Job No. : 16036
Date: April 2017

Respond! Housing Association

Residential Development at Flinters Field, Athy, Co. Kildare

Engineering Report

MALONE O'REGAN

2B Richview Office Park
Clonskeagh
Dublin 14

Contents Amendment Record

2B Richview Office Park, Clonskeagh, Dublin 14
Tel: +353-1-260 2655 Fax: +353-1-260 2660 E-mail: info@MORce.ie

MALONE O'REGAN

Title: **Residential Development at Flinters Field, Athy, Co. Kildare Engineering Report**

Job Number: **16036**

Prepared By: **Douglas Weir** **Signed:**

Checked By: **Noel Dillon** **Signed:**

Approved By: **Noel Dillon** **Signed:**

Revision Record

Issue No.	Date	Description	Remark	Prepared	Checked	Approved
PR1	16/12/16	Pre Planning for Local Authority Comment	n/a	DW	ND	ND
P	16/02/17	Planning	n/a	DW	ND	ND
P1	13/04/17	Planning	n/a	DW	ND	ND

CONTENTS

		Page No.

1 INTRODUCTION 1

1.1 Introduction 1

1.2 Project Description 1

1.3 Site Location 1

1.4 References 2

2 SURFACE WATER DRAINAGE DESIGN 3

2.1 Proposed Layout 3

2.2 Attenuation / Runoff Calculations 3

3 FOUL WATER DRAINAGE DESIGN 5

3.1 Proposed Layout 5

3.2 Foul Discharge Calculations 5

4 WATERMAINS 6

4.1 Proposed Layout 6

4.2 Water Demand Calculations 6

5 ROAD NETWORK 7

5.1 Internal Road Network 7

6 FLOOD RISK ASSESSMENT 8

6.1 OPW Flood Records 8

6.2 The National Preliminary Flood Risk Assessment 8

6.3 Sequential Approach to Flood Risk Management 9

6.3.1 Flood Zones 10

6.3.2 Vulnerability Class of Proposed Development 10

APPENDIX A – ATTENUATION CALCULATIONS

APPENDIX B – CFRAM FLOOD MAPPING

1 INTRODUCTION

1.1 Introduction

Malone O'Regan have been commissioned by the applicant, The Respond! Housing Association to prepare a planning submission in respect of a proposed residential development at Flinters Field, Athy, County Kildare.

The purpose of this document is to outline the engineering proposals associated with the new development. The proposed development is fully described on the drawings which accompany this planning submission. Where reference is made to drawings and drawing numbers within this report these should be taken as meaning those drawings produced by Malone O'Regan unless specifically stated otherwise.

1.2 Project Description

The proposed development comprises the construction of 35 no. terraced, detached, semi-detached and terraced properties along with all associated infrastructure works including internal roads, footpaths, foul and surface water drainage pipework, surface water attenuation, a water supply network, landscaped play area and all other required services.

The proposed development is to be located adjacent to an existing residential development which was constructed by Respond in 2001. This previous development comprises a number of semi-detached residential properties and a community hall located along two residential streets known as Flinters Place and Flinters Close.

It is intended that vehicular access to the site will be via Flinters Place in the northern corner of the site and Flinters Close in the western corner of the site. A separate pedestrian link to Woodstock St to the northeast of the site is also proposed. The proposed road layout will also allow for a possible future road linkage in the southern corner of the site.

1.3 Site Location

The proposed development is to be located on a 1.9534ha greenfield site approximately 500m to the northwest of Athy town centre. The site is bordered to the north, south and east by other existing residential developments. The Grand Canal runs along the western boundary of the site. The River Barrow is located approximately 350m to the northeast of the site.

Figure 1.1 Location of the proposed development.

1.4 References

Reference has been made to the following publications in the preparation of this report.

- Greater Dublin Regional Code of Practice for Drainage Works, Version 6.0.
- Greater Dublin Strategic Drainage Study.
- EPA Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels.
- Planning Systems and Flood Risk Management: Guidelines for Planning Authorities November 2009.
- Design Manual for Urban Roads and Streets

2 SURFACE WATER DRAINAGE DESIGN

2.1 Proposed Layout

The proposed surface water drainage layout is indicated on drawing 16036/102. It is proposed to discharge all surface water runoff from the site into an existing surface water drain located in the northwestern portion of the site.

Surface water runoff from the new road surfaces and the roofs of the new buildings will be collected by gullies and directed towards two separate attenuation tanks. The outfall from each attenuation tank will be controlled using a Hydrobrake and the total surface water discharge rate will be limited to the 'greenfield' runoff value for the site.

