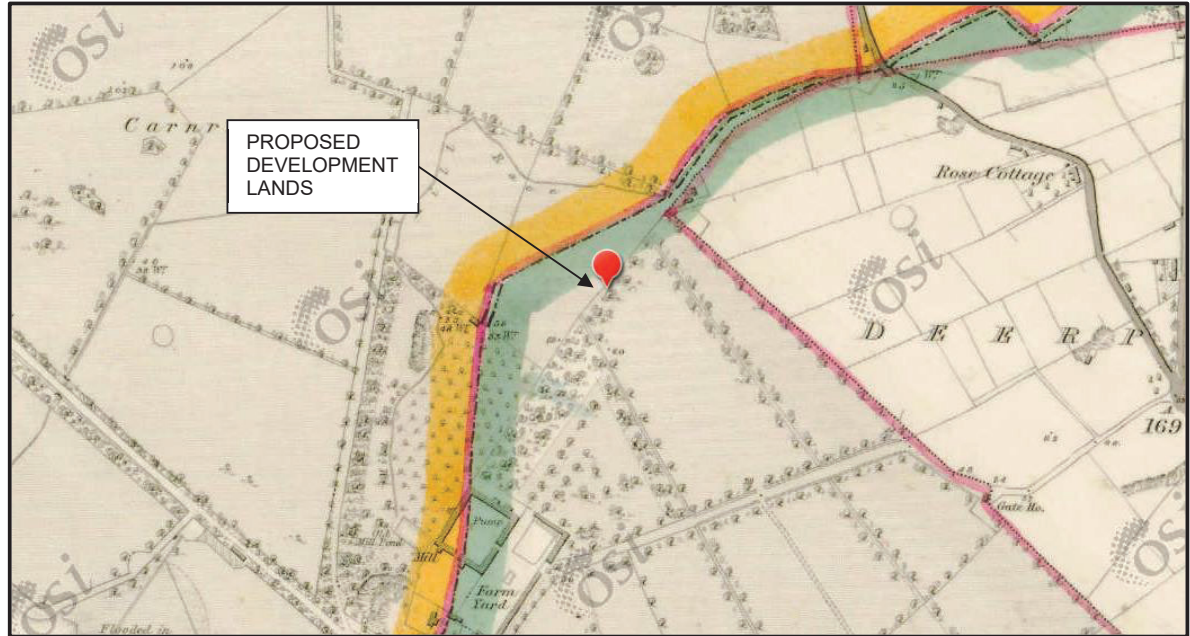


Figure 3.2 OSI Historical 6-Inch colour (1837-1842)

3.1.2 PUBLIC FLOODING RECORDS

Available historical flood maps and reports on floodmaps.ie⁶ and floodinfo.ie⁷ were consulted. The floodmaps.ie report mapping for the proposed development lands is shown in Figure 3.3 below. The floodinfo.ie report mapping for lands in the vicinity of the proposed development lands is shown in Figure 3.4 below. There are no historical flood events noted at the proposed development lands.

