LANGAN

CONSULTING ENGINEERS

FLOOD RISK ASSESSMENT

RESIDENTIAL DEVELOPMENT AT KILKELLY RD., SWINFORD, CO. MAYO

MAYO COUNTY COUNCIL

18006-RP-2301-FL01 | FEBRUARY 2018

CIVIL
STRUCTURAL
ENVIRONMENTAL

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QUALITY CHECK SHEET

DOCUMENT TITLE: FLOOD RISK ASSESSMENT

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CLIENT: MAYO COUNTY COUNCIL

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 PROJECT DETAILS

1.1 INTRODUCTION

Planning permission is being sought to construct a Residential Development at Kilkelly Rd., Swinford, Co. Mayo. Langan Consulting Engineers (LCE) was appointed to carry out a Flood Risk Assessment (FRA) in support of the planning application.

This FRA comprised of:

- a desk study;
- a site visit; and
- 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 Government[1].

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

[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.

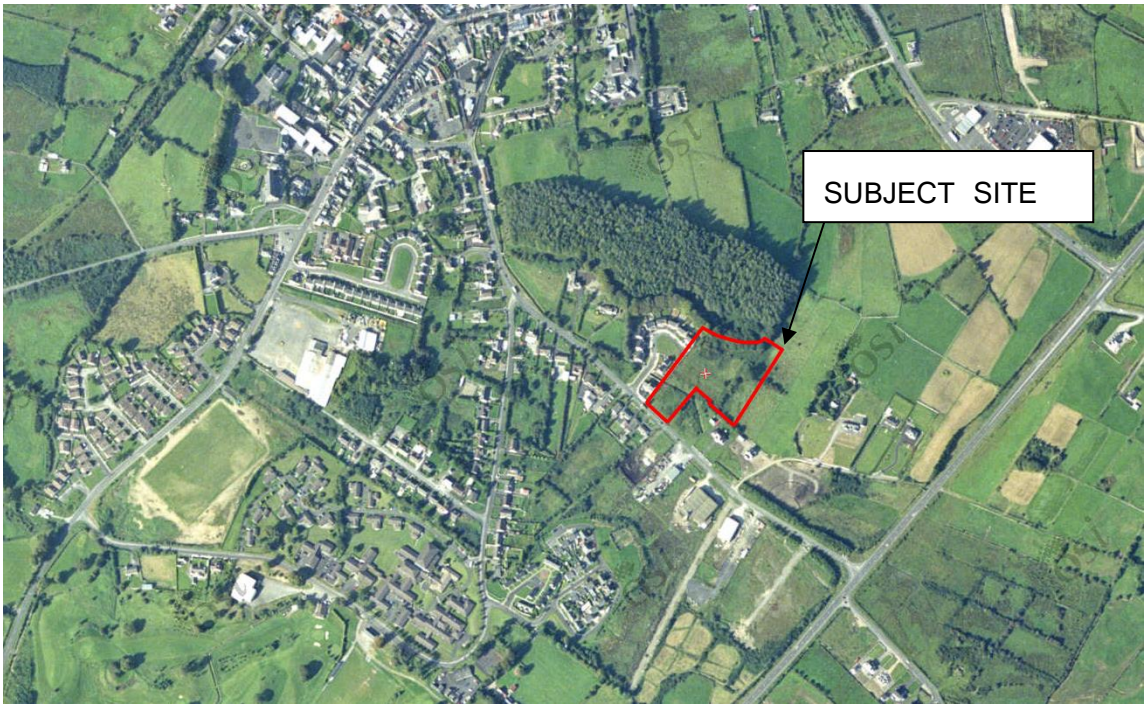

Figure 1.1 Location of the proposed development site

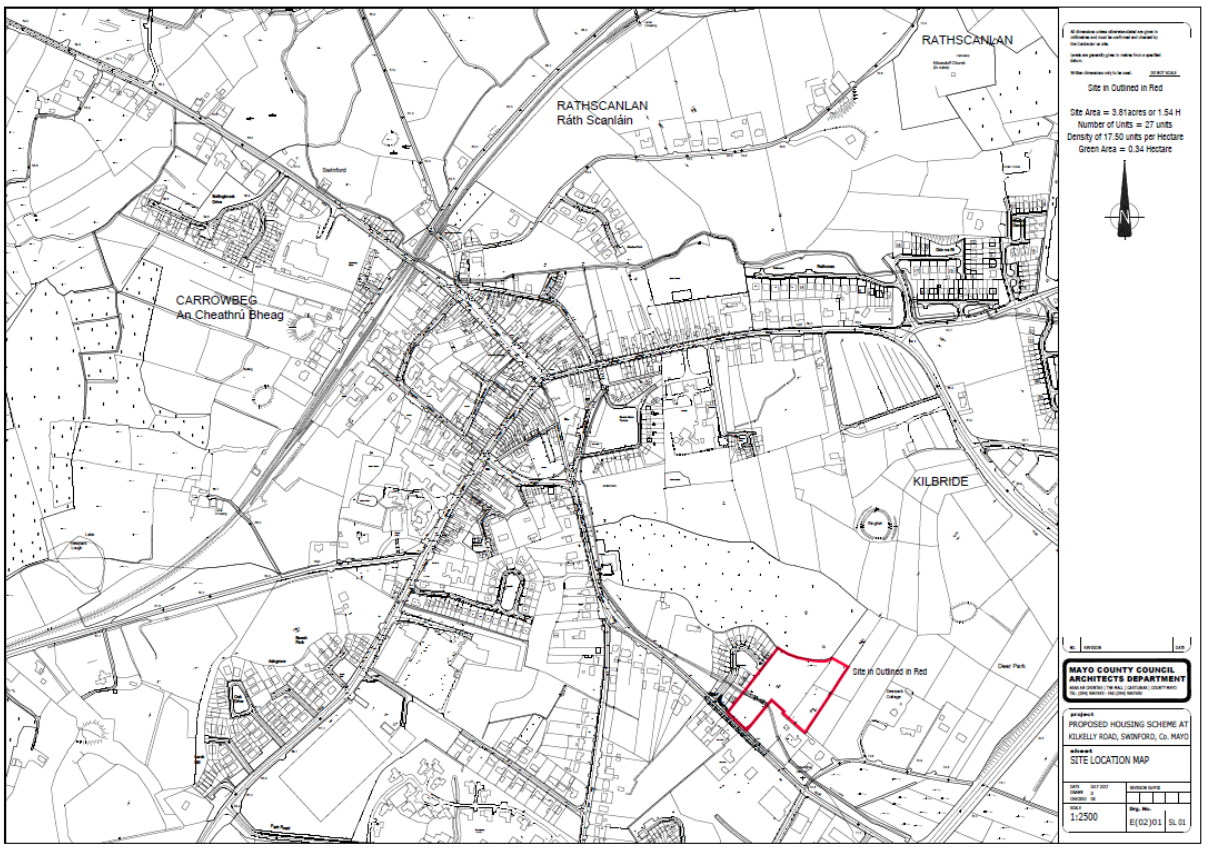

Figure 1.2 Location of the proposed development site (OSI mapping)

1.2 PROPOSED DEVELOPMENT

The application seeks permission to construct a residential development together with ancillary works. The area of the subject site is approximately 1.5ha. The proposed site layout plan for the development is included in Appendix A of this report.

1.3 SITE VISIT AND SURVEY

The subject site was visited on the 29th of January 2018. A topographical survey of the development site was provided by Mayo County Council. A topographical survey of hydraulic features in the vicinity of the site was carried out by LCE. Both surveys are relative to Irish Transverse Mercator (ITM) and Ordnance Datum Malin Head. All levels referred to in this report are relative to Ordnance Datum Malin Head (mOD).

1.4 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.

1.5 HOLD ITEMS

n/a

1.6 ABBREVIATIONS AND DEFINITIONS

1.6.1 ABBREVIATIONS

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
GPS	Global Positioning System
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 Plan
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems

1.6.2 KEY DEFINITIONS

Alluvium	*A deposit of clay, silt, and sand left by flowing floodwater in a river valley or delta, typically producing fertile soil.*

2 SITE CHARACTERISTICS[2][3]

2.1 SITE TOPOGRAPHY

The proposed development is on a green-field site. The site is bounded to the north, and east by agricultural lands. The site is bounded to the north-west and south by residential lands. It is bounded by a regional road [Ref: R325] to the south-west. The site is traversed by an un-named watercourse.

Existing ground levels on the site range from +68.5mOD along the banks of the un-named watercourse, to +75.5mOD along the north-east corner of the site.

2.2 SITE DRAINAGE CHARACTERISTICS

The subject un-named watercourse traverses the south-western portion of the site, adjacent to the site boundary. It rises approximately 9km south-east of the site. It flows in a north-westerly direction in the vicinity of the site, discharging to a larger watercourse just north of Swinford town. This larger watercourse flows in a north-westerly direction for a distance of 3.5km where it discharges to the river Moy in the townland of Cloongullaun. The river Moy flows from this point in a northerly direction for a distance of 8.5km to Ballina where it discharges to Killala bay. An overview of the regional drainage network is outlined in Figure 2.1 below. An overview of the local drainage network is outlined in Figure 2.2 below.

[2] LCE topographic survey, 29th January 2018.