All surface water drainage will be designed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

2.2 Attenuation / Runoff Calculations

Development Area Details

Total Area = 19,534 m2 (1.9534 hectares)

Calculation of Impermeable area:

	Area (m^2)	**Permeability Factor**	**Impermeable Area (m^2)**
Roofs	2105	0.95	2000
Roads	3380	0.90	3042
Other Hardstanding	3525	0.80	2820
Grass	10524	0.10	1052
		Total Imp. Area =	**8,914 m2**

Rainfall Data

The rainfall data used was based on Met Eireann Rainfall Data for Athy. The rainfall data and drainage criteria employed are as follows:

M5 – 60 = 15.8mm (Max. rainfall in 1 hour for 5 year return period)

M5 - 2D = 48.4mm (Max. rainfall in 2 days for 5 year return period)

Ratio, r = 0.33 (M5 - 60/ M5 - 2D)

Standard Average Annual Rainfall (SAAR) = 825mm

When calculating the required size of attenuation tank using Micro Drainage, an additional 10% was added to the above rainfall intensities to account for the future effects of climate change.

Permissible Runoff

The permissible rate of surface water runoff from the site has been taken as 2 litres per second per hectare. Given the site area of 1.9534 hectares, the allowable discharge rate is therefore 3.90 litres/s.

Attenuation Design & Outflow Connection

Calculations for the design of the attenuation tank are provided in Appendix A. These calculations are based on the design parameters listed above. The attenuation tank has been sized to cater for a 1 in 100 year storm event.

The required attenuation volume has been calculated using industry-standard design package Micro Drainage. The calculations provided in Appendix A show that the total volume of attenuation storage required on the site is 400m^3.

Two separate attenuation tanks will be provided. The area of impermeable surfacing draining into each tank has been calculated. The attenuation tank located on the western side of the site, in front of house numbers 08 – 10 will receive 52% of the total runoff from the site. The other attenuation tank, located beside house number 02, will receive 48% of the total site runoff. Each tank has been sized to provide a volume in excess of 400m^3 x 52% = 208m^3.

Each tank will have a storage capacity of **212m^3**. The outflow from each tank will be limited to half of the total permissible runoff i.e. **1.95 l/s**.

3 FOUL WATER DRAINAGE DESIGN

3.1 Proposed Layout

It is proposed to provide foul drainage pipework to serve the development as indicated on drawing 16036/103. This new pipework will connect into an existing sewer which was installed as part of the previous Respond! Development on the adjoining lands. The existing sewer runs across the site from the western corner towards Woodstock St. It is proposed to connect the new pipework into this existing sewer at three separate locations.

All foul water drainage will be designed in accordance with the Greater Dublin Regional Code of Practice for Drainage Works.

Note Further information is requested from the Local Authority for the drainage in the neighbouring housing estates (St Dominic's Park and Cardington Crescent). This information may lead to changes in the site levels on the south east side.

3.2 Foul Discharge Calculations

The average and peak discharge rates were calculated using loading rates provided by Irish Water:

Dry Weather Flow (DWF) = 600 litres per dwelling
(Source: Irish Water Pre-Connection Enquiry Form)

Number of properties = 35.

Total DWF = 600 x 35 = 21,000 litres / day
= 0.243 l/s

Peak Discharge = 6 x DWF = 6 x 0.243
= 1.46 l/s

4 WATERMAINS

4.1 Proposed Layout

The proposed watermain layout is indicated on drawing 16036/104 which accompanies this planning submission. It is proposed to provide new lengths of HDPE watermain to serve the development. The new watermains will be fed off an existing watermain which was installed as part of the previous Respond! development on the adjoining lands.

4.2 Water Demand Calculations

The average and peak water demand rates were calculated in accordance with the Irish Water Pre-Connection Enquiry Form which assumes a loading rate of 150 litres / person / day and an average occupancy ratio of 2.7 persons per dwelling. The average day, peak week demand is taken as 1.25 times the average daily domestic demand. The peak demand is taken to be 2.1 times the average day, peak week demand.

Number of properties = 35

Average Daily Domestic Demand = 150 x 35 x 2.7 = 14,175 litres / day
= 0.164 l/s

Average Day Peak Week Demand = 0.164 x 1.25 = 0.205 l/s

Peak Demand = 0.205 x 2.1
= 0.431 l/s

Normal Demand (assuming principal water usage over 8 hrs) = 0.205 x 24/8 = 0.615 l/s

5 ROAD NETWORK

5.1 Internal Road Network

The internal road layout is indicated on drawing 16036/101. It is proposed to connect the new sections of carriageway to the existing roadways located within the previous Respond! development on the adjoining lands. A swept path analysis has been conducted and is shown on drawing 16036/105. It can be seen that emergency vehicles and bin lorries are able to safely manoeuvre around the proposed site layout.