⁶ www.floodmaps.ie

⁷ www.floodinfo.ie

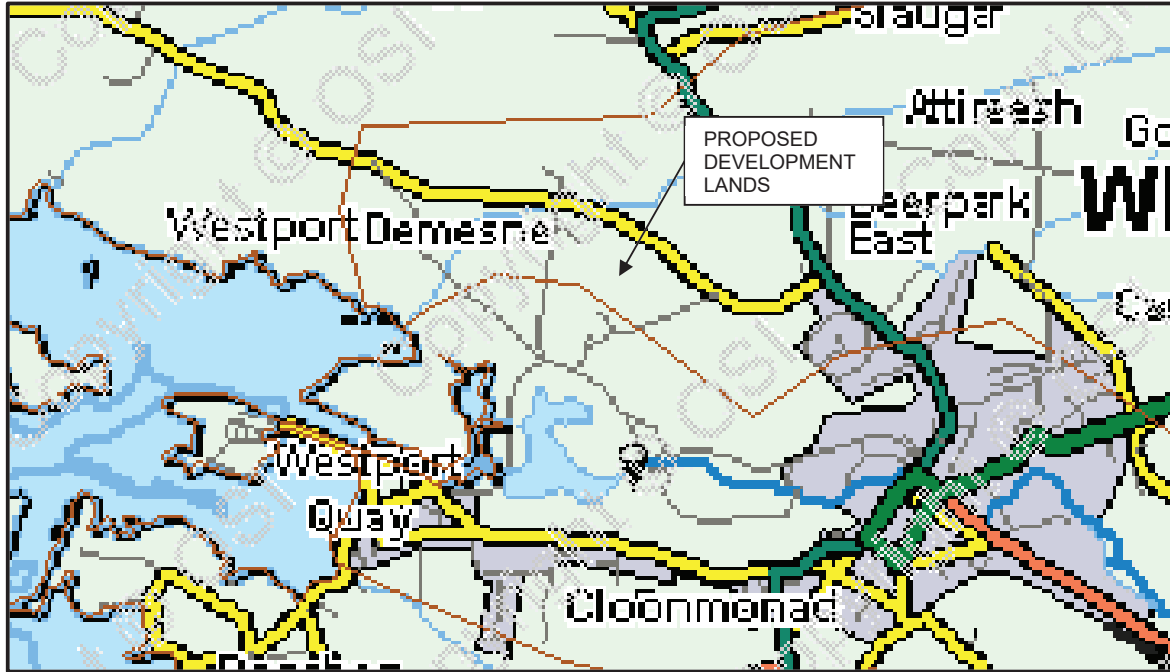


Figure 3.3 Floodmaps.ie – flood report⁶

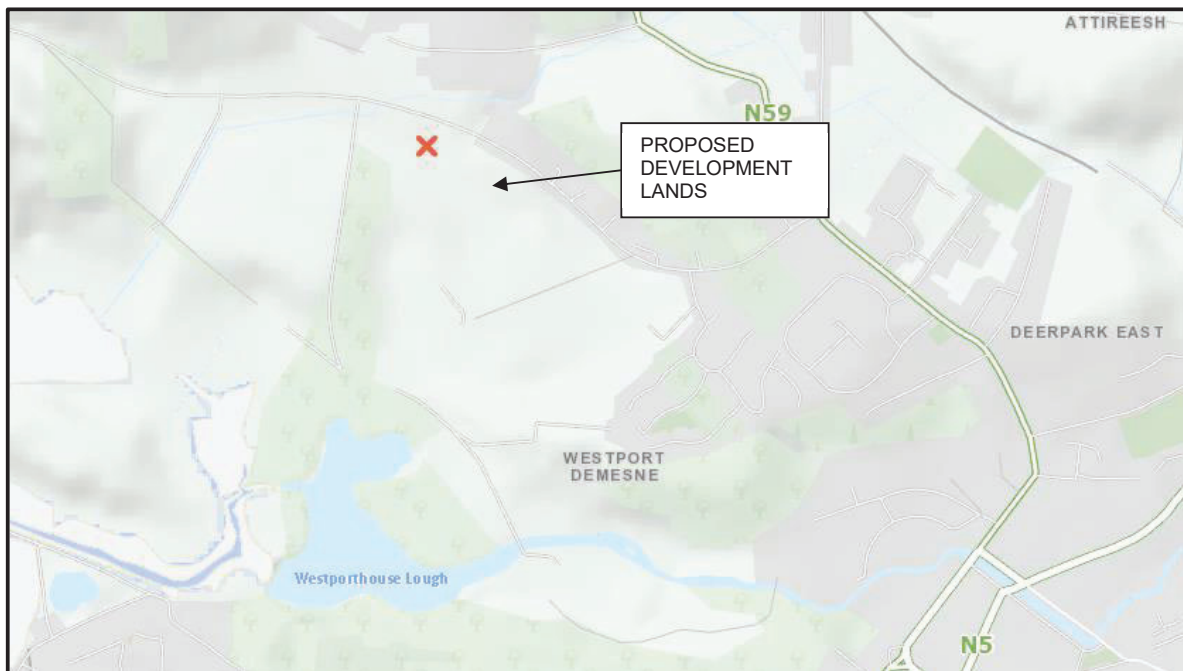


Figure 3.4 Floodinfo.ie – flood report⁷

3.1.3 ANECDOTAL EVIDENCE

The following anecdotal evidence of flooding was collected by LCE in February 2020.