[3] www.gsi.ie

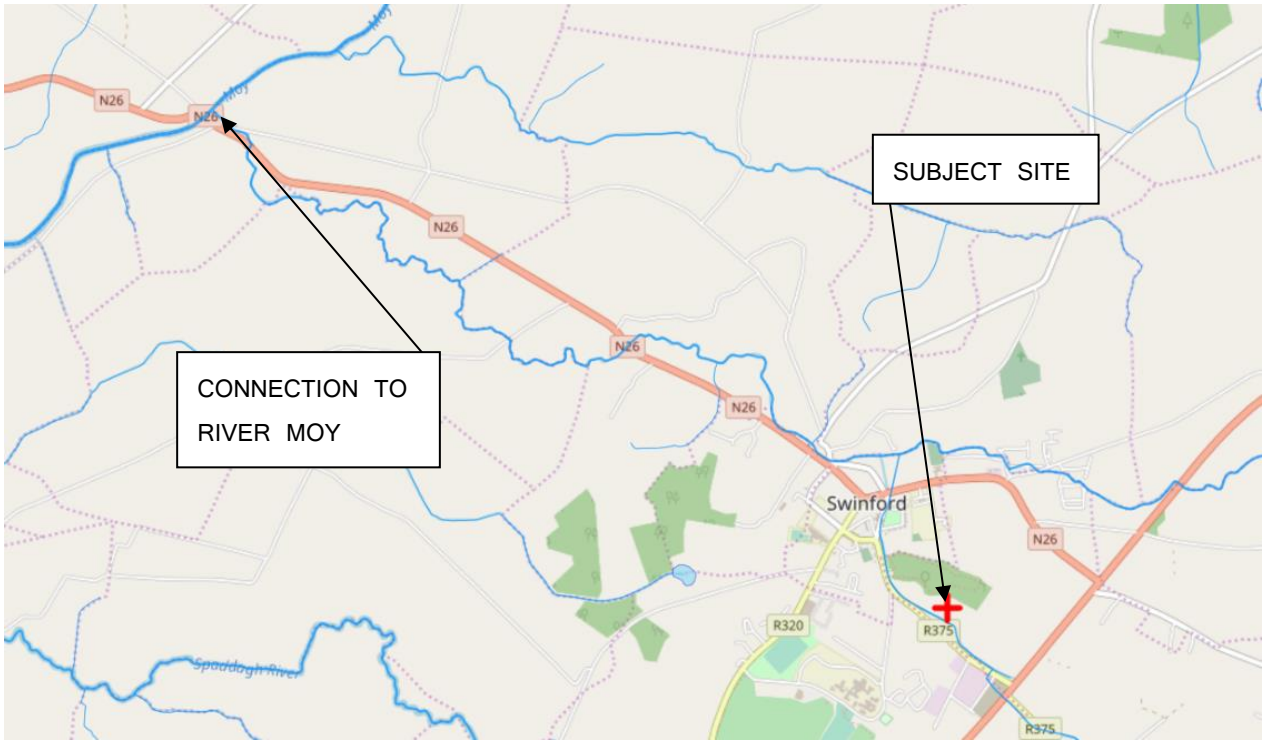

Figure 2.1 Regional drainage network overview[4]

[4] www.epa.ie

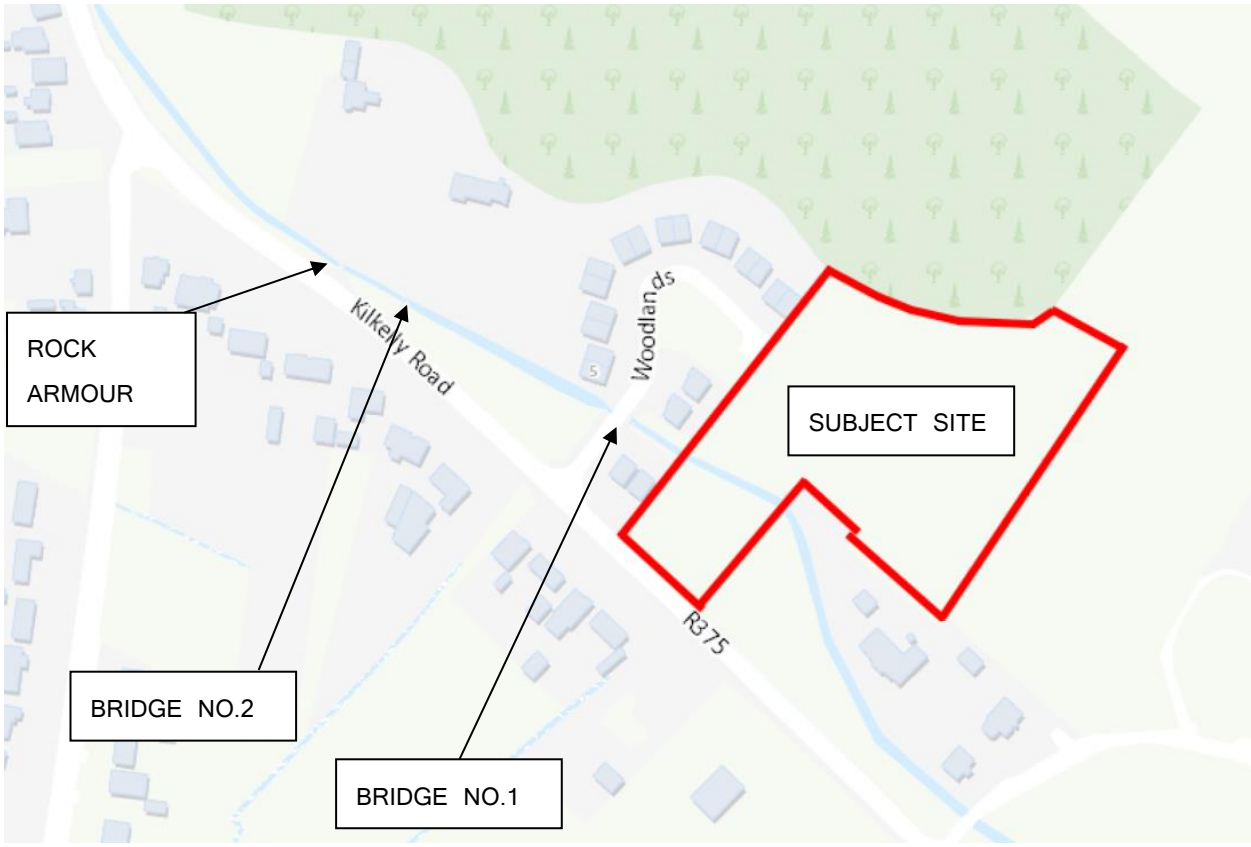

Figure 2.2 Local drainage network overview

In the vicinity of the subject site, the gradient of the un-named river is approximately 1 in 175. The river channel is well maintained. The approximate width from the top of the river bank on each side, as noted during the site visit, was 5.5m (varies). The approximate width from the bottom of the river bank on each side, as noted during the site visit, was 2.5m (varies). The average water depth at the middle of the river, as noted during the site, visit was 0.3m. The average water depth along the banks of the river, as noted during the site visit, was 0.2-0.4m. Images of the subject watercourse are included in Figure 2.3 and Figure 2.4 below.

An access bridge, labelled "Bridge No.1", servicing the adjacent residential development is located immediately downstream of the site, close to the western boundary. The road level at the bridge is +69.40mOD. The soffit level of the bridge is +68.90mOD. The invert level of the river at the bridge is +67.15mOD. The location of this bridge is shown in Figure 2.2 above. An image of the downstream bridge is shown in Figure 2.5.

A double pipe bridge, labelled “Bridge No.2”, is located approximately 100m downstream of the subject site. The road level at the bridge is +68.96mOD. The soffit level of the bridge is +67.89mOD. The invert level of the river at the bridge is +67.05mOD. The diameter of the pipes is 0.75m. It appears this bridge arrangement has a negative impact on the ease of maintenance of the watercourse, hence it may have a negative impact on the river channel conveyance. The location of this bridge is shown in Figure 2.2 above. An image of the downstream bridge is shown in Figure 2.6.

There is some scour protection constructed on the western bank of the un-named river at a location 200 metres downstream of the subject development site. The protection consists of rock gabions, over a distance of approximately 40 metres. The gabions have an average height of 2 metres. The gabions were noted to be in a good condition at the time of survey. An image of the erosion protection is shown in Figure 2.7.

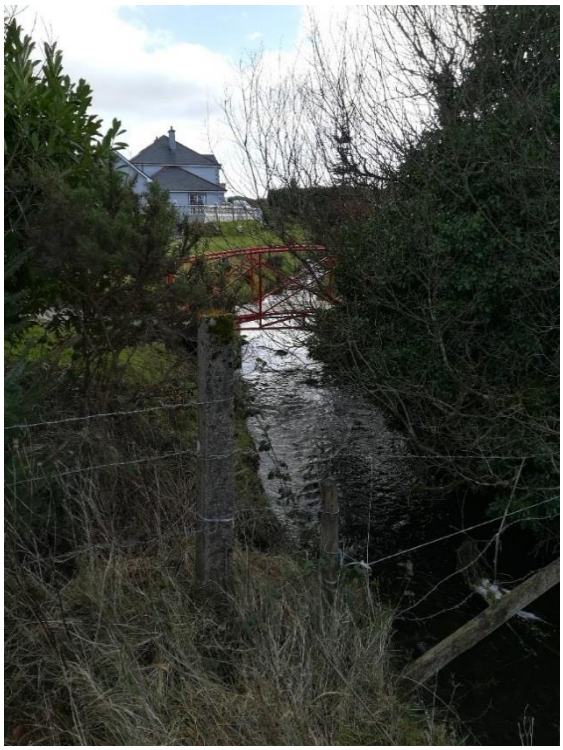

Figure 2.3 Un-named river at eastern site boundary (facing upstream)

Figure 2.4 Un-named river traversing site (facing downstream)

Figure 2.5 Downstream Bridge No.1 on western site boundary (facing downstream)

Figure 2.6 Downstream Bridge No.2 (facing downstream)

Figure 2.7 Erosion protection downstream (facing downstream)

2.3 GEOLOGY AND HYDROGEOLOGY[3]

The Geological Survey of Ireland (GSI) national bedrock map (1:1,000,000) shows the bedrock geology at the subject site to be "Visean limestone & calcareous shale". The area is classified as a "Regionally Important Aquifer - Karstified" (see Figure 2.8 and Figure 2.9 below).

