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Site Specific Flood Risk Assessment

Proposed Residential Development

Belmount, Academy Street, Navan, County Meath

Client: Coindale Limited

Job No. D061

November 2019

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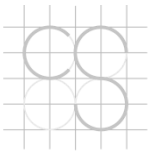

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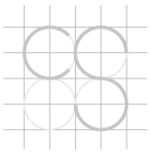
SITE SPECIFIC FLOOD RISK ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT BELMOUNT, ACADEMY STREET, NAVAN, COUNTY MEATH

CONTENTS

File Location: J:\D_JOBS\Job-D061\B_Documents\C_Civil\A_CS Reports\FRA

Job Ref.	Author	Reviewed By	Authorised By	Issue Date	Rev. No.
D061	GS	RFM	RFM	15/11/19	-



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1.0 INTRODUCTION

1.1 Scope

Cronin & Sutton Consulting Engineers (CS Consulting) have been commissioned by Coindale Limited to prepare a Site Specific Flood Risk Assessment for a proposed residential development at Belmount, Academy Street, Navan, County Meath.

In preparing this report, CS Consulting has made reference to the following:

- Meath County Council Development Plan 2013–2019;
  (including Strategic Flood Risk Assessment)
- Navan Strategic Flood Risk Assessment 2013-2019;
- Office of Public Works Flood Maps;
- Department of the Environment Flooding Guidelines;
- Geological Survey of Ireland Maps;
- Local Authority Drainage Records;
- *Planning System and Flood Risk Management Guidelines for Planning Authorities*, issued by the Department of the Environment, Heritage and Local Government and the OPW.

- This Flood Risk Assessment takes on board & addresses the comments from An Bord Pleanála the planning board & Meath County Council expressed following the initial planning consultation, specifically Item 8 of the Boards opinion.

The Site Specific Flood Risk Assessment is to be read in conjunction with the engineering drawings and documents submitted by CS Consulting and with the various additional information submitted by the other members of the design team. It should be noted that the Engineering Services Report prepared by CS Consulting addresses stormwater management and sustainable urban drainage systems for the proposed development.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Site Location

The site of the proposed development lies along the west of Academy Street and the Dublin Road. The site has a total area of approx. 15.10 ha and is located in the administrative jurisdiction of Meath County Council.

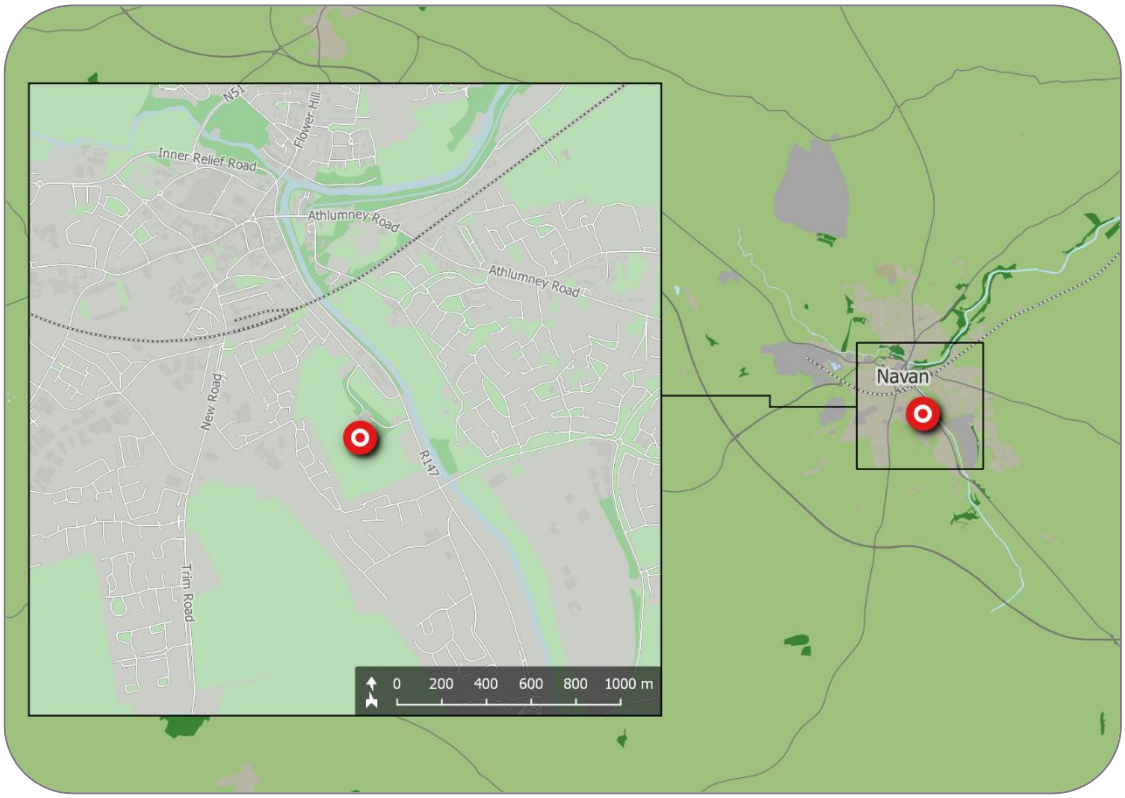


Figure 1 – Location of proposed development site
(map data sources: EPA, OSM Contributors)

The location of the proposed development site is shown in Figure 1 above; the indicative extents of the development site, as well as relevant elements of the surrounding road network, are shown in more detail in figure 2. The site is bounded to the west and south by existing dwellings; to the east by existing dwellings and Academy Street and to the north by agricultural

lands and Belmount House located in proximity to the centre of the subject site.

Figure 2 – Site extents and transport infrastructure
(map data and imagery sources: NTA, OSM Contributors, Google)

2.2 Existing Land Use

The subject site is greenfield and predominantly agricultural in use without any prominent water features on site. The site has a number of local drainage ditches which drained the land for agricultural purposes. There is no off site drainage ditches passing through the site as adjacent lands have been developed.

2.3 Description of Proposed Development

The proposal relates to a residential development of 544 no. dwellings on a site of c. 15.1 hectares comprising 260 no. houses (18 no. 2 bed, 207 no. 3 bed & 35 no. 4 bed) and 198 no. apartments (46 no. 1 bed, 152 no 2 bed), 30 no. duplex apartments (15 no. 2 bed & 15 no. 3 bed), and 56 no. dwellings in corner blocks (16 no. 1 bed, 24 no. 2 bed & 16 no. 3 bed) as well as the provision of two crèches (ground floor of apartment building [c. 195 sq. m] and single storey creche in housing area [c. 443 sq. m]) Open Space of c. 2.63 hectares including playground areas; all ancillary landscape works with public lighting, planting and boundary treatments including regrading/re-profiling of site where required as well as provision of cycle paths; Provision of vehicular and pedestrian looped access through the site from 3 no. junctions located on Academy Street as well as pedestrian connection in south east of site to Dublin Road and upgrade works to junction onto the Dublin Road; along with 875 no. car parking spaces (including 4 no. car sharing spaces) and 581 cycle spaces; Surface water attenuation measures and underground attenuation systems as well as all ancillary site development works (reprofiling of site as required) as well as connection to existing public water supply and drainage services. All site development and landscape works.