LCE contacted Mr. Paddy Cummins, G.S.S. Westport Office, Mayo County Council on the 20th of February 2020. He has knowledge of this area for over 24 years. He noted lands adjacent to the entrance road to Westport House have poor soil infiltration capacity. He noted that he has witnessed some stormwater

ponding on only this portion of the proposed development lands. He noted some remedial works were carried out to the piped public drainage services prior to his appointment 24 years to the council. Since then, he is not aware of any ongoing issues with these drainage services.

3.1.4 CONSULTATION WITH LOCAL AUTHORITIES

Mr. Tomás McLoughlin, Westport Area Engineer was contacted on the 20th of January 2020. LCE notified the area engineer that a flood risk assessment is currently being prepared for the proposed development lands. LCE requested feedback on historical flooding records.

Mr. Tomás McLoughlin confirmed on the 5th of February last, that his appointment to the Westport Area is relatively new, in this time he was not aware of any ongoing flood or drainage issues in the vicinity of proposed development lands. Refer to Section 3.1.3 Mr. Paddy Cummins for further local authority records.

3.1.5 HISTORICAL FLOODING CONCLUSION

There are records of ongoing pluvial flooding over a small portion of land within the southwestern extents of the proposed development lands, see Figure 2.8 above.

3.2 OPW PFRA INDICATIVE FLOOD MAPS

The OPW Preliminary Flood Risk Assessment (PFRA) maps are the preliminary flood risk maps as part of the Catchment Flood Risk Assessment and Management (CFRAM) programme. These maps highlight areas of potential flood risk.

Available CFRAM PFRA flood maps were consulted⁸. The PFRA mapping in the vicinity of for the proposed development lands is shown in Figure 3.5.

There is a fluvial risk during a 1 in 100-year event noted in catchment no.1 of the proposed development lands on the PFRA mapping. There is a pluvial risk during a 1 in 100-year event noted in catchment no.2 of the proposed development lands on the PFRA mapping. PFRA mapping also shows some ponding occurring at the southern portion of Catchment no. 2 during an extreme flood event.

However, these maps are of coarse resolution therefore a more localised assessment is required.

⁸ OPW CFRAM data

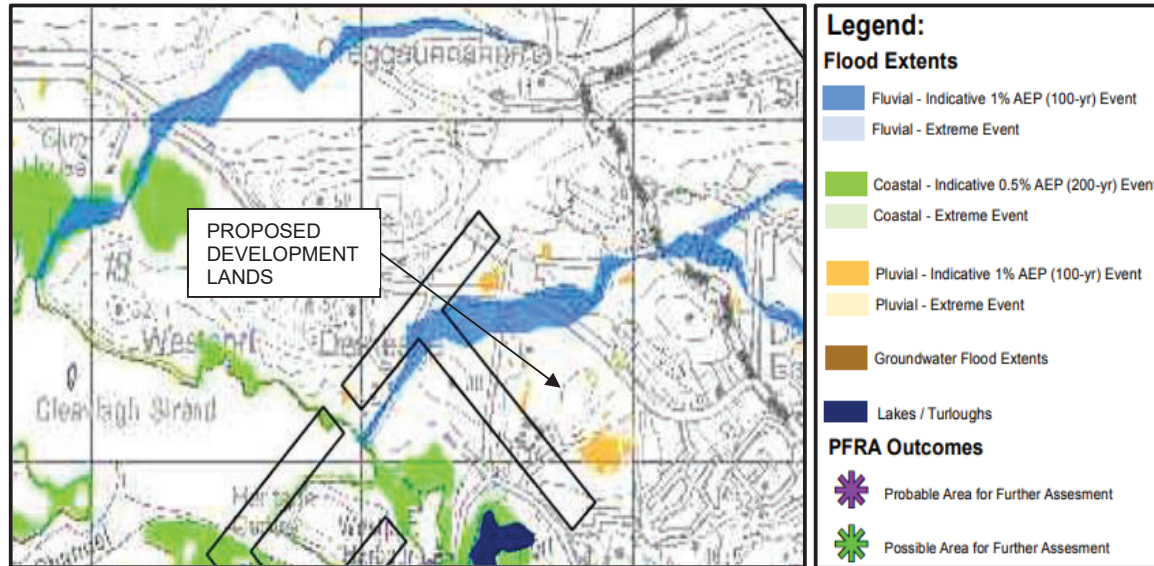


Figure 3.5 PFRA mapping

3.3 PREDICTIVE FLOOD MAPS PRODUCED UNDER THE CFRAM STUDIES

Predictive flood extent maps have been produced by the OPW as part of the Catchment Flood Risk Assessment and Management (CFRAM) programme. These maps highlight areas of potential flood risk, excluding and including an allowance for climate change.