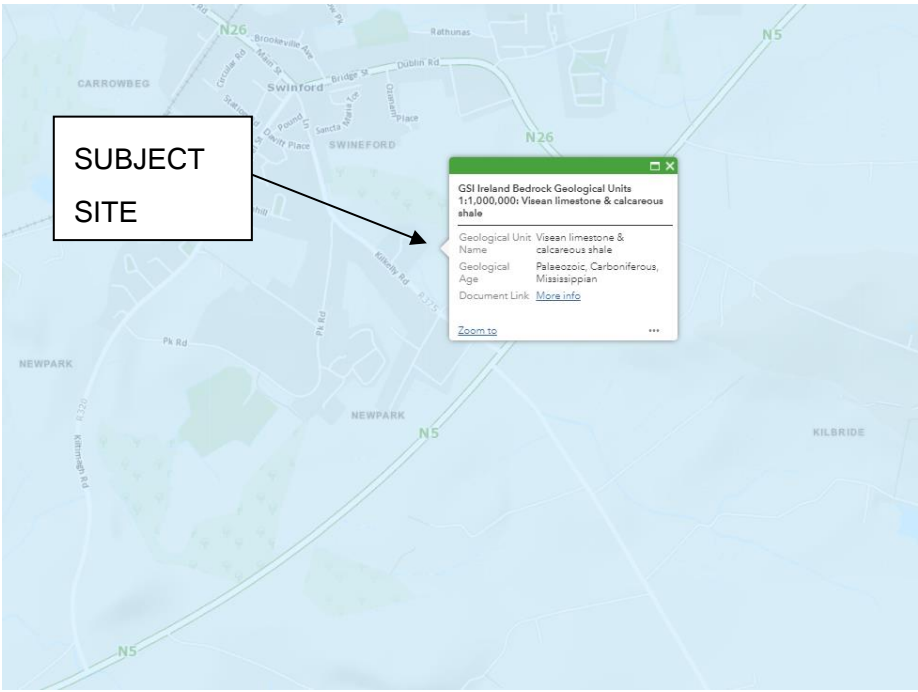

Figure 2.8 GSI bedrock

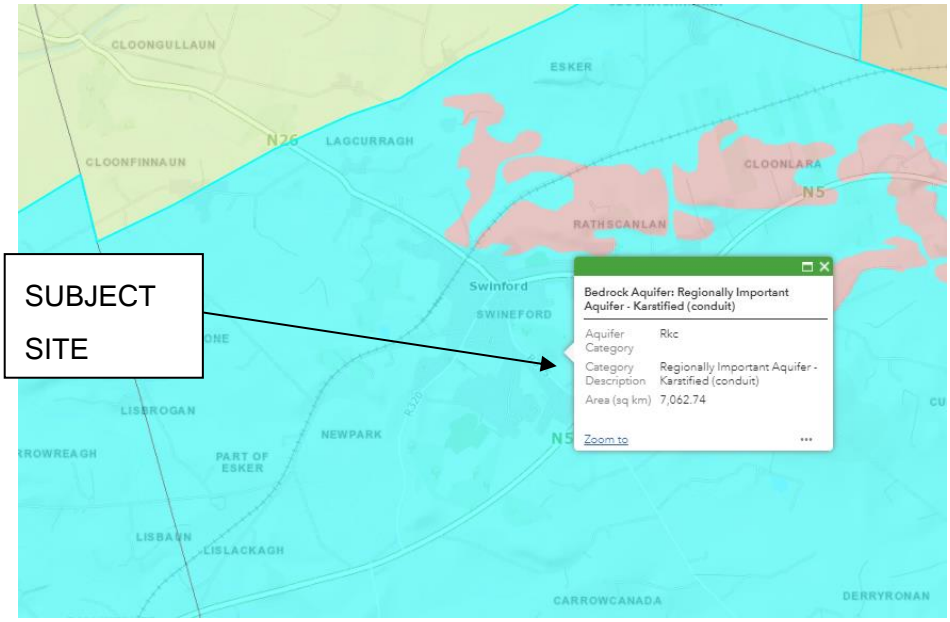

Figure 2.9 GSI groundwater aquifer

There are a number of karst features noted approximately 2.0km south-east of the subject site. They are noted as springs and localised depressions. The groundwater is noted as flowing from the east in a south-west direction. The location of the nearby karst features is shown in Figure 2.10.

A karst feature referred to as a "Spa Well" is also noted near the subject site on the historical mapping (see section 3.13).

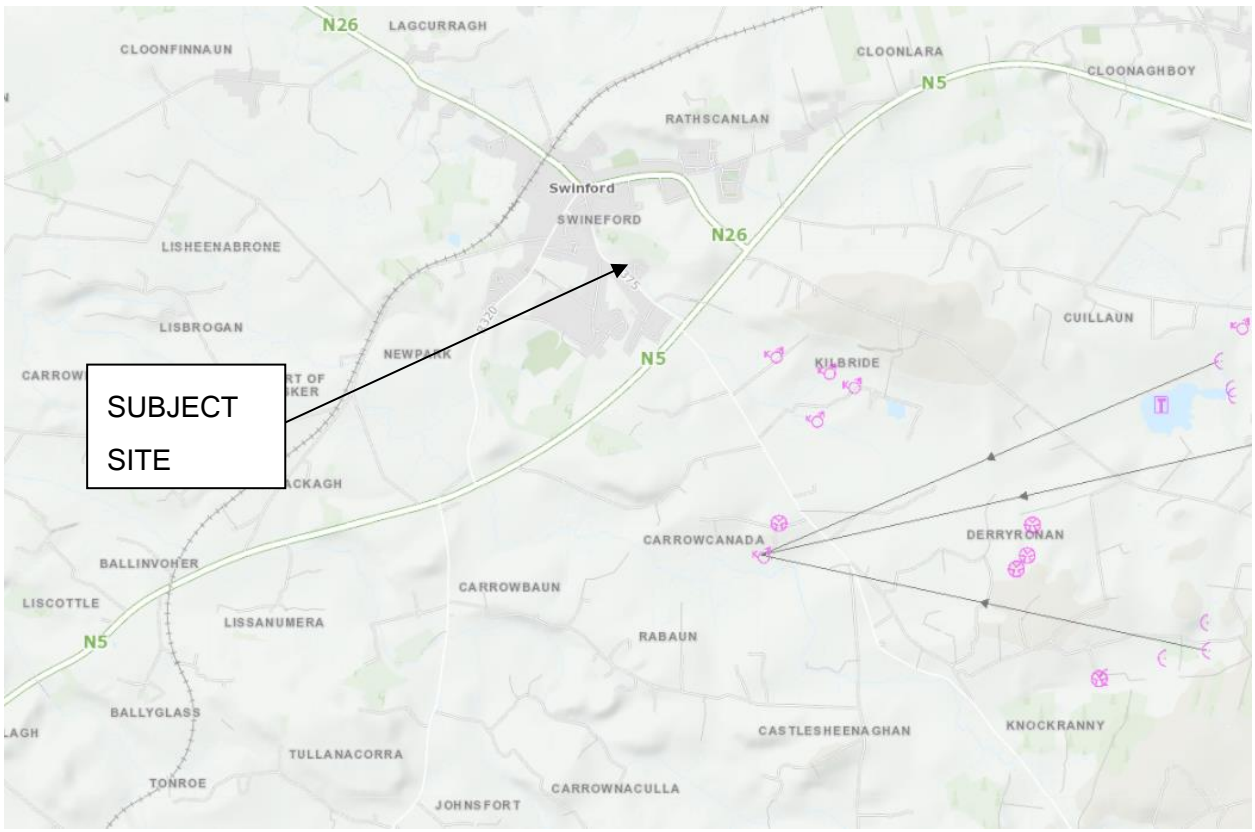

Figure 2.10 GSI Karst features in the area

GSI soil maps (see Figure 2.11) indicate the subject site is in an area of soils described as "Till derived chiefly from limestone". There is no evidence of alluvium soils in the vicinity of the development site.

Figure 2.11 GSI Teagasc soils mapping[3]

2.4 HYDROLOGY

The Met Eireann average annual reference rainfall data (1981-2010) for the area is estimated as 1,273mm[5].

[5] www.met.ie

2.5 SURFACE HYDROLOGY

Regionally the subject site is located within the Western River Basin District. A description of the drainage features and surface hydrology is included in section 2.2 above.

2.6 GROUNDWATER HYDROLOGY[3]

The subject site is located within the Swinford groundwater body. The flow regime is noted as Karstic. The groundwater vulnerability is noted as High. The recharge coefficient for the underlying aquifer is 22.5%.

3 FLOOD RISK ASSESSMENT - BACKGROUND INFORMATION

In order to inform the assessment of flood risk at the site, the following information sources were explored. Information supporting the text in this section may be found in Appendix B of this report.

3.1 ANECDOTAL EVIDENCE

SOURCE DESCRIPTION:

Local residents and societies may be able to provide knowledge on historic flood events and local studies etc.

SITE-SPECIFIC COMMENT:

An email was sent to Mr. Declan Ginnelly, Local Authority Area Engineer for Swinford by Mr. James Langan on the 13th of February 2018 regarding this flood study. A site location drawing for the subject development was attached to the email. The email was followed up with a phone call. Mr. Ginnelly confirmed he was not aware of any occurrence of historic flooding at the subject site.

He noted this stream was the main watercourse flowing through Swinford town. In relation to the karst feature noted downstream, adjacent to the public playground, he confirmed there is a spring in this area. He is aware that the public use this for drinking water.

Mr. Ginnelly confirmed that the downstream river erosion protection was installed as a support to road widening works in the area.

3.2 OPW PFRA INDICATIVE FLOOD MAPS

SOURCE DESCRIPTION:

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.

SITE-SPECIFIC COMMENT:

Available CFRAM PFRA flood maps were consulted[6]. The subject site is located adjacent to a watercourse noted as flooding locally during the 1 in 100 year fluvial event. However, these maps are at a very coarse resolution. A more accurate localised assessment shall be considered.

The subject site is inside the Areas for Further Assessment (AFA) for Swinford town. A review of more detailed (i.e. accurate) OPW CFRAM mapping is provided in section 3.5 below.

See Appendix B.1 for PFRA mapping.

3.3 NATIONAL COASTAL PROTECTION STRATEGY STUDY

SOURCE DESCRIPTION:

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

SITE-SPECIFIC COMMENT:

Not applicable.

[6] OPW CFRAM data

3.4 PREDICTIVE AND HISTORIC FLOOD MAPS AND BENEFITTING LANDS MAPS

SOURCE DESCRIPTION:

Historical data contained on maps and Local Authority records of flooding in the area. Benefiting land maps illustrate lands which have broadly benefited from arterial drainage campaigns historically.