The proposed development shall be constructed in five phases. Please refer the Figure 3 for the site layout phasing.

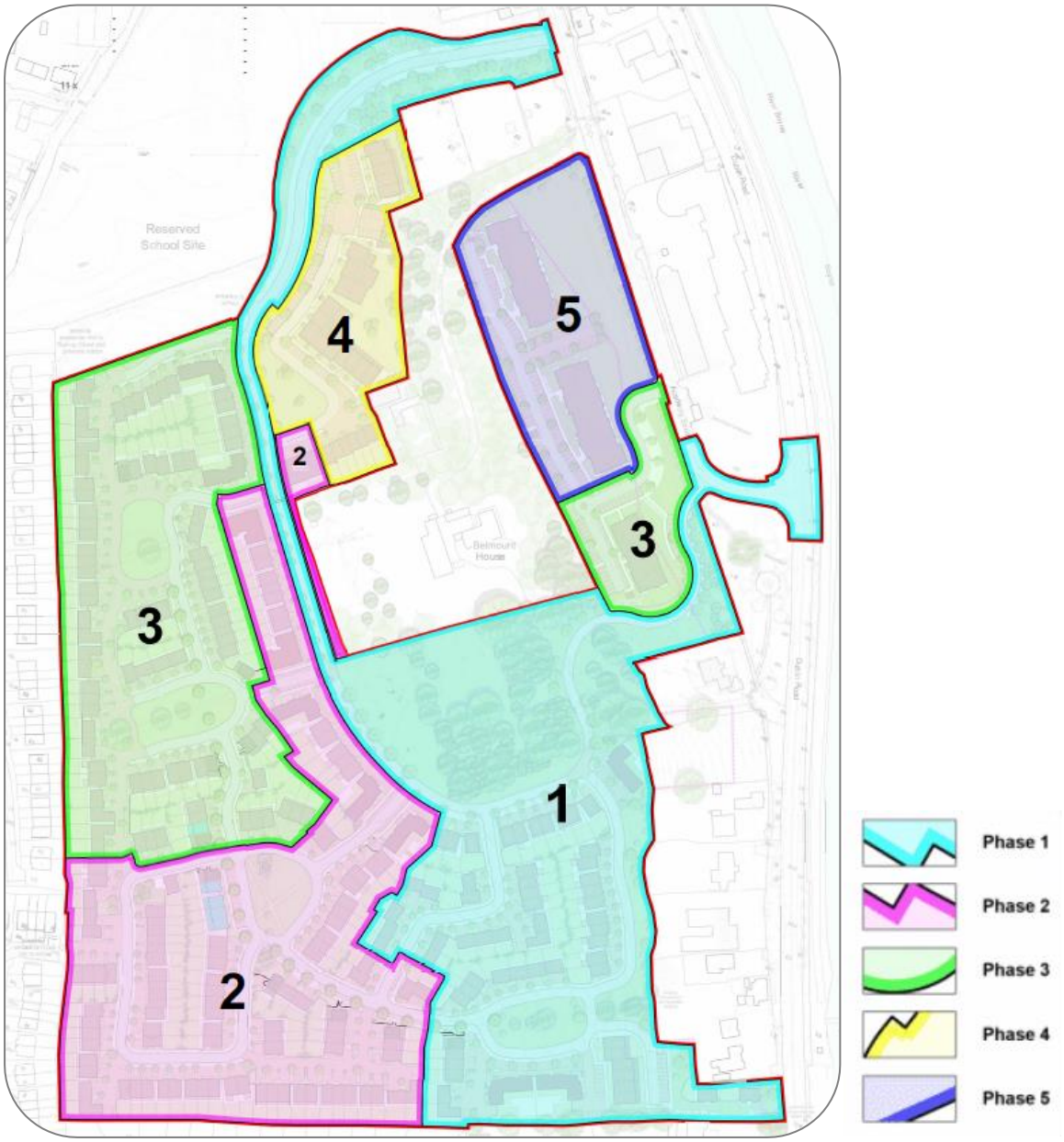


Figure 3 – Site Layout Phasing
(imagery data: Conroy Crowe Kelly Architects)

3.0 LEVEL OF SERVICE

There is an existing inherent risk of any flood event occurring during any given year. Typically, this likelihood of occurrence was traditionally expressed as a 1-in-100 chance of a 100-year storm event happening in any given year.

A less ambiguous expression of probability is the Annual Exceedance Probability (AEP), which may be defined as the probability of a flood event being exceeded in any given year. Therefore a 1-in-100-year event as a 1% AEP; similarly, a 100% AEP can be expressed as a 1-in-1-year event.

3.1 The *Planning System and Flood Risk Management, Guidelines for Planning Authorities* set out the best practice standards for flood risk assessment in Ireland. These are summarised in **Table 1** below.

Flooding Source	Drainage	River	Tidal/Coastal
Residential	1% AEP	0.1% AEP	0.1% AEP
Commercial	1% AEP	1% AEP	0.5% AEP
Water-compatible (docks, marinas)	-	>1% AEP	>0.5% AEP

Table 1 - Summary of Level of Service – Flooding Source.

Under these guidelines, a proposed development site has first to be assessed to determine the flood zone category it falls under.

3.2 It is a requirement of both Meath County Council's and the Department of the Environment, community & Local Government flooding guidelines, *The Planning System and Flood Risk Management, Guidelines for Planning Authorities,* that the predicted effects of climate change are incorporated into any proposed design. Table 2 below indicates the predicted climate change variations.

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

Table 2 - The predicted climate change variations

3.3 The flooding guidelines categorise the risks associated with flooding into three areas, Zone A, B & C. This categorisation is indicated below.

- **Zone A** – High Probability of Flooding. Where the average probability of flooding from rivers and sea is highest (greater than 1% annually or 1 in 100 for river flooding or 0.5% annually or 1 in 200 for coastal flooding).
- **Zone B** – Moderate Probability of Flooding. Where the average probability of flooding from rivers and sea is moderate (risk between 0.1% annually or 1 in 1000 years and 1% annually or 1 in 100 years for river flooding, and between 0.1% or 1 in 1000 years and 0.5% annually or 1 in 200 for coastal flooding).
- **Zone C** – Low Probability of Flooding. Where the probability of flooding from rivers and sea is moderate (risk is less than 0.1% annually or 1 in 1000 years for both rivers and coastal flooding).