The CFRAM AFA fluvial flood extent maps for the adjacent unnamed watercourse servicing catchment no.1 were consulted. The CFRAM AFA map no. W32WPT_EXFCD_F2_01 is shown in Figure 3.6. below. The mapping estimates a portion of the proposed development land is subject to flooding. It suggests the watercourse in catchment no.1 overflows the *Golf Course Rd* during this event. LCE note that there is an existing dwelling in the path of this estimated flood overflow.

The CFRAM AFA estimated fluvial flood level for the 1 in 10-year, 1 in 100-year and 1 in 1000-year events at the proposed development land is provided in Table 3.1 for the current day scenario.

Table 3.1 CFRAM AFA Fluvial flood level

Scenario	Node	Water Level (mOD Malin) per Annual Exceedance Probability (AEP)		
		1 in 10-year (10% AEP)	1 in 100-year (1% AEP)	1 in 1000-year (0.1% AEP)
Current day	32COOL0074A	+12.15	+12.35	+12.57

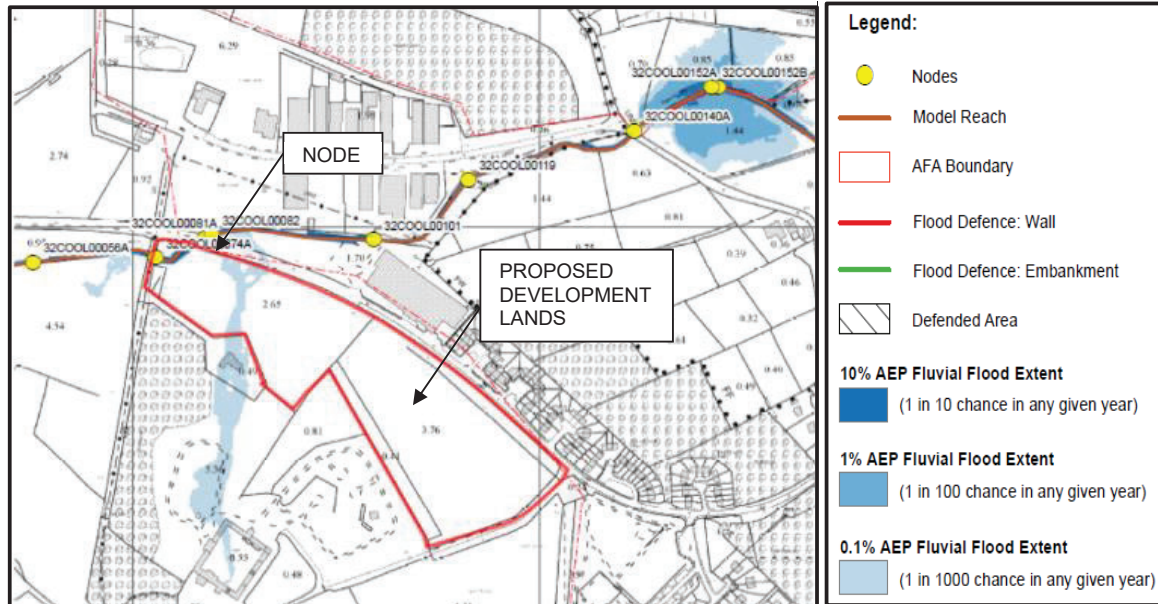


Figure 3.6 CFRAM Fluvial flood map (current scenario)

3.4 RIVER BASIN MANAGEMENT PLANS AND REPORTS

The Water Framework Directive was adopted by the EU in order to halt and reverse the decline in water quality. The Directive sets very strict deadlines for meeting water quality objectives, especially in protected areas. The River Basin Management Plans (RBMP) outline what is required in order to achieve the objectives of the Directive in the various River Basin Districts.

The RBMP for Ireland (2018-2021) was published in April 2018.⁹ The RBMP does not contain any information or requirements which impact directly on this site-specific FRA. In line with the objectives of the RBMP all flood mitigation measures should be designed to consider the potential impact of possible measures on water bodies.