SITE-SPECIFIC COMMENT:

Available historical flood maps and reports on floodmaps.ie were consulted[7]. There is a historic flood event noted approximately 370m downstream of the subject site. The event is noted as river flooding in December 1999. There is no evidence of flooding at the subject site during this event.

Lands within the subject site are identified on the Arterial Drainage mapping as having benefitted by drainage works carried out historically by the OPW.

See reports and mapping in Appendix B.3 and B.4, outlining flood history and adjacent benefiting lands.

3.5 PREDICTIVE FLOOD MAPS PRODUCED UNDER THE CFRAM STUDIES

SOURCE DESCRIPTION:

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.

[7] www.floodmaps.ie

SITE-SPECIFIC COMMENT:

The West CFRAM study fluvial flood extent maps for Swinford were consulted. The nearest flood source highlighted on the CFRAM mapping is the un-named watercourse as noted above.

The available CFRAM maps illustrate the flood extent for the present condition under the 1 in 10, 1 in 100 and 1 in 1000 year condition. The mapping indicates small, localised flooding along the watercourse banks for the 1:10, 1:100 and 1:1000 year flood event. To confirm flood extents on the subject site, a site-specific investigation is included below which establishes flood extents using on-site topography.

See Appendix B.5 for CFRAM mapping.

3.6 RIVER BASIN MANAGEMENT PLANS AND REPORTS

SOURCE DESCRIPTION:

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.

SITE-SPECIFIC COMMENT:

RBMPs are currently under revision at a national level. The draft RBMP for Ireland (2018-2021) does not contain any information or requirements which impact on this site-specific FRA[4].

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.

Petrol inceptors and catch pits should be installed for surface water run-off during the operation of the proposed developments to prevent contaminants from entering the system.

All site drainage should be designed in accordance with Sustainable Drainage systems (SuDS) principles[8].

3.7 PREVIOUS STRATEGIC FLOOD RISK ASSESSMENTS

SOURCE DESCRIPTION:

Where necessary, Strategic Flood Risk Assessments (SFRA) have been carried out by Local Authorities in order to address flood risk in planning of future development.

SITE-SPECIFIC COMMENT:

A SFRA is included in the Mayo County Development Plan 2014-2020[9]. The SFRA includes mapping which covers the subject site. The mapping is based on the PFRA mapping as discussed above. As required by the SFRA, lands within an area of flood risk require a site-specific FRA. A detailed site-specific FRA is provided in this report to further investigate the extent of the flood risk as the site.

See Appendix B.6 for SFRA mapping.

3.8 EXPERT ADVICE FROM THE OPW

SOURCE DESCRIPTION:

As the state agency responsible for flood risk management, the OPW provides expert advice on available flood risk data.

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[8] CIRIA C609 Sustainable drainage systems.

[9] Strategic Flood Risk Assessment for the Draft Mayo County Development Plan 2014-2020.

SITE-SPECIFIC COMMENT:

Not applicable as per the "Planning System and Flood Risk Management Guidelines". However, as part of this Flood Risk Assessment services, LCE are in regular contact with the OPW to avail of the latest information available for flood risk assessment.

3.9 CONSULTATION WITH LOCAL AUTHORITIES

SOURCE DESCRIPTION:

The Local Authority may be able to provide knowledge on historic flood events and local studies etc.

SITE-SPECIFIC COMMENT:

As part of the development of this FRA, LCE has been in consultation with the Local Authority to understand latest requirements and planning constraints at the subject development site. Discussions were held between Mr. David Mellet (Senior Executive Engineer with Mayo County Council) and Mr. James Langan (LCE) in January 2018.

Local anecdotal evidence has been gathered, see section 3.1.

3.10 TOPOGRAPHICAL MAPS

SOURCE DESCRIPTION:

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.

SITE-SPECIFIC COMMENT:

LCE carried out a GPS topographical survey. This site survey, carried out relative to ITM and Ordnance Datum Malin Head is the basis for all level references in this report. LCE's site survey is used to develop flood zone mapping, as described in section 4 below.

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

3.11 INFORMATION ON FLOOD DEFENCE

SOURCE DESCRIPTION:

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

SITE-SPECIFIC COMMENT:

There were no flood defences noted during the site inspection. River erosion protection was observed downstream, see section 2.2.

3.12 GEOLOGICAL SURVEY OF IRELAND MAPPING

SOURCE DESCRIPTION:

Alluvial deposit maps of the GSI (which would allow the potential for the implementation of source control and infiltration techniques, groundwater and overland flood risk to be assessed). These maps, while not providing full coverage, can indicate areas that have flooded in the past, (source of alluvium) and may be particularly useful at the early stages of the FRA process where no other information is available.

SITE-SPECIFIC COMMENT:

Not applicable as per the "Planning System and Flood Risk Management Guidelines". However, available GIS mapping was researched[3]. See the information provided in section 2 above.

3.13 HISTORIC ORDNANCE SURVEY MAPPING[10]

SOURCE DESCRIPTION:

Historical mapping often indicates areas liable to flooding.

SITE-SPECIFIC COMMENT:

Available historic maps were researched. The adjacent watercourse is noted on the historical mapping. There is no historical reference to "liable to flooding" at the subject development site.

A karst feature referred to as a 'Spa Well' is noted downstream of the subject site on the 6 inch colour (1829-41) mapping.

Historical mapping is included in Appendix B.8 of this report.

3.14 LOCAL LIBRARIES AND NEWSPAPER REPORTS

SOURCE DESCRIPTION:

Historical reports of flooding in the area.

SITE-SPECIFIC COMMENT:

No reports sourced relating to the subject site.

[10] www.osi.ie

3.15 WALKOVER SURVEY

SOURCE DESCRIPTION:

To assess potential sources of flooding, likely routes for flood waters and the site's key features, including flood defences, and their condition.

SITE-SPECIFIC COMMENT:

A walkover survey was conducted. Details of the site characteristics are included in section 2.

3.16 NATIONAL, REGIONAL AND LOCAL SPATIAL PLANS

SOURCE DESCRIPTION:

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

SITE-SPECIFIC COMMENT:

The subject site is located within an area zoned as 'Phase 1 Lands'[11] This is discussed further in section 4.6 below.

Land zoning mapping is included in Appendix B.9 of this report.

[11] Mayo County Development Plan 2014-2020, Volume 1 April 2014, Incorporating Variation No.1 Made on 13th July 2015.

4 FLOOD RISK ASSESSMENT

4.1 FLOOD SOURCES AT THE SITE

The following potential flood sources exist at the site:

a) Fluvial flooding from the adjacent watercourse; and
b) Pluvial flooding from rainfall and surface water run-off.

The site is located in a karst area, however there is no officially recorded history of groundwater flooding at the subject site.

Management of surface water will be a critical factor in the mitigation of flood risk at the site.

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 risk[1]. 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 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. In order to establish the extreme water levels for various return periods for the adjacent watercourse, a hydraulic model of the watercourse is required. The results of the modelling carried out for the CFRAM studies in the area are available for the present day scenario. These model results and a site-specific topographical survey were used to establish the flood zoning at the subject site.

The water level for the 1 in 100 year and 1 in 1000 year return period at node "34NPRK00084B" from the CFRAM model (at the downstream bridge, adjacent to the subject site), is provided in Table 4.1 below.

Table 4.1 Flood zone levels[12]

Flood Zone	Flood Probability	Level (mOD)
A	Greater than 1% (1 in 100 year)	Below +68.6
B	1% (1 in 100 year) to 0.1% (1 in 1000 year)	+68.6 to +69.0
C	Smaller than 0.1% (1 in 1000 year)	Above +69.0

[12] Western CFRAM UoM 34 - Moy / Killala Bay Hydraulic Modelling Report: Volume 2e – Swinford, Final, September 2016

The flood zones for the site are outlined on drawing no. 18006-DG-2301 in Appendix C. 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.

All areas subject to development have been zoned. The subject site is predominantly within Zone C. Some of the proposed dwellings (3 no. units) in the south-west area of the site are located in Zone B.

Some areas along the banks of the un-named watercourse are noted as within Zone A. For the purposes of this FRA, these areas along the banks of the watercourse are ignored as they are considered negligible.

4.3 APPROPRIATENESS OF DEVELOPMENT

The proposed development is residential. The proposed location of the dwelling houses is outlined on the site layout drawing in Appendix A. The buildings are located in Zone C and Zone B.

Under the OPW Planning System and Flood Risk Management Guidelines published in November 2009, highly vulnerable development, such as hospitals, residential care homes, Garda, fire and ambulance stations, dwelling houses and primary strategic transport and utilities infrastructure, would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met.

In order to inform the Justification Test, this development must be subject to an appropriate FRA which takes into account flood hazards from all sources and any historical evidence of flooding at the site. These aspects of the FRA are investigated in section 2 and section 3.

In addition to establishing the appropriateness of a development in terms of flood zones, the safe design levels for buildings and infrastructure are required. This includes provision for climate change and flooding from all sources. The safe design level is established in section 4.4 below.

The impact of the development on flooding elsewhere is also required to be considered as part of a FRA for the development. This is included in section 4.5.

A Justification Test has subsequently been carried out and is included in section 4.6.

4.4 DESIGN FLOOD LEVEL

At the time of this report, modelled flood levels from the CFRAM studies are only available for the present day scenario. However, flood design is required to include for the impact of climate change. A water level for the 1 in 100 year and 1 in 1000 year return period at the CFRAM node "34NPRK00084B"[12] was estimated based on interpolation between predicted water level and flow rate vs estimated return period.

The estimated safe design flood level is +69.7mOD. This is the 1 in 1000 year flood level, including climate change (Mid-Range Future Scenario (MRFS)), a freeboard factor and a model uncertainty factor to provide a margin of safety in design.

4.5 IMPACT OF DEVELOPMENT OF FLOODING ELSEWHERE

The proposed development is predominantly located in Flood Zone C. A portion of the site is located in Flood Zone B.

The proposed layout of the development should be optimised to result in a negligible overall impact on the existing flood storage on-site.

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

No infilling of the site is outlined on the proposed layout drawings included in Appendix A.

4.6 JUSTIFICATION TEST

4.6.1 OPW GUIDANCE

As per section 5 of the 2009 "Planning System and Flood Risk Management Guidelines"[1],

"where a planning authority is considering proposals for 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 below."