In accordance with the *Planning Systems and Flood Risk Management Guidelines for Planning Authorities*, dwellings are classified as 'highly vulnerable developments'.

3.4 Reviewing the Meath County Council flood maps, the majority of the subject site is located in **Flood Zone C** with a small portion located in **Flood Zone B**. Please see **Appendix A**.

3.5 The section of the site located in Flood Zone 'B' is located adjacent to Academy Street. It runs parallel to the site. As no residential development is

proposed to take place in this area the implications of same having a detrimental effect on the subject lands are minimal.

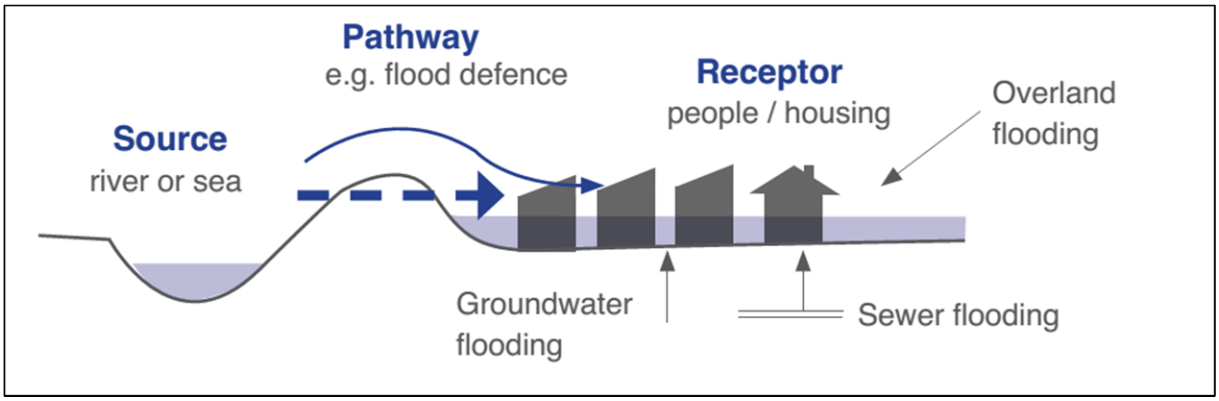


Figure 4 – Source-pathway-receptor model Site location

(Flood Risk Management Guidelines)

3.6 The flooding guidelines have developed an 'appropriateness' matrix for various developments and their potential risk factors. The table indicates if further analysis is required in the form of a justification test. Table 3 below outlines the conditions that require a justification test.

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable Development	***Justification Test***	***Justification Test***	Appropriate
Less Vulnerable Development	***Justification Test***	Appropriate	Appropriate
Water-compatible Development	Appropriate	Appropriate	Appropriate

Table 3 - Flood Zone Vs Justification Test Matrix

As noted above, the majority of the site is located within **Flood Zone C** and a small portion within **Flood Zone B.**

4.0 FLOOD RISKS & MITIGATION MEASURES

4.1 Fluvial Flooding

The site is located approximately 80m to the west of Boyne River. A review of the Office of Public Works flood maps database, (www.floodmaps.ie) for the area did not indicate previous flooding events on site. The most recent flood events close to the site occurred on Academy Street in January 1991 and according to the Navan Strategic Flood Risk Assessment, that flooding "*could be from a combination of fluvial and pluvial sources*". Refer to the OPW map report included in **Appendix B**.

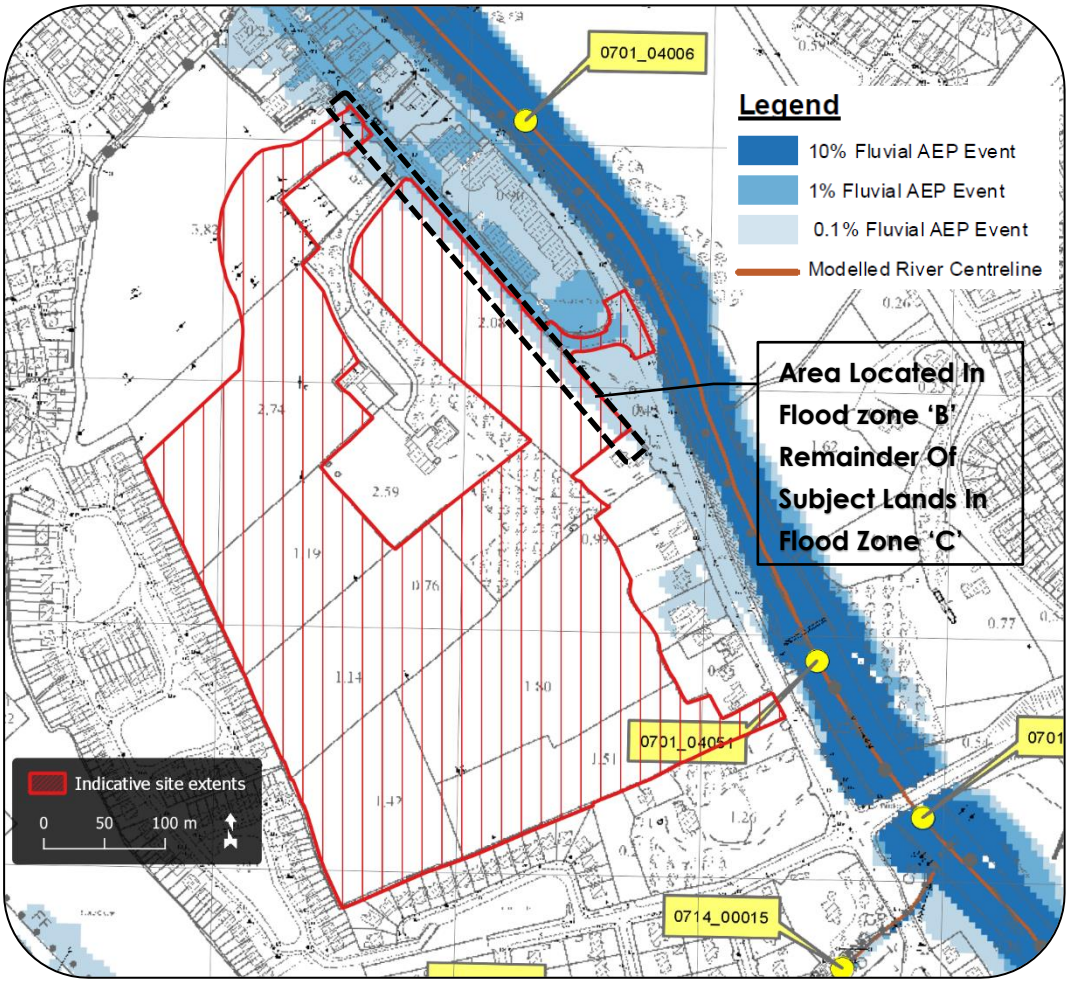


Figure 4 – FEM FRAM fluvial flood risk extents map extract
(imagery source: Office of Public Works)

The *Eastern Catchment Flood Risk Assessment and Management* Study (CFRAM) conducted by the OPW has produced maps of fluvial (river) flooding risk for the area surrounding the subject site. The full set of relevant CFRAM maps is provided as **Appendix C**.