Where necessary, surface water run-off from the proposed development should be attenuated on-site, prior to discharge to the adjacent watercourse. This will reduce the quantity of water to be disposed of to the existing watercourses in the vicinity. On-site storm water attenuation will reduce the quantity of water entering the adjacent watercourse during extreme events.

All site drainage should be designed in accordance with Sustainable Drainage systems (SuDS) principles¹⁰.

3.5 BENEFITTING LANDS

The proposed development lands are not identified on the Arterial Drainage mapping as having benefitted by drainage works carried out historically by the OPW. The Arterial Drainage mapping for the proposed development land area is shown in Figure 3.7 below.

The presence of historical drainage features suggests the lands may have benefitted from arterial drainage works during the establishment of the Estate of Westport House. No records are available of these works.

⁹ River Basin Management Plan for Ireland 2018-2021, as prepared by the Department of Housing, Planning and Local Government, April 2018.

¹⁰ CIRIA C609 Sustainable drainage systems.

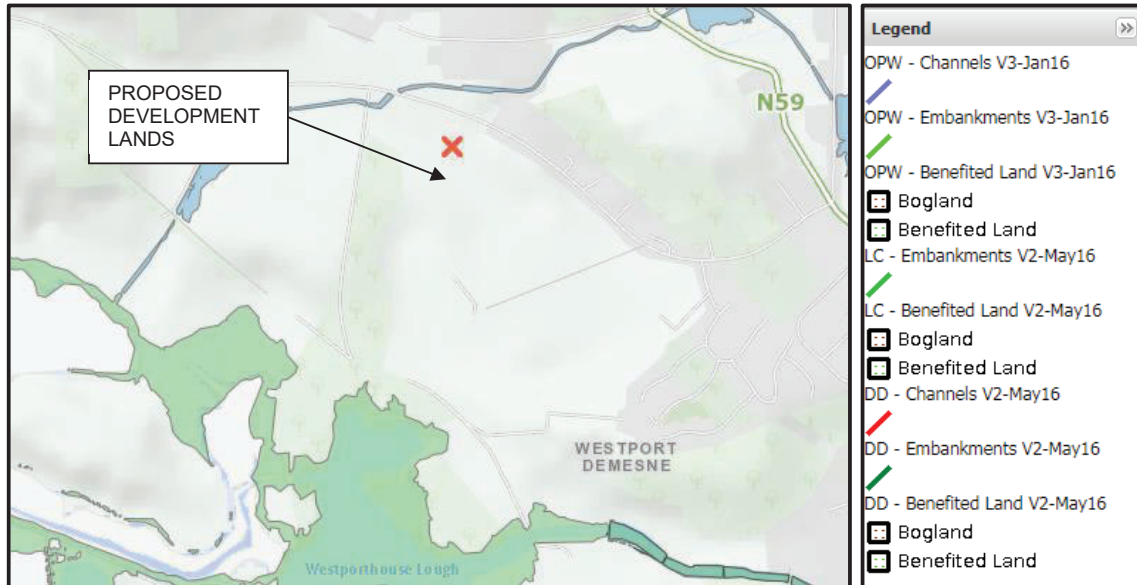


Figure 3.7 OPW benefiting lands²

3.6 NATIONAL COASTAL PROTECTION STRATEGY STUDY

The National Coastal Protection Strategic Study maps highlight areas of potential flood risk from extreme tidal events, including storm surge.

The proposed development land is less than 1 km from the coast; however, it is sufficiently elevated to mitigate against coastal flooding.

3.7 TOPOGRAPHICAL MAPS

Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques. These maps provide greater accuracy for site-specific flood extent based on river and coastal modelling.

LCE's site survey is used to develop flood zone mapping. This site survey is the basis for all level references in this report. The site survey is used to develop flood zone mapping, as described in Section 4 below.

Site-specific flood zone mapping is included in Appendix B.

3.8 INFORMATION ON FLOOD DEFENCE

Site survey/ walkovers provide details of existing flood defences, their condition and performance.

There were no flood defences noted in the vicinity of the proposed development lands.

3.9 NATIONAL, REGIONAL AND LOCAL SPATIAL PLANS

Development plans and Local Area Plans (LAP) provide key information on existing and potential future receptors.

The proposed development lands are included in the Westport town development plan.¹¹ The development plan zones the lands for residential development. The development plan has the land zoned as A1

¹¹ Westport Town & Environs Development Plan 2010-2016

Residential Phase I High Density and A2 Residential Phase I Medium Density. The land zoning map for the proposed development lands is shown in Figure 3.8 below.