In order to support the planning authority in review of the proposal, the Justification Test, as per Box 5.1 of the guidelines (see Figure 4.1 below) has been completed.

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 Justification Test as per Box 5.1[1]

4.6.2 JUSTIFICATION TEST: DEVELOPMENT PLAN ZONING (BOX 5.1, POINT 1)

The subject development is located within an area zoned as 'Phase 1 Lands'[11] (see Figure 4.2). 'Phase 1 lands' are defined as "*lands comprising of unfinished housing estates listed in the Department of Environment, Community and Local Government's*

National Housing Development Survey 2010 and lands that currently have planning permission for 2 or more housing units that have not yet commenced development."[11]

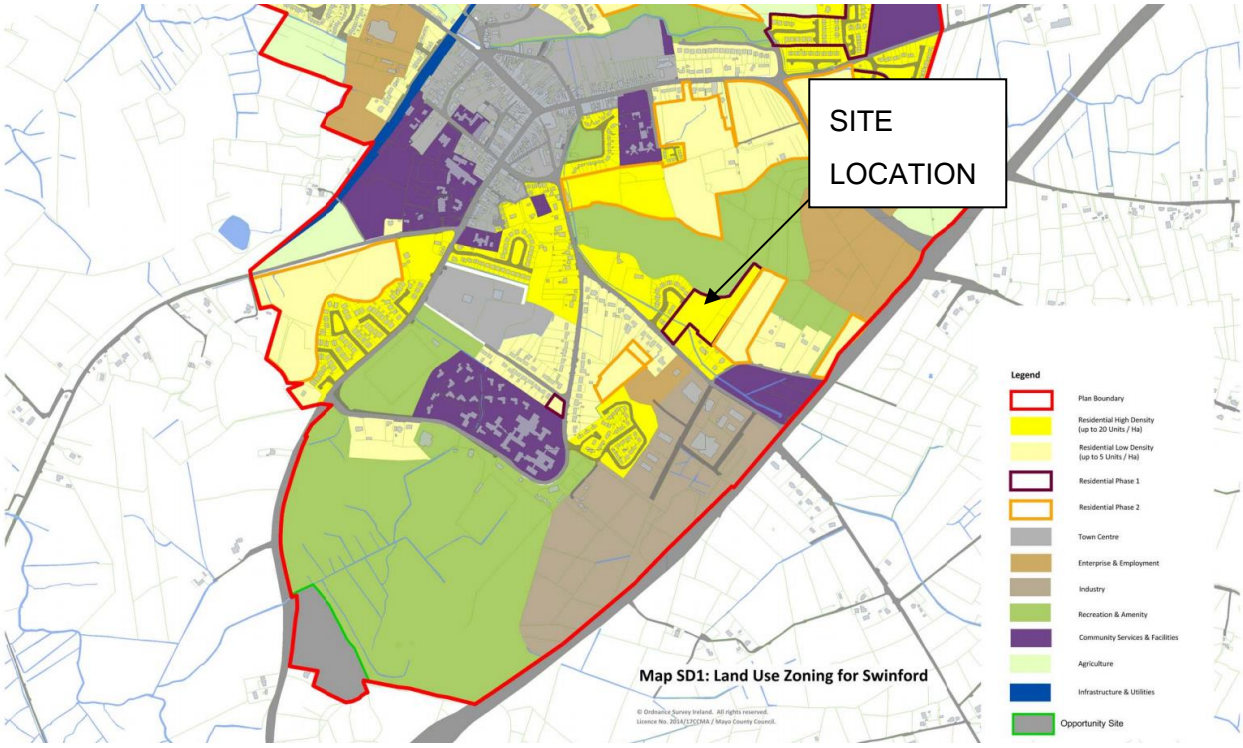

Figure 4.2 Swinford town zoning[11]

4.6.3 WILL NOT INCREASE FLOOD RISK ELSEWHERE (BOX 5.1, POINT 2 (I))

It is not expected that the proposed development, as detailed on the development drawings in Appendix A, will increase flood risk elsewhere. The impact of the development on flooding elsewhere is discussed in section 4.5 above.

4.6.4 THE DEVELOPMENT TO INCLUDE METHODS TO MINIMISE FLOOD RISK (BOX 5.1, POINT 2 (II))

The development includes the following measures to remove or reduce the risk of flooding:

- The site levels should be raised to an appropriate level based on this findings of this FRA, see the design flood level in section 4.4 above.

- The site drainage system for the subject site should include appropriate storm water attenuation prior to discharge during extreme events.
- The drainage design for the site should include for all sources of flooding. The drainage system should be designed to minimise flood risk and should include sustainable flood risk measures such as SuDS where suitable.

The development, as described in this report, will have minimal impact on the current flood risk and will not increase the existing risk of flooding elsewhere.

4.6.5 MANAGE RESIDUAL RISKS (BOX 5.1, POINT 2 (III))

The following are key components in the management of residual risk for this area:

- The site drainage system for the subject development should include appropriate storm water attenuation prior to discharge during extreme events.
- The landscaped areas within the site should be re-graded to maintain existing flood storage.
- All proposed dwellings and access/ egress routes should be designed to the proposed safe design level (section 4.4 above)
- Existing drains, culverts, gullies and drainage systems should be maintained.

4.6.6 MEETS WIDER PLANNING OBJECTIVES (BOX 5.1, POINT 2 (IV))

The proposed development is within the 'Phase 1' zoned area for residential development. The project is being developed by the Local Authority.

The proposed development should take account of good urban design and vibrant and active streetscapes as it applies to the Mayo County Development Plan 2014-2020.

All architectural details should be agreed with the Local Authority planning department where necessary.

4.6.7 ACCEPTANCE OF RESIDUAL RISK

The measures proposed to reduce/ remove flood risk and to manage any residual risk are outlined above. These measures are deemed acceptable considering the type and use of the proposed development.

4.6.8 MAJOR DEVELOPMENT (GUIDELINES SECTION 5.27)

As per the requirements of section 5.27 of the 2009 OPW flood guidelines, this document includes an appropriate FRA and a Justification Test as it applies to development.

This FRA follows the principals of the sequential approach.

4.6.9 JUSTIFICATION TEST CONCLUSION

The development as proposed is deemed to meet the requirements of the Justification Test as outlined in the OPW "Planning System and Flood Risk Management Guidelines", therefore the construction of a small portion of dwelling houses within Zone B at this site is deemed acceptable.

5 CONCLUSIONS & GENERAL RECOMMENDATIONS

5.1 CONCLUSION

The primary source of flood risk in this area is fluvial from the adjacent watercourse to the south-west of the subject site. However, based on the findings of this flood risk assessment, the level of flood risk to the subject site is insignificant due to the proposed elevation of the development relative to the watercourse.

There is no record of any significant flood history in the vicinity of the proposed development site by either a statutory body or anecdotally.

Adequate configuration of proposed ground levels and surface water management design can mitigate against any flooding on the site from the adjacent watercourses.

The site has been zoned based on the OPW "Planning System and Flood Risk Management Guidelines". The proposed development is located predominantly in Zone C with some dwellings (3 no. units) located in Zone B. The development as proposed is deemed to meet the requirements of the Justification Test as outlined in the OPW "Planning System and Flood Risk Management Guidelines", therefore the construction of a small portion of dwelling houses within Zone B at this site is deemed acceptable.

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

A river crossing is proposed as part of the development. The river crossing should be adequately designed to ensure the proposed development will not have any impact on access to any watercourse, floodplain or flood protection located in its vicinity. Consenting for the river crossing should be obtained through the appropriate public body.

5.2 RECOMMENDATIONS

It is recommended that the minimum proposed finished floor level should be maintained at +69.7mOD.

The access and egress routes for the proposed development should be maintained at +69.0mOD.

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.

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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.

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.

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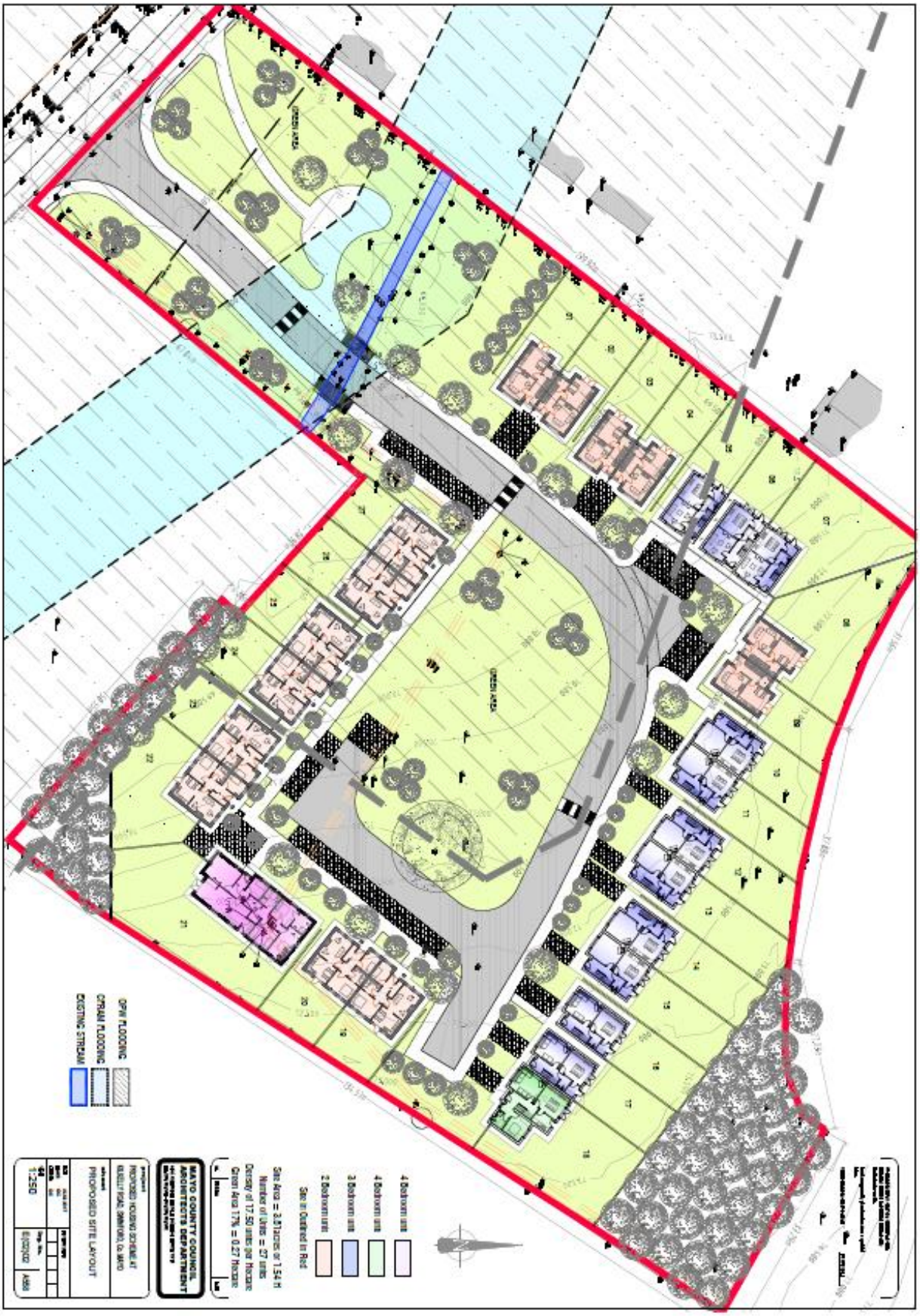
APPENDIX A
PROPOSED SITE DEVELOPMENT DRAWINGS