A small proportion of the subject site adjacent to Academy St. is located within the Zone 'B'. Development of the type proposed is classified as *highly vulnerable development*, as designated in Table 3 above. The risk of fluvial flooding in this zone is modelled as 0.1% annually: this corresponds to a flooding event on average every 1000 years that would cover the small portion at the east of the site (i.e. a 1-in-1000-year event). As modelled this area could potentially flood during an extreme 1-in-1000 year event. It is not proposed to construct any units in this area, and it will remain as a landscaped area, with access locations off Academy St.

It is important to note minimum finish floor level of the proposed development will be 35.20m AOD, based on the 'mid-range' flood level for this subject site area, (along Academy St.) which is 33.07m AOD (current flooding level plus 500mm). Best practice dictates that the finish floor level of the proposed development should have a freeboard of 500mm added to this level to set the required finished floor level of 33.57m AOD. In addition, the topography of the subject site is favourable to avoid a floodplain due to higher levels above the 1% AEP event water level and the proposed development will be avoid any development in the predicted area at risk of flooding.

In relation to the proposed road accesses on Academy Street, based on the Navan Fluvial Flood Extents Map (November 2017), part of the Eastern CFRAM Study, there is a flood risk of the 1% AEP event (i.e. a 1-in-100-year event) at the entrances of the proposed development, this is located in Flood Zone 'A'. Discussions with Meath County Council indicated that the subject lands must have a safe access location, to ensure that emergency

vehicles can access the subject lands, even if a flooding event occurs off site along Academy St. As such access location three & the associated adjacent public road on Academy St. was chosen to be modified to ensure access could be maintained should a flooding event occur. The predicated 1% Fluvial AEP Flood Depth is between 0.25m and 0.5m at this location. The existing road level on Academy Street at the Access 3 will be raised 250mm to allow a fire tender vehicle to access the proposed development in case of an emergency. It was discussed and agreed with Meath County Council that this would be a suitable modification, as current emergency vehicles do not have any restrictions in passing through water up to 250mm in depth.

See Figure 5. This was reviewed in response to Meath County Council report, submitted An Bord Pleanála.

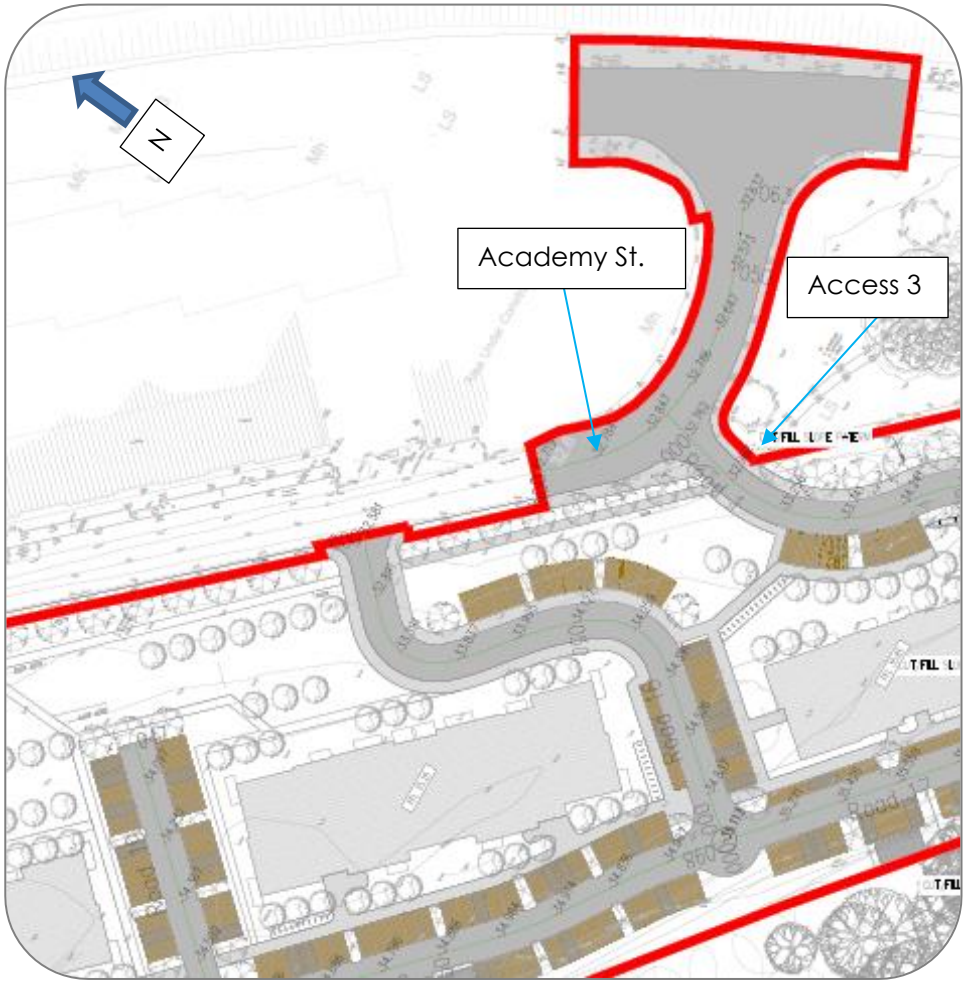


Figure 5 – Access 3
(imagery data: CS Consulting Drawing D061-028)

Furthermore, there is a pedestrian access on The Dublin Road where there is no risk of fluvial flooding, as it is in Flood Zone 'C'. Please refer the Navan Fluvial Flood Depths (1% Fluvial AEP Flood Depth) in **Appendix C**.

4.2 Tidal Flooding

The sites location is such that it is not affected by tidal water bodies and as such tidal flooding is negligible.

4.3 Pluvial Flooding

Pluvial flooding is flooding which has originated from overland flow resulting from high intensity rain fall. Previous flood events in the area can be reviewed on the Office of Public Works web site (www.floodmaps.ie). Although the historical flood mapping indicates flood events on Academy Street, there is no historical pluvial flooding event recorded in the area. See **Appendix B**.

The risk of overland flooding from the higher lands to the west of the subject site is mitigated by the fact that these lands have been developed and have their own surface water system. However, as a precaution in it is recommended that a filter drain be installed in the back gardens adjoining the western boundary.