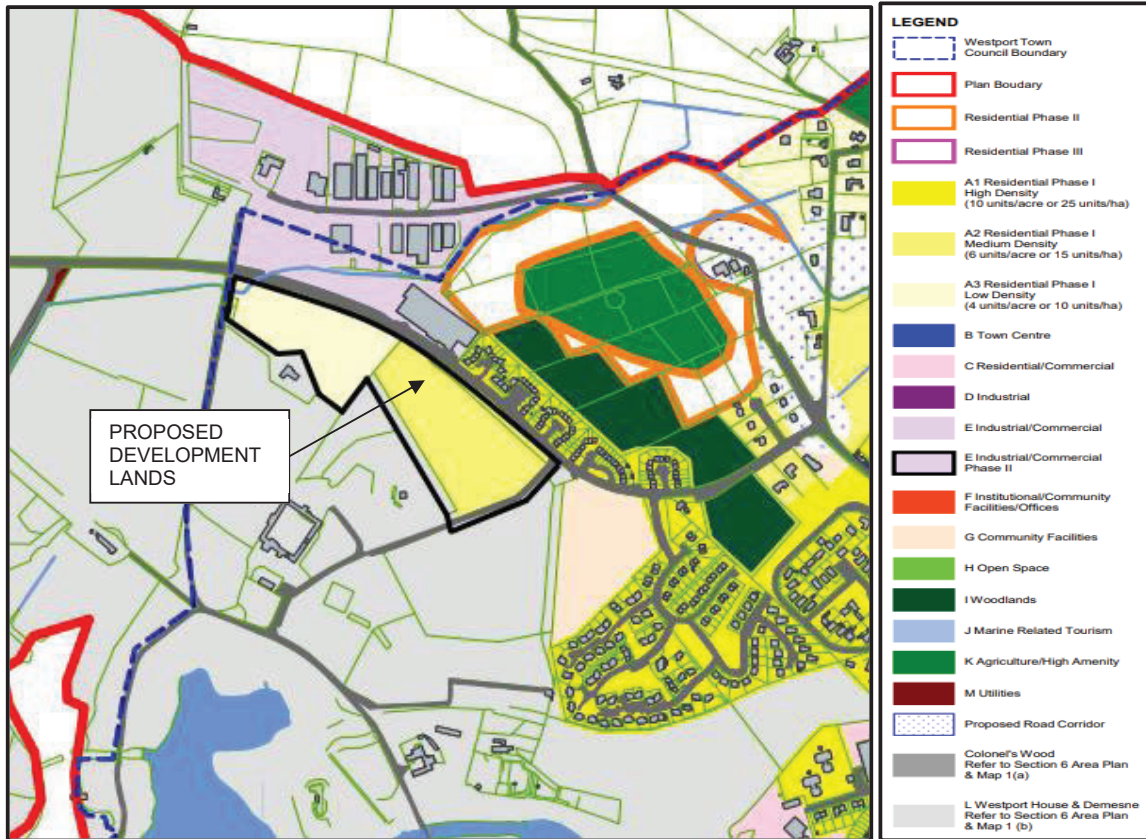


Figure 3.8 Westport land zoning map

4 FLOOD RISK ASSESSMENT

4.1 FLOOD SOURCES AT THE SITE

The following potential flood sources exist at the proposed development lands:

- a) Fluvial flooding from adjacent unnamed watercourses, and
- b) Pluvial flooding from rainfall and surface water run-off,

4.1.1 CATCHMENT NO.1:

There is a fluvial flood risk in catchment no.1 from a watercourse that traverses the proposed development lands.

The development may generate a secondary flood risk to an adjacent property from storm water generated within the proposed development land. An outfall for same was not identified in this study.

Storm water design and management of surface water will be the critical factor in the mitigation of this type of flood risk at the proposed development lands, with particular attention to an existing adjacent residential development.

4.1.2 CATCHMENT NO.2:

No fluvial flood risk source was identified in catchment no.2.

A pluvial flood risk exists in catchment no.2. This risk is increased with storm water generated within the proposed development land. The catchment is serviced by both historical drainage and piped public drainage networks.

Storm water design and management of surface water will be the critical factor in the mitigation of this type of flood risk at the proposed development land.