EXISTING STREAM
CFRAM FLOODING
OPW FLOODING
4 Bedroom unit
4 Bedroom unit
3 Bedroom unit
2 Bedroom unit
Site in Outlined in Red
Site Area = 3.87Acres or 1.54 H
Number of Units = 27 units
Density of 17.50 units per Hectare
Green Area 17% = 0.27 Hectare
MAYO COUNTY COUNCIL
ARCHITECTS DEPARTMENT
PROPOSED HOUSING SCHEME AT
KILKELLY ROAD, SWINFORD, Co. MAYO
PROPOSED SITE LAYOUT
1:250
A100

APPENDIX B
FLOOD RISK ASSESSMENT BACKGROUND INFORMATION

B.1 OPW PFRAs

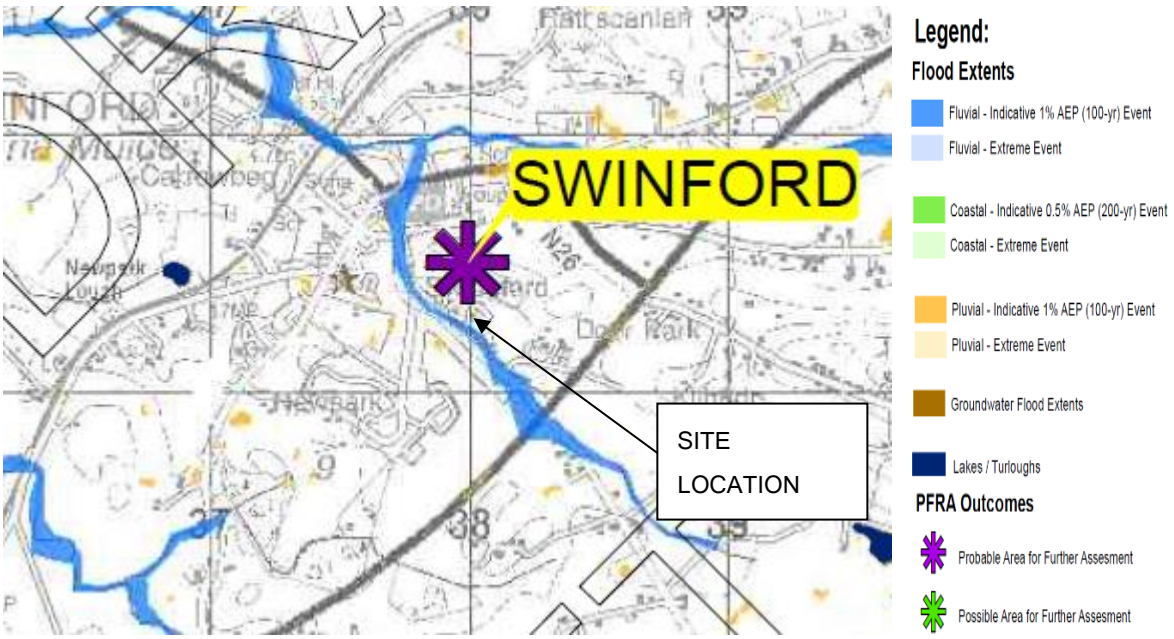


Figure B.1 PFRA mapping (approx. site outline in red)