4.4 Potential for Site to Contribute to Off-Site Flooding

In accordance with the requirements of Meath County Council, the proposed developed will contain an attenuation system designed to retain storm water generated on site for the predicted 1-in-100-year extreme storm event, increased by 10% for the predicted effects of climate change. The storm water will be restricted to a flow of 2.47 l/sec/ha for all storm events.

4.5 Existing Off Site Drainage

The subject site will only discharge a restricted flow into the existing public storm water sewer thereby reducing the hydraulic pressure on the Boyne River during extreme rainfall events.

4.6 Groundwater Flooding

According to the Geological Survey of Ireland (GSI) interactive maps, the subject site is underlain with *Dark limestone & shale*, which is part of the *Lucan Formation*. The groundwater vulnerability assessment of the site shows that the vulnerability of groundwater in the area is *high*. The local aquifer is described as *locally important aquifer which is generally moderately productive for local zones*. The proposed development will not increase the potential for groundwater flooding as such the risk is deemed acceptable. See **Appendix D** for GSI mapping information for background groundwater & geology data for the subject site.

5.0 FLOOD JUSTIFICATION TEST

5.1 In accordance with The Planning system and Flood Risk Management issued by the Department of the Environment, Heritage and Local Government should a site be classified as per Table 3.2.

Vulnerability class	Land uses and types of development which include*:
Highly vulnerable development (including essential infrastructure)	Garda, ambulance and fire stations and command centres required to be operational during flooding; Hospitals; Emergency access and egress points; Schools; Dwelling houses, student halls of residence and hostels; Residential institutions such as residential care homes, children's homes and social services homes; Caravans and mobile home parks; Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility; and Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less vulnerable development	Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions; Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans; Land and buildings used for agriculture and forestry; Waste treatment (except landfill and hazardous waste); Mineral working and processing; and Local transport infrastructure.
Water-compatible development	Flood control infrastructure; Docks, marinas and wharves; Navigation facilities; Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Water-based recreation and tourism (excluding sleeping accommodation); Lifeguard and coastguard stations; Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms; and Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).
*Uses not listed here should be considered on their own merits	

Figure 6 – Classification of vulnerability of different types of developments
(The Planning System and Flood Risk Management Guidelines)

5.2 The subject site is deemed 'highly vulnerable' due to the proposed development consisting of residential units a small proportion of the site, which includes access locations, being located in the predicated 1-in-1000 year flood zone, **Flood Zone 'B'**. However, the majority of the site is located within **Flood Zone C** As such a justification test is required for the proportion of the site in **Flood Zone 'C'** to include the access locations.

5.3 There are two parts to the justification test, (A) Justification test for Development Plans and (B) Justification Test for Development Management. The Justification Test for Development Plans is intended to inform land-use zoning decisions in the preparation of a Development Plan.

5.4 The subject site is zoned for residential development & open space in the current Navan Development Plan, 2009 - 2015. The Development plan and the Strategic Flood Risk Assessment for Meath County Council, 2013 – 2019. A Justification Test for Development Management for the site has been carried for the proposed development. See the item 5.5 below for the Justification Test.

5.5 Justification Test for Development Management

Justification Test for Development Management	
1.0	**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.** The subject lands are currently zoned for the proposed residential development.
2.0	**The proposal has been subject to an appropriate flood risk that demonstrates:**
(i)	***The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;*** **Answer:** Yes, the proposed use of attenuation system, sized for a 1 in 100 year storm event and increased by 10% (for predicted effects of climate change) will restrict storm water discharge rates during extreme storm events. This will aid in freeing up capacity in the public drainage network, as the volume entering the public combined system will be reduced to greenfield levels. The proposed razing on the public road at access location three, will not cause additional flooding away from this area, as the moderate volume of displaced water would remain in open spaces along Academy St.
(ii)	***The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;*** **Answer:** Yes, Meath County Council can monitor any flood warnings issued. In addition, the existing finish floor level on Academy Street at Access 3 location will be raised 250mm to allow a fire tender vehicle to access the proposed development in case of an emergency. Discussions with Meath County Council indicated that one of the three proposed access locations must be suitable for emergency vehicular access in the event of flooding occurring on academy St. to ensure that residents in the proposed development could be catered for by the emergency services if required.

(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 provisions for emergency services access;*** **Answer:** Yes, the nature and type of the proposed development which will have management staff will ensure that, in the highly unlikely event that the flood waters from the Boyne River cause surface flooding, then an orderly evacuation of the site could be carried out in accordance with management safety protocols or the flood defences installed.
(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.** **Answer:** Yes: the proposed development is in accordance with planning objectives and in accordance with development and flooding prevention guidelines. The proposed inclusion of a storm water attenuation regime will restrict stormwater discharge from the site to pre-development levels for extreme storm events, up to the predicated 1-in-100 year storm, increased by 10% for the predicated influence of climate change. The majority of the site is within Flood Zone 'C', however, a small linear section adjacent to Academy St. is located in Flood Zone 'B'. As the proposed access locations is off Academy St. & following discussions with Meath County Council, modifications are proposed to the access location No. 3 to ensure full emergency vehicle access should an extreme flood event occur.
Conclusion: The site passes the Justification Test for Development Management.	

6.0 CONCLUSION

- The site historically has no recorded flood events as noted in the OPW's historical flood maps.

- Modelling of the Boyne River has indicated that the eastern boundary of the subject site is located outside of the 1% Fluvial AEP, (Flood Zone A) , but within of the 0.1% Fluvial AEP Zone, (Flood Zone 'B'). However, the pluvial flooding has been assessed and the proposed development will avoid any flooding in the predicted area at risk of flooding and the proposed minimum finished floor level is above the water flood level plus a freeboard of 500mm.

- Pluvial flooding has been assessed and the proposed use of attenuation tanks to limit the storm water discharge rate from the site to 2.47l/s/Ha will aid in increasing the capacity of the Boyne River adjacent to the site.

- The risk of the site contributing to offsite flooding, or the site's vulnerability to flooding from the public drainage network, is mitigated by the installation of attenuation tanks to retain the storm volumes experienced on site during high intensity storm events.

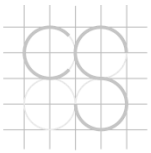
- The sites local geology & hydrogeological conditions do not indicate that flooding from groundwater is an issue at the site.

- Based upon The Navan Fluvial Flood Extents Map there is a risk of the 1% AEP event (this **1% Fluvial** AEP Flood Depth is between 0.25m and 0.50m). Discussions with Meath County Council indicated that there must be vehicular access to the proposed developments at least one location off Academy St. The existing ground level on Academy Street at the Access 3 will be raised 250mm to allow a fire tender vehicle to access the proposed development in case of an emergency.