4.2 FLOOD ZONES

4.2.1 ZONE DEFINITIONS

The "Planning System and Flood Risk Management Guidelines" as published in November 2009 by the Department of the Environment, Heritage and Local Government use three different flood zones to define areas of flood risk¹. 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 for the purposes of these guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1 in 100-year for river flooding and 1 in 200-year for coastal flooding). Only water-compatible development, such as docks and marinas, dockside activities that require a waterside location, amenity open space, outdoor sports, and recreation, would be considered appropriate in this zone.

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 1 in 1000-year and 1 in 100-year for river flooding and between 1 in 1000-year and 200-year for coastal flooding). Less vulnerable development, such as retail, commercial and industrial uses, sites used for short-let for caravans and camping and secondary strategic transport and utilities infrastructure, and water-compatible development might be considered appropriate in this zone.

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 1 in 1000-year for both river and coastal flooding). Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast).

4.2.2 CATCHMENT NO. 1

4.2.2.1 FLOOD ZONE LEVELS

Flood zones are defined on the basis of the 1 in 100-year and 1 in 1000-year extreme water levels from various flood sources. The results of the modelling carried out for the CFRAM AFA studies in the area are available for the present and future scenario. These model results and a site-specific topographical survey were used to establish the flood zoning at the proposed development lands.

The estimated modelled water level for the 1 in 100-year and 1 in 1000-year return period is provided in Table 4.1 below.

Table 4.1 Flood zone levels

Flood Zone	Flood Probability	Level (mOD)
A	Greater than 1% (1 in 100-year)	Below +12.35
B	1% (1 in 100-year) to 0.1% (1 in 1000-year)	+12.35 to +12.57
C	Smaller than 0.1% (1 in 1000-year)	Above +12.57

The flood zones for the proposed development lands are outlined on drawing no. 19166-DG-2301 in Appendix B.

These flood zones are based on the levels in Table 4.1 above and the existing site levels from topographical surveys. Some interpolation was required to establish contours for flood zone extents.

The subject proposed development land has been zoned. The proposed development land is located in Flood Zone A, B and C.

4.2.2.2 DESIGN FLOOD LEVEL

An estimated design flood level is required to ensure the proposed construction is located at a safe level above the potential flood extent. The estimated design flood level for the development is the 1 in 1000-year flood level, including a freeboard factor to account for a margin of safety, climate change and model uncertainty. LCE recommend the damp proof membranes for all structures is constructed 0.1 meters above the safe design flood level.

The estimated design flood level for structures are +13.30mOD.

The estimated design flood level for access and egress are +12.57mOD.

4.2.3 CATCHMENT NO. 2

4.2.3.1 FLOOD ZONE LEVELS

It is not possible to determine pluvial flood zone levels as no direct link to observed flooding extent and rainfall rate was assessed. Additional site investigation, flood level monitoring and hydraulic modelling is required to assess the flood risk.

4.2.3.2 DESIGN FLOOD LEVEL

Similarly, to section 4.2.3.1 above, an estimated design flood level cannot be determined for this catchment at this stage.

4.3 RESIDUAL RISK

There is a residual flood risk at the proposed development lands inherent in the design and maintenance of the drainage network in the vicinity of the proposed development land. This residual risk is mitigated through freeboard; however, all findings are subject to adequate design and maintenance of drainage networks and flood defences.

4.4 APPROPRIATENESS OF DEVELOPMENT

The proposed development is categorised as “residential development” based on the OPW “Planning System and Flood Risk Management Guidelines”. The proposed development is outlined on the site layout drawing in Appendix A. [HOLD]

The proposed development land is classified as within Flood Zone A, B and C. Under the OPW Planning System and Flood Risk Management Guidelines published in November 2009, the subject development type is considered appropriate for Flood Zone C. [HOLD] Flood risk assessment zone mapping is included in Appendix B of this report. [HOLD]

4.5 IMPACT OF DEVELOPMENT OF FLOODING ELSEWHERE

All site surface water management design should consider the impact of any discharge on flooding elsewhere. The final stormwater system should be designed by appropriately qualified and experienced personnel.

Drainage issues noted include culvert capacity on Golf Course road and also ponding (pluvial) on-site. To ensure the development does not impact flood risk to adjacent properties, a drainage design should be prepared and implemented in advance of the proposed development.