B.2 National Coastal Protection Strategic Study Mapping

n/a

B.3 Predictive and Historical Flood Maps

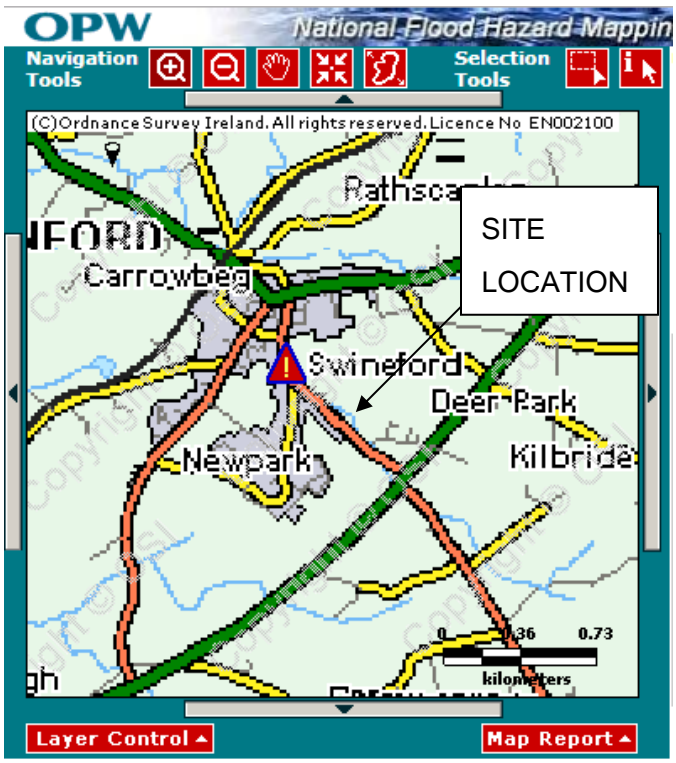


Figure B.2 Floodmaps.ie - flood report

Figure B.3 Floodmaps.ie - flooding image December 1999

B.4 Benefitting Lands Mapping

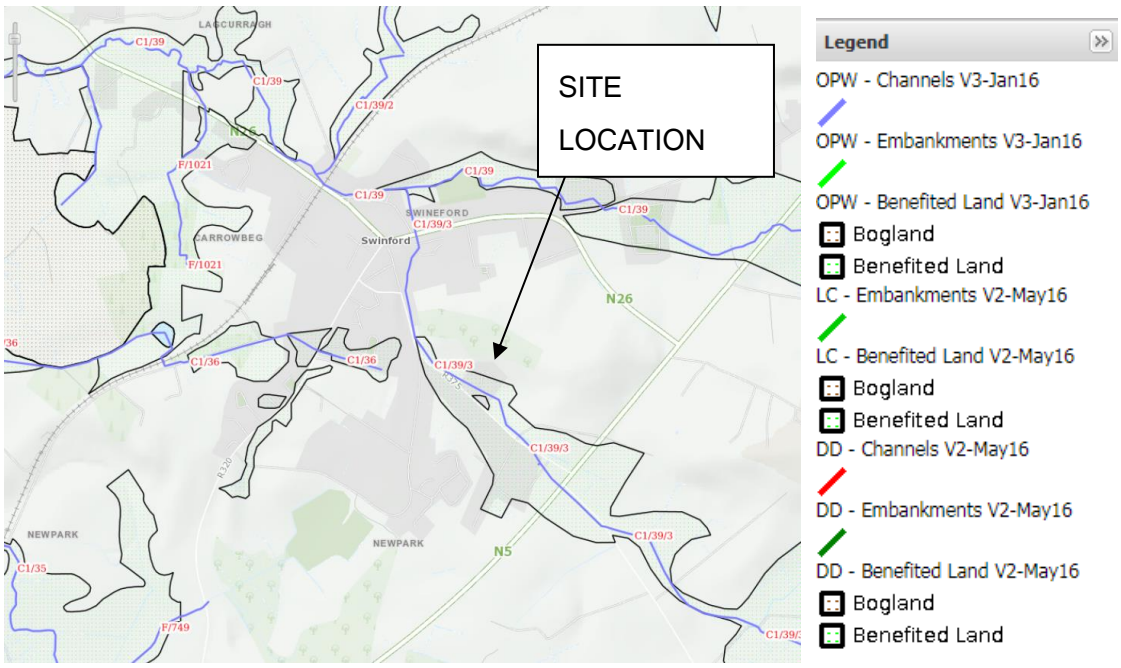


Figure B.4 OPW benefiting lands

B.5 OPW CFRAM Present Flood Extent Maps

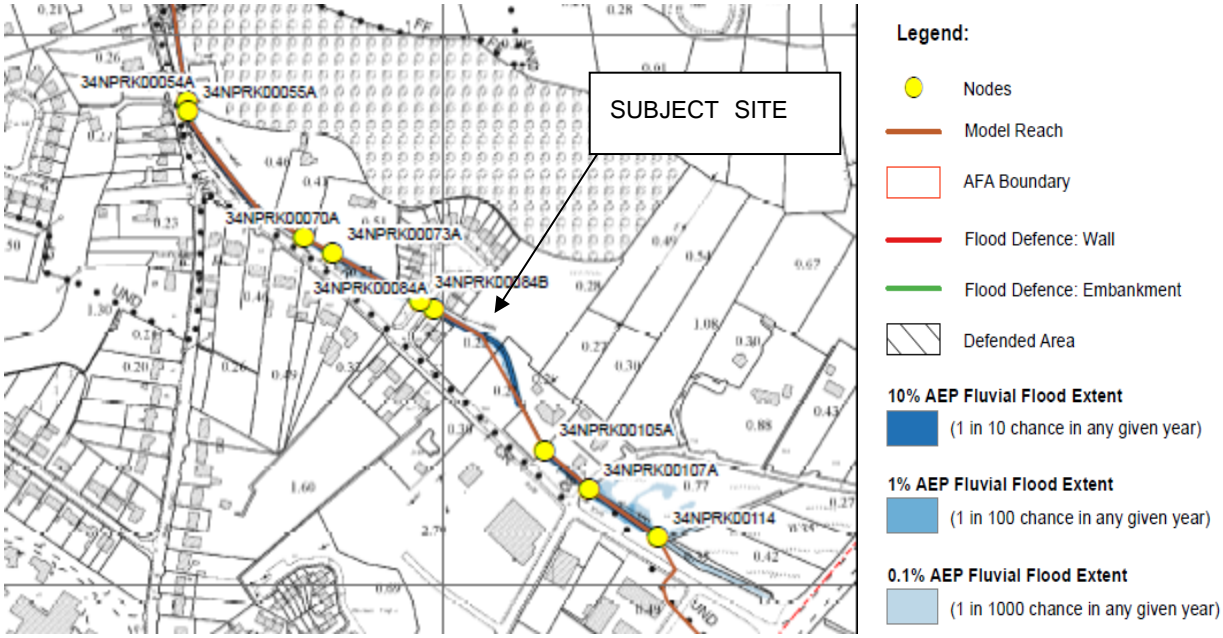


Figure B.5 CFRAM Fluvial flood map (current scenario)

B.6 Strategic Flood Risk Assessment

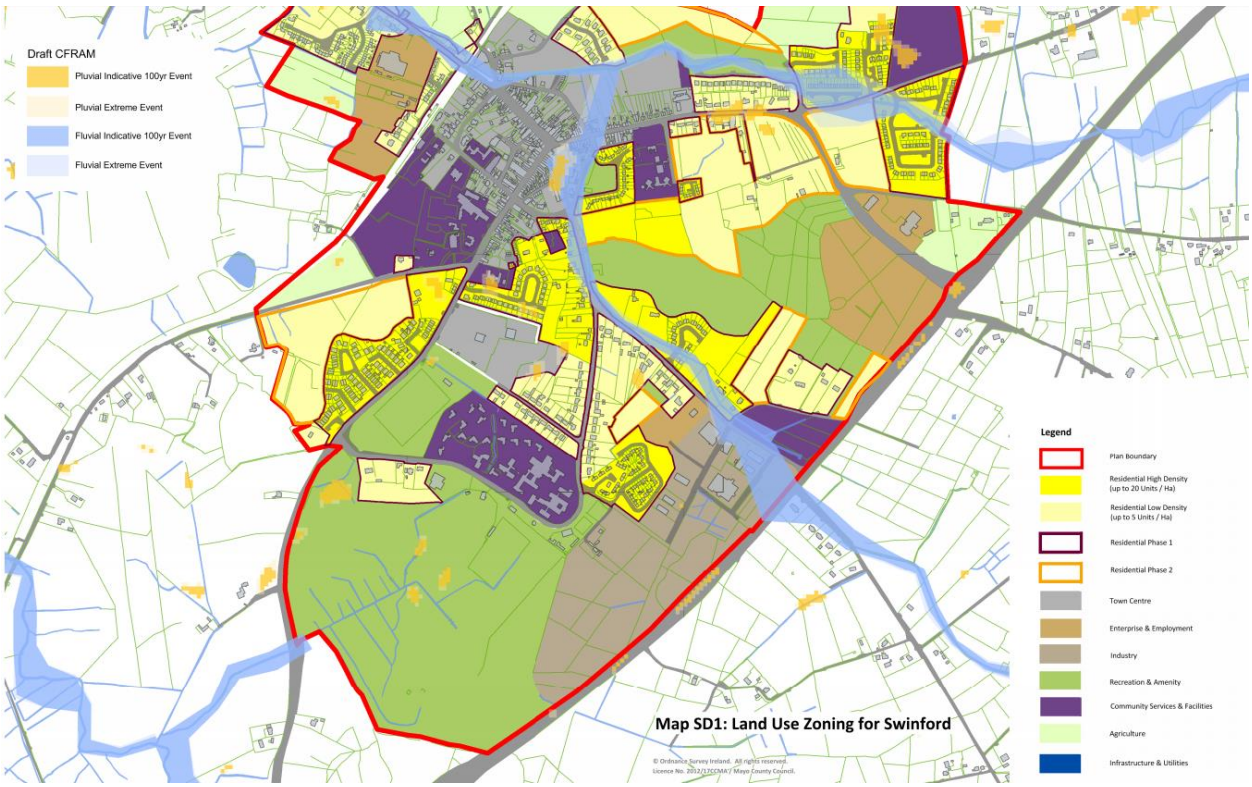


Figure B.6 Strategic Flood Risk Assessment mapping for Swinford

B.7 GSI Mapping

See section 2 above.

B.8 Historical Ordnance Survey Mapping

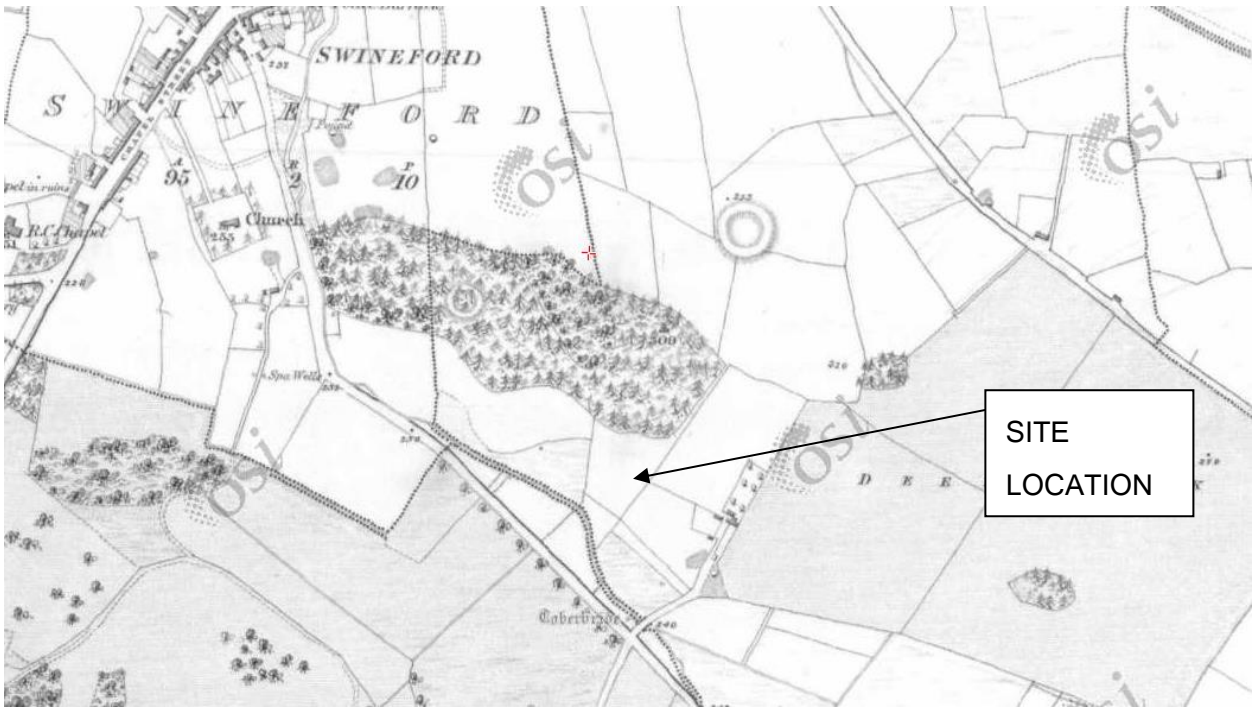


Figure B.7 6 Inch colour (1829-41)

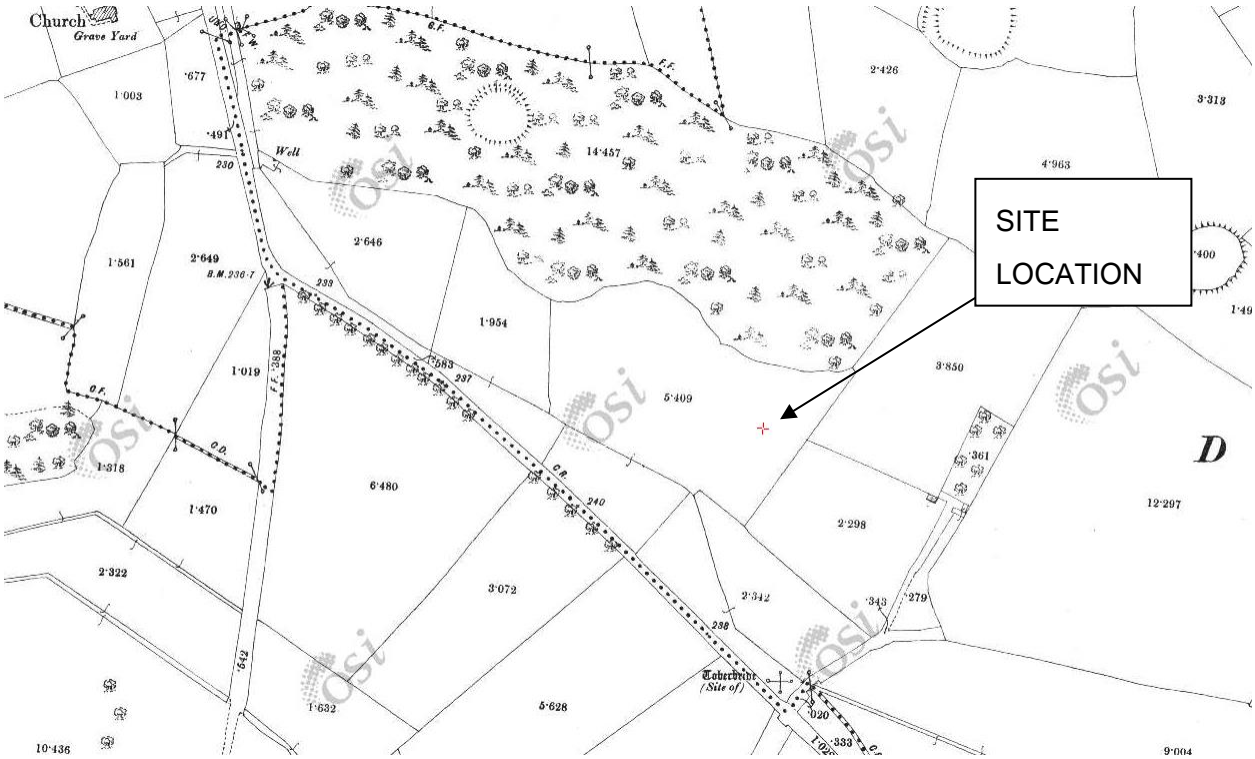


Figure B.8 25 Inch B&W (1897-1913)