Additionally, the pedestrian access on the Dublin Road has no risk of fluvial flooding. The proposed works to slightly raise the intersection will cause potential storm water which would have gathered at this location to be stored on the public open space adjacent to the proposed works. therefore there will be no downstream flooding due to these works.

Appendix A:

Meath County Council Flood Zone Mapping



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North

LEGEND

Flood Zone A

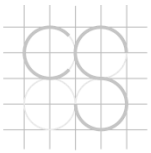
Flood Zone B

Defended Area

JBA consulting

APPENDIX A

Flood Zone Mapping



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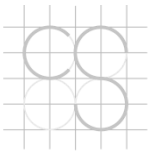
Appendix B:

Office of Public Works Historic Flood Report



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OPW National Flood Hazard Mapping

Summary Local Area Report

This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Meath

NGR: N 872 674

Map Scale 1:5,229

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

22 Results

1. Boyne Navan Nov 2002
Start Date: 15/Nov/2002
County: Meath
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

2. Blackwater Navan Nov 2000
Start Date: 07/Nov/2000
County: Meath
Flood Quality Code:2
Additional Information: Photos (2) Reports (2) Press Archive (1) More Mapped Information

3. Boyne Navan Nov 2000
Start Date: 06/Nov/2000
County: Meath
Flood Quality Code:2
Additional Information: Photos (6) Reports (3) Press Archive (3) More Mapped Information

4. Boyne Kilcarn Bridge Navan Nov 2000
Start Date: 05/Nov/2000
County: Meath
Flood Quality Code:2
Additional Information: Photos (3) More Mapped Information

5. Boyne Navan Feb 1990
Start Date: 07/Feb/1990
County: Meath
Flood Quality Code:2

Additional Information: Photos (1) Press Archive (1) More Mapped Information

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6. Boyne Navan Dec 1978 — Start Date: 27/Dec/1978

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) Press Archive (2) More Mapped Information

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7. Boyne Kilcarn Dec 1968 Jan 1969 — Start Date: 01/Dec/1968

County: Meath — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

8. Boyne Navan Nov 1965 — Start Date: 17/Nov/1965

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

9. Boyne Navan Kilcarn Bridge Recurring — Start Date:

County: Meath — Flood Quality Code:2

Additional Information: Photos (3) Reports (1) More Mapped Information

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10. Boyne Commons Lane Navan August 2008 — Start Date: 16/Aug/2008

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

11. Boyne Kilcarn Nov 2002 — Start Date: 14/Nov/2002

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

12. Boyne Railway Bridge, Navan Nov 2002 — Start Date: 14/Nov/2002

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

13. Boyne Athlumney Nov 2002 — Start Date: 14/Nov/2002

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

14. Boyne Blackwater Nov 2002 — Start Date: 14/Nov/2002

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

15. Boyne Blackcastle Nov 2002 — Start Date: 14/Nov/2002

County: Meath — Flood Quality Code:2

Additional Information: Reports (1) More Mapped Information

16. Boyne Academy Street, Navan 1991 — Start Date: 01/Jan/1991

County: Meath — Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

17. Navan Swan Culvert, Trim Road Recurring — Start Date:

County: Meath — Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

18. Navan Atlumney Recurring — Start Date:

County: Meath — Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

---

19. Swan Kilcarn Housing Estate Navan Recurring

Start Date:

County: Meath

Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

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20. Navan Commons Road Recurring

Start Date:

County: Meath

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

---

21. Raish Court Navan Recurring

Start Date:

County: Meath

Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

---

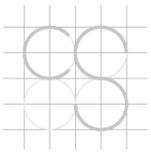
22. Moatville Housing Estate Navan Recurring

Start Date:

County: Meath

Flood Quality Code:4

Additional Information: Reports (1) Press Archive (1) More Mapped Information



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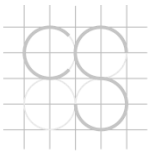
Appendix C:

Fingal East Meath Flood Risk Assessment and Management Mapping



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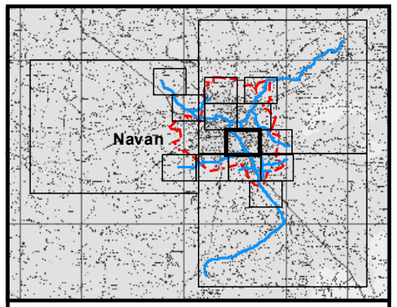
Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
0714_00040	39.17	N/A	39.27	N/A	39.45	N/A
0714_00015	34.36	1.49	34.52	2.29	35.11	4.21
0701_04099	33.54	264.79	34.22	378.64	34.95	524.06
0701_04071	33.34	265.30	34.04	379.64	34.80	517.07
0701_04051	33.07	266.01	33.83	384.96	34.43	532.82
0701_04006	32.28	N/A	33.07	N/A	33.85	N/A
0701_03956	31.75	N/A	32.48	N/A	33.24	N/A



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

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP Standard of Protection of Flood Defence
- 1% AEP (Walls / Embankments)
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
03	Amendment made to model	16/11/17
02	Flood Defences added to page 10	26/10/17
01	Flood Defences added to map.	05/05/17

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

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W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Navan Fluvial Flood Extents

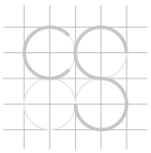
Map Type:	EXTENT	
Source:	FLUVIAL	
Map Area:	HPW	
Scenario:	CURRENT	
Drawn By :	F.M.C.	Date : 16 November 2017
Checked By :	S.P.	Date : 16 November 2017
Approved By :	G.G.	Date : 16 November 2017