5 CONCLUSIONS & GENERAL RECOMMENDATIONS

5.1 CONCLUSION

The proposed development land has 2 no. drainage catchments, defined by central localised elevated lands.

Catchment no. 1

The primary source of flood risk to catchment no.1 is fluvial flooding from adjacent unnamed watercourse. The development may generate a secondary flood risk to an adjacent property from storm water generated within the proposed development land.

Lands in this catchment are not identified on the Arterial Drainage mapping as having benefitted by drainage works carried out historically by the OPW. There is no public or anecdotal evidence of historical flooding occurring within catchment no.1.

CFRAM mapping indicates a central portion of this catchment and the adjacent public road is subject to fluvial flooding during 1 in 100-year flood events. This conflicts with public and anecdotal evidence recorded as part of this assessment.

Catchment no. 2

The primary source of flood risk to catchment no.2 is pluvial flooding.

Lands in this catchment are not identified on the Arterial Drainage mapping as having benefitted by drainage works carried out historically by the OPW. There is evidence of historical drainage works in catchment no. 2, most likely during the development of Westport House Estate. There is evidence of ongoing ponding occurring on a minor portion of low-lying lands within catchment no. 2 (southwestern corner) adjacent to a public road.

CFRAM mapping does not show fluvial flooding in the vicinity of catchment no.2. PFRA mapping shows some ponding occurring at the southern portion of Catchment no. 2 during an extreme flood event and pluvial flooding to the south of Catchment no. 2 during a 1 in 100 year flood event.

Drainage catchment no.1 has been zoned using the available CFRAM model based on the OPW "Planning System and Flood Risk Management Guidelines". The proposed development is located predominantly in Zone A. It is not possible to determine flood zone levels in drainage catchment no.2.

Pluvial flood risk can be mitigated through adequate drainage design. Management of surface water will be a critical factor in the mitigation of flood risk at the proposed development lands. [HOLD]

Based on the location of the proposed development, the existing ground levels and the estimated flood extents, the proposed development is likely to have a negligible impact on the flood storage in the area. [HOLD]

5.2 RECOMMENDATIONS

A review of the CFRAM model of the unnamed watercourse in catchment no.1 should be carried out. The review should consist of additional surveying of the watercourse and adjacent flood plains, together with additional hydraulic modelling to calibrate the model with anecdotal and public records within this area.

A study of the existing drainage infrastructure in catchment no.1 and no.2 should be carried out to assess its condition and capacity to service stormwater from the proposed development. On completion of the above, safe flood design level can be established the design of the proposed development. [HOLD]

There should be no net change in flood storage volume in the proposed development. Where necessary, surface water run-off from the proposed development should be attenuated on-site, prior to discharge to the adjacent watercourse. All site drainage should be designed in accordance with Sustainable Drainage systems (SuDS) principles.

DISCLAIMER

Langan Consulting Engineers (LCE) accepts no liability for any loss or damage arising as a result of any person, other than the named client, acting in reliance on any information, opinion or advice contained in this document. This document and its content are confidential and may not be disclosed, copied, quoted, or published unless, LCE has given its prior written consent. This document may not be relied upon by any person, other than the client, its officers, and employees.

LCE gives no warranty and accepts no liability as to the accuracy or completeness of information provided to it by or on behalf of the client or its representatives and takes no account of matters that existed when the document was transmitted to the client but which were not known to LCE until subsequently.

Analysis contains inherent uncertainty. LCE recommends the application of the upper bound flood level estimate from all analysis, and the inclusion of a min. of 500mm freeboard. Selection of mid-range estimates and lesser freeboard is at the risk of the client and the planning authority. All information relating to drainage and water networks assumes ongoing maintenance of the network and removal of obstructions to flow.

This report is based on available CFRAM and FSU data at the time of appointment. The client is responsible for the cost of any additional services resulting from any CFRAM and FSU updates after this date.

LCE accepts no liability for any matters arising if any recommendations contained in this document are not carried out, or are partially carried out, without further advice being obtained.

No person, including the client, is entitled to use or rely on this document and its contents at any time if any fees (or reimbursement of expenses) due to LCE by its client are outstanding. In those circumstances, LCE may require the return of all copies of this document.

APPENDIX A PROPOSED SITE LAYOUT

APPENDIX B FLOOD RISK ASSESSMENT ZONING