B.9 Local Area Plan

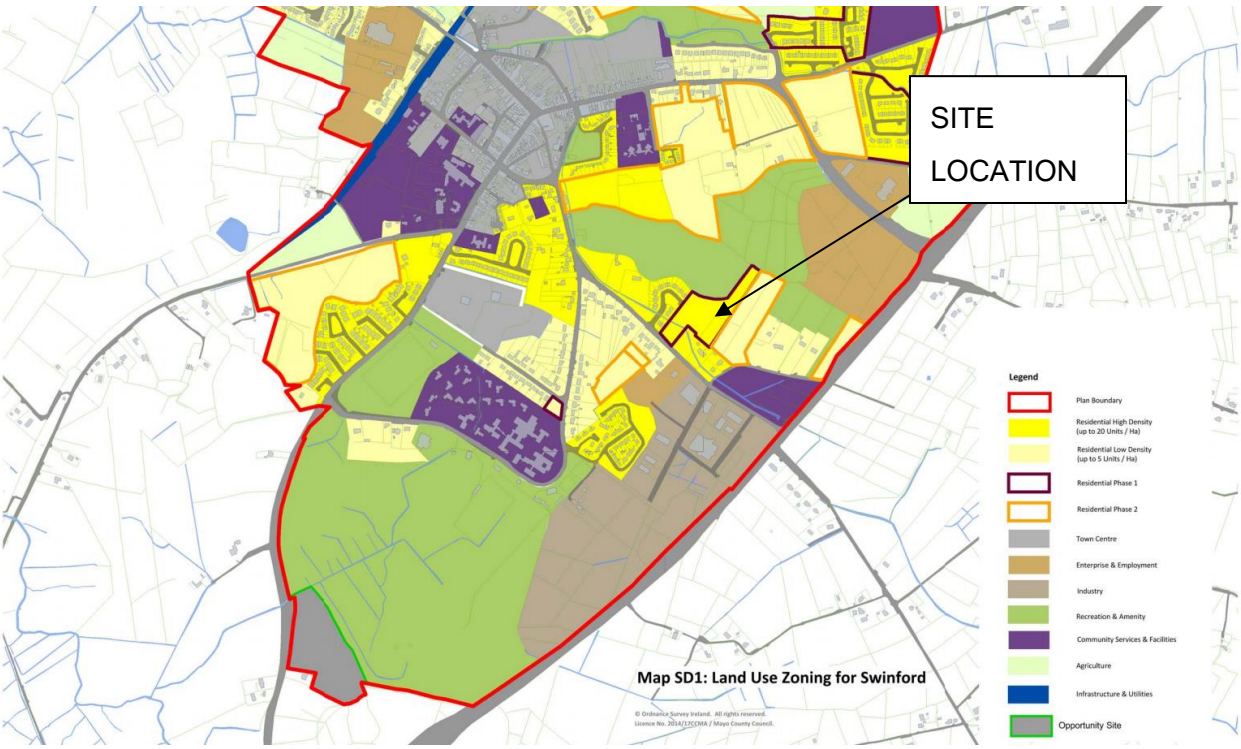
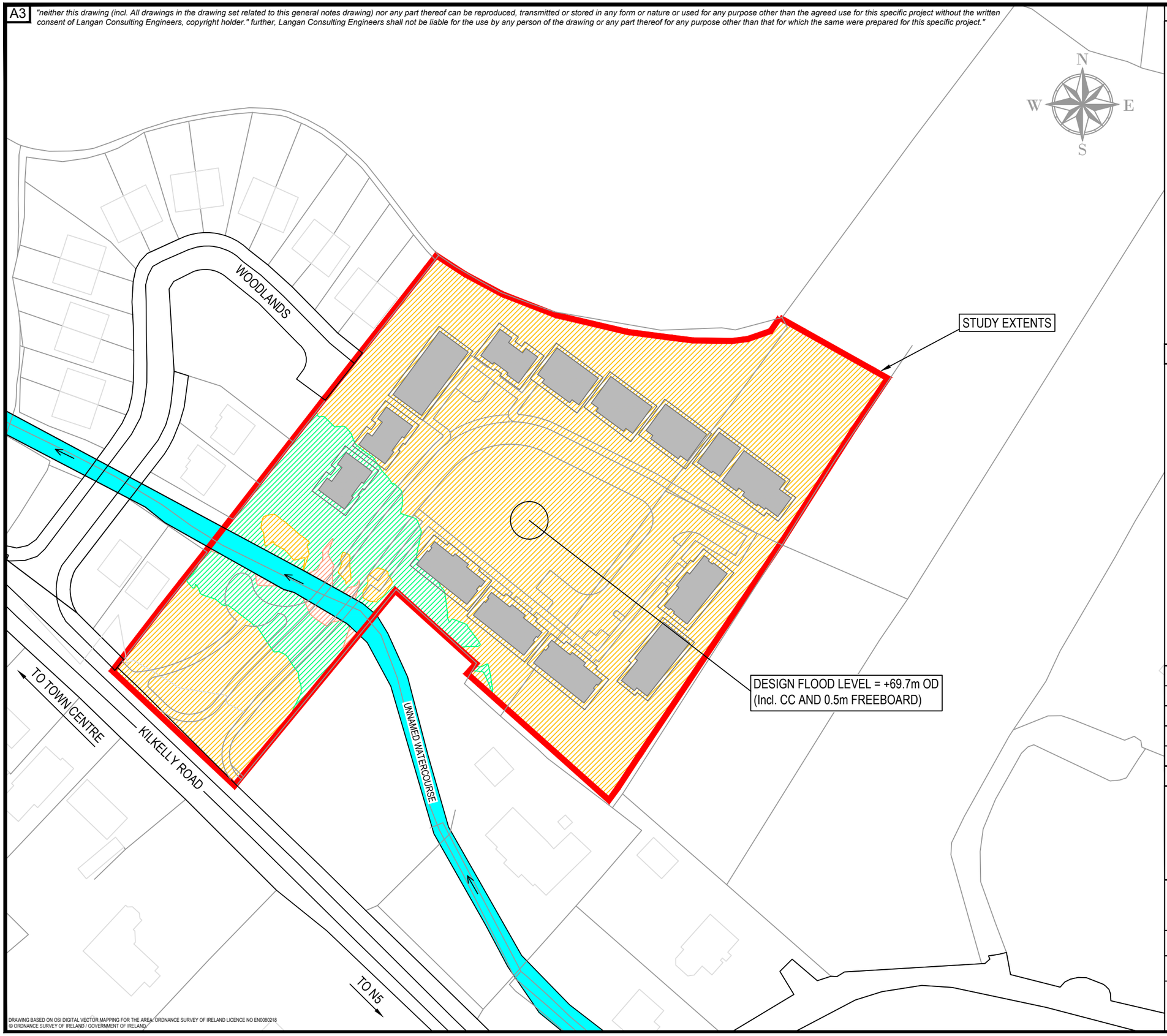


Figure B.9 Swinford Local Area Plan (LAP)

APPENDIX C
FLOOD RISK ASSESSMENT ZONING

A3



NOTES:

1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE NOTED.
2. ALL LEVELS ARE IN METERS RELATIVE TO ORDINANCE DATUM MALIN UNLESS OTHERWISE NOTED.
3. ALL COORDINATES ARE IN METERS AND RELATE TO ITM (IRISH TRANSVERSE MERCATOR) UNLESS OTHERWISE NOTED.
4. DO NOT SCALE FROM DRAWINGS, USE FIGURED DIMENSIONS ONLY. ALL DIMENSIONS SHALL BE CONFIRMED ON SITE.
5. DRAWINGS ARE FOR THE PURPOSES OUTLINED IN THE TITLE BOX ONLY.
6. DRAWINGS ARE BASED ON SITE SURVEY INFORMATION AND OSI VECTOR MAPPING (2018).
7. SITE LOCATION REFERENCE X=538060; Y=799257 (ITM)
8. ARCHITECTS LAYOUT BASED ON MAYO COUNTY COUNCIL DRG No. E(01)02 ISSUED 9th JAN 2018.

LEGEND

ZONE A = < +68.6 ODM

ZONE B = > +68.6m TO < +69.0 ODM

ZONE C = > +69.0m ODM

FINAL

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PROJECT SPECIFICATIONS AND REPORTS.

DATE	REV	BY	CHK	DESCRIPTION
14/02/18	FL01	GC	TMH	FINAL ISSUE
02/02/18	DR01	GC	TMH	DRAFT ISSUE

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LANGAN
CONSULTING ENGINEERS
CIVIL | STRUCTURAL | ENVIRONMENTAL

PROJECT TITLE:	FLOOD REPORT ASSESSMENT	DATE:	FEB 2018
AT :	PROPOSED HOUSING SCHEME KILKELLY, SWINFORD, CO MAYO	DWG No:	2301
CLIENT:	MAYO COUNTY COUNCIL	SCALE:	1:1000 @ A3
JOB NUMBER:	18006	DRAWING BY:	GC
DRAWING TITLE:	FLOOD ZONE MAP LAYOUT PLAN	CHECKED BY:	TMH
		REVISION:	FL01