Drawing No. : E07NAV_EXFCD_F3_09

Map Series : Page 9 of 16

Drawing Scale : 1:5,000 @ A3

0 50 100 200 300 400 500 Metres



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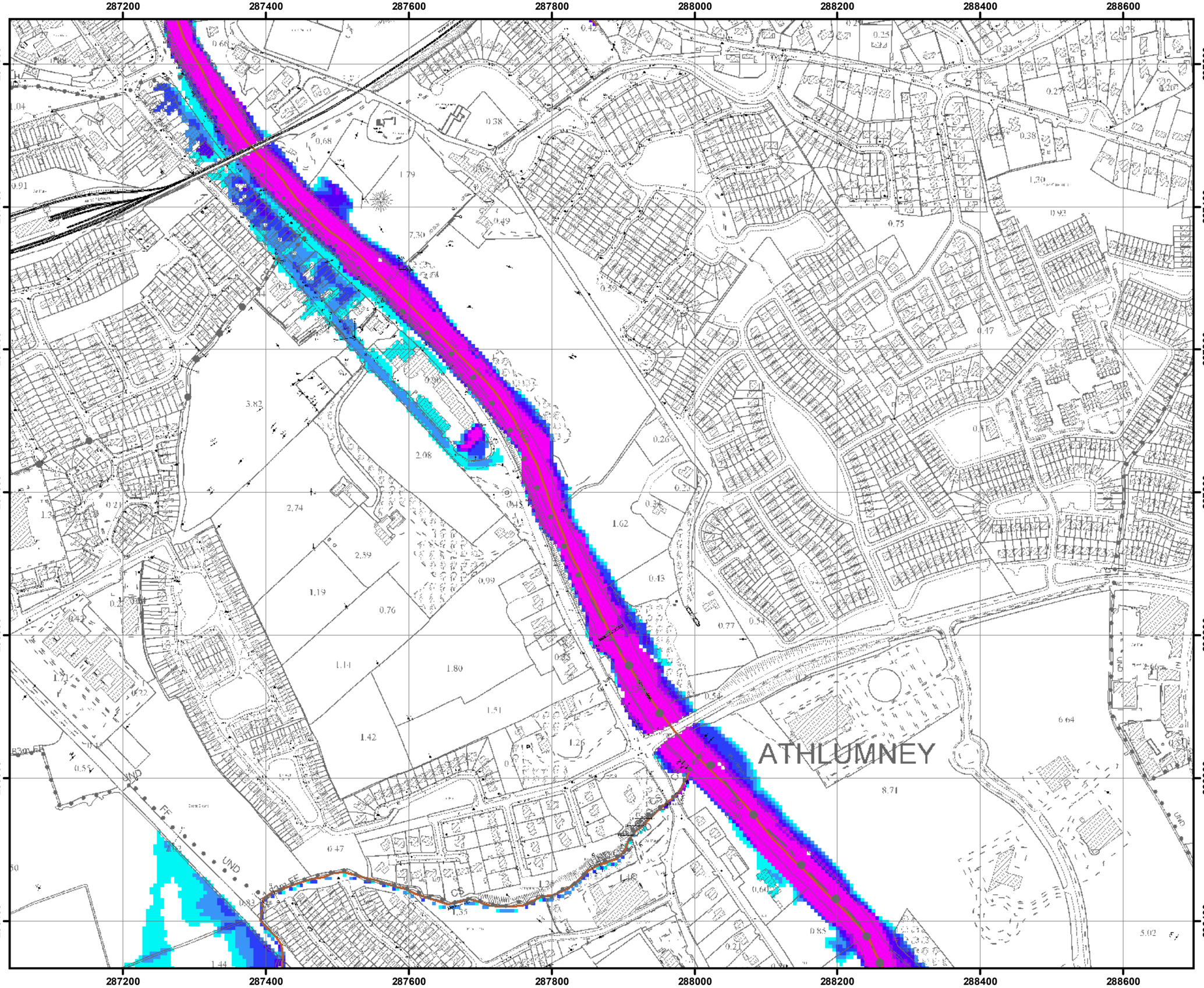

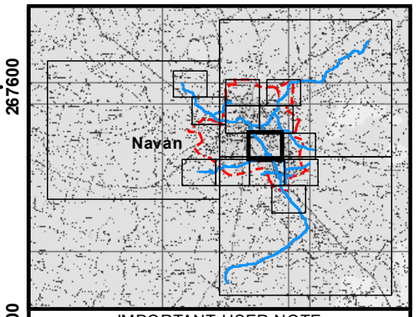

IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

1% Fluvial AEP Flood Depth

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 1m
- 1.0 - 1.5m
- 1.5 - 2m
- >2m
- Modelled River Centreline
- AFA Extents

FINAL

REV:	NOTE:	DATE:
01	Amendment made to model	16/11/2017

EASTERN CFRAM STUDY
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E ireland@rpsgroup.com

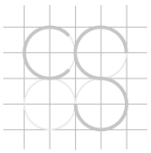
Map:
Navan Fluvial Flood Depths

Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.McG. Date : 16 November 2017
Checked By :	S.P. Date : 16 November 2017
Approved By :	G.G. Date : 16 November 2017

Drawing No. :
E07NAV_DPFCD010_F3_09

Map Series : Page 9 of 16

Drawing Scale : 1:5,000 @A3



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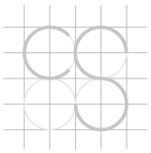
Appendix D:

Geological Survey of Ireland – Hydrogeology & Bedrock Geology Maps



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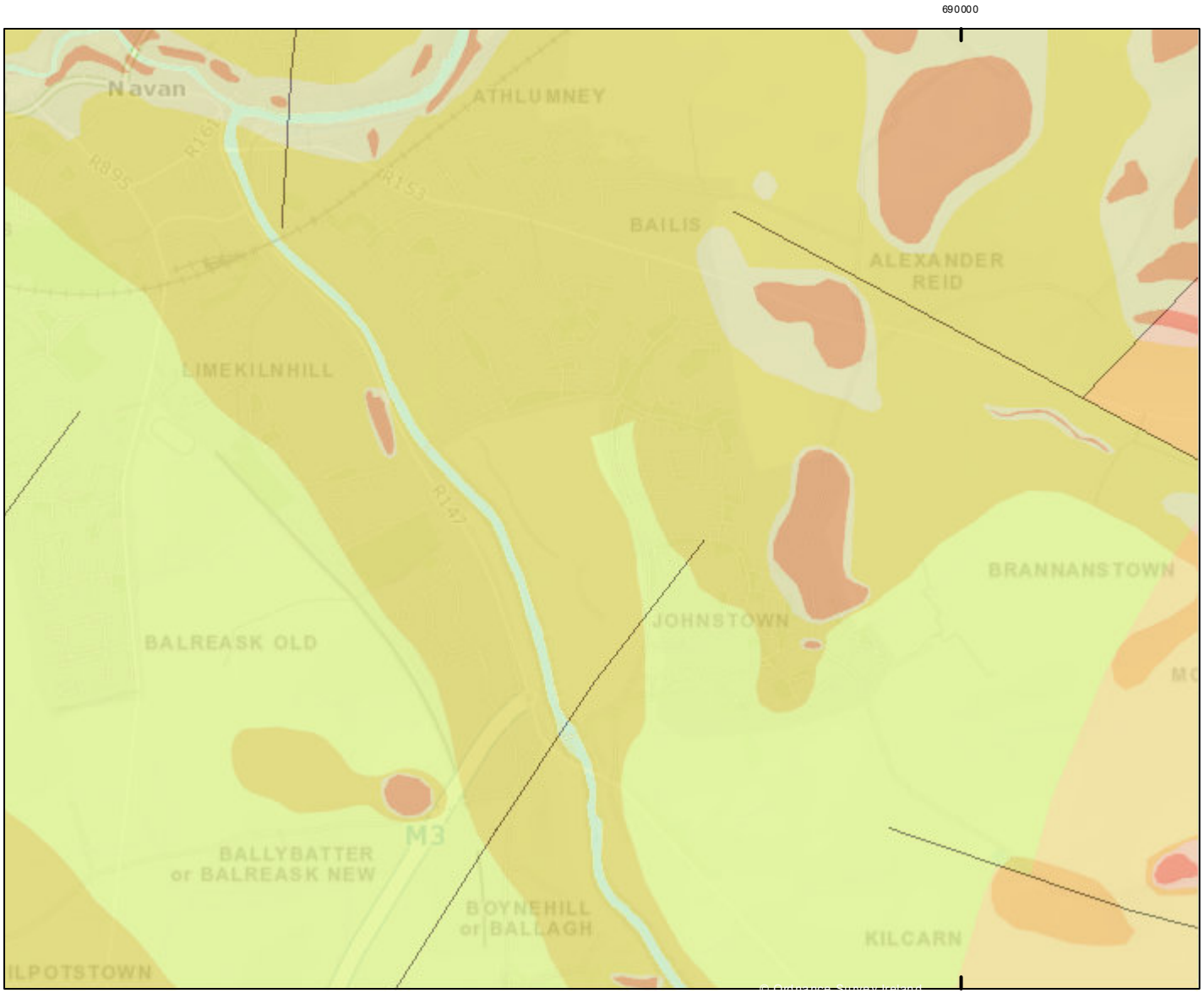
DUBLIN - LONDON - LIMERICK

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

D061 - Academy Street



Scale: 1:25,000

Geological Survey Ireland

PSI Licence

0 0.175 0.35 0.7 mi

0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 688,590 766,447

3/6/2019, 4:31:51 PM

Legend

Bedrock Aquifer
Faults

Gravel Aquifer

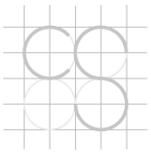
Locally Important Gravel Aquifer
Regionally Important Gravel Aquifer

Bedrock Aquifer

Rkc - Regionally Important Aquifer - Karstified (conduit)
Rkd - Regionally Important Aquifer - Karstified (diffuse)
RK - Regionally Important Aquifer - Karstified
Rf - Regionally Important Aquifer - Fissured bedrock
Lm - Locally Important Aquifer - Bedrock which is Generally Moderately Productive
Lk - Locally Important Aquifer - Karstified
Ll - Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones
Pl - Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones
Pu - Poor Aquifer - Bedrock which is Generally Unproductive
Lake

Groundwater Vulnerability

X - Rock at or near surface or Karst
E - Extreme
H - High
M - Moderate
L - Low
W - Water



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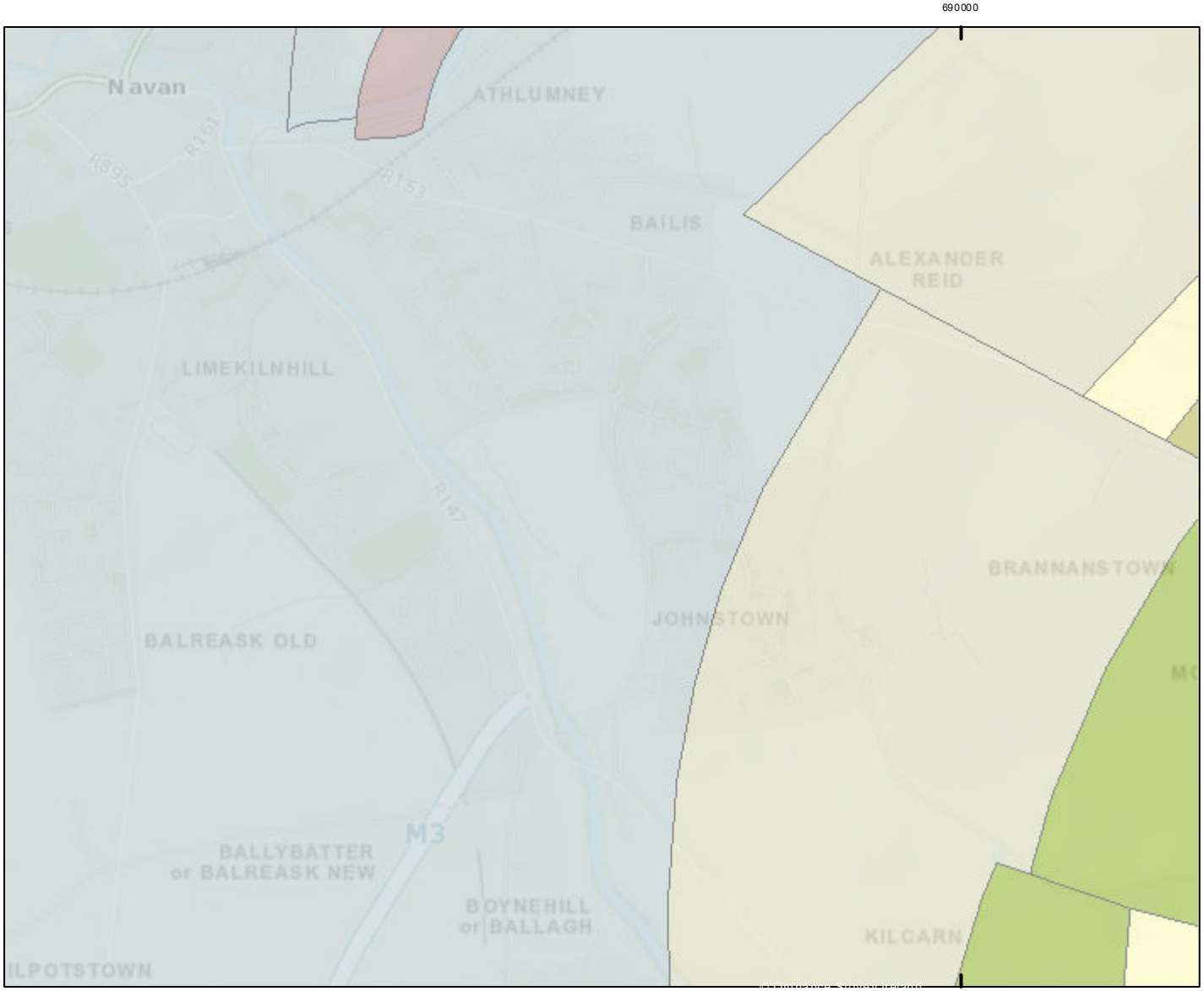
DUBLIN - LONDON - LIMERICK

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

D061 - Geology



Scale: 1:25,000

Geological Survey Ireland

PSI Licence

N
W E
S

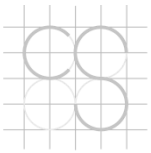
0 0.175 0.35 0.7 mi

0 0.275 0.55 1.1 km

Map Centre Coordinates (ITM) 688,590 766,447

3/6/2019, 4:32:42 PM

Legend



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