A pedestrian footpath is proposed alongside the internal road network. Dropped kerbs and tactile paving will be provided at all pedestrian road crossing points. A pedestrian link to Woodstock St to the northeast of the site is also proposed.

All proposed roads, footpaths will be fully designed to meet the requirements of the Design Manual for Roads and Streets.

6 FLOOD RISK ASSESSMENT

The following sources of information were reviewed in order to identify any flood risk to the proposed development site:

- OPW Flood Records from www.floodmaps.ie
- The National Preliminary Flood Risk Assessment (PFRA) – Overview Report & Indicative Flood Maps (OPW, March 2012, www.cfram.ie)
- The Planning Systems and Flood Risk Management: Guidelines for Planning Authorities; Technical Appendices November 2009

6.1 OPW Flood Records

An examination was made of the OPW Flood Records (www.floodmaps.ie). There are no recorded flood events in the vicinity of the site.

6.2 The National Preliminary Flood Risk Assessment

A further source of information used to establish the risk of flooding on the site is the flood maps contained within the OPW Catchment Flood Risk Assessment and Management (CFRAM) Study.

The relevant CFRAM maps indicating the extent of flooding caused by a fluvial flood event with an annual exceedance probability (AEP) of 10% (10yr event), 1% (100yr event) and 0.1% (1000yr event) are included in Appendix B.

An extract from these maps is provided in Figure 6.1 below. The light blue hatching indicates the areas which could be affected by flooding during an event with a 0.1% (1,000-yr event) annual exceedance probability. The proposed development site is indicated with a red boundary.

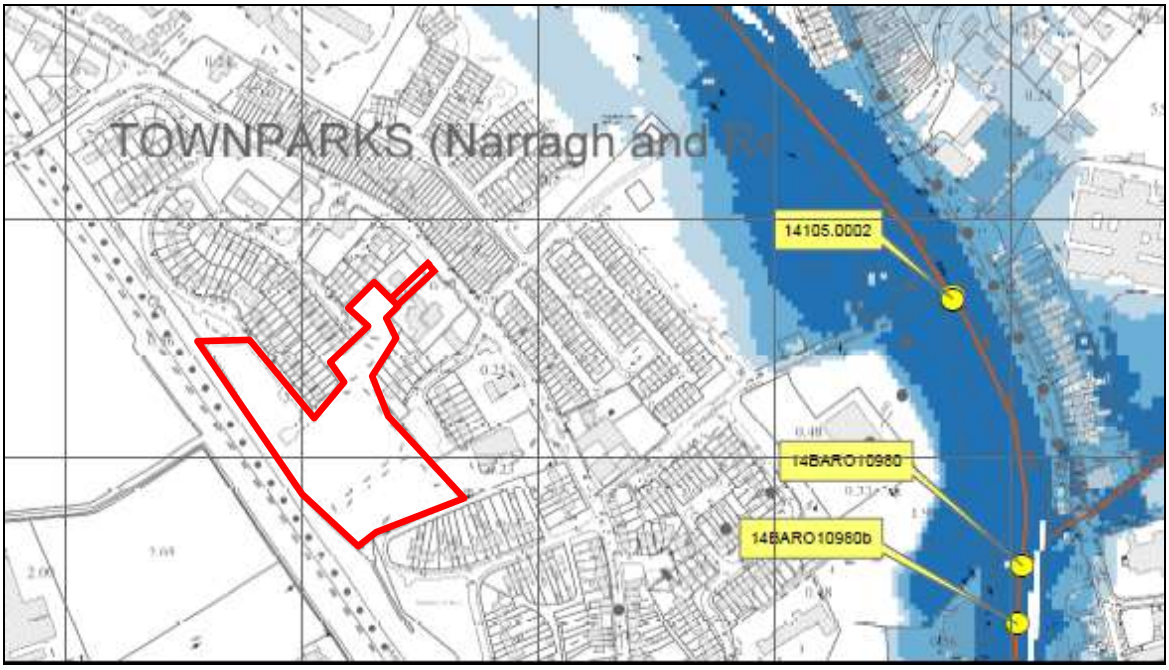


Figure 6.1 – Extract from PFRA Maps

From Figure 6.1 and the maps in Appendix B it can be seen that the site is predicted to remain unaffected by the most extreme 1 in 1000 year flood events. Flooding appears to be limited to the areas immediately alongside the River Barrow.

6.3 Sequential Approach to Flood Risk Management

The document “Planning Systems and Flood Risk Management: Guidelines for Planning Authorities November 2009” requires the adoption of a sequential approach to flood risk management when assessing the location for new developments. This approach is a risk-based method to guide development away from areas that have been identified through flood risk assessment as being at risk from flooding. The philosophy used in this approach is outlined in figure 6.2 below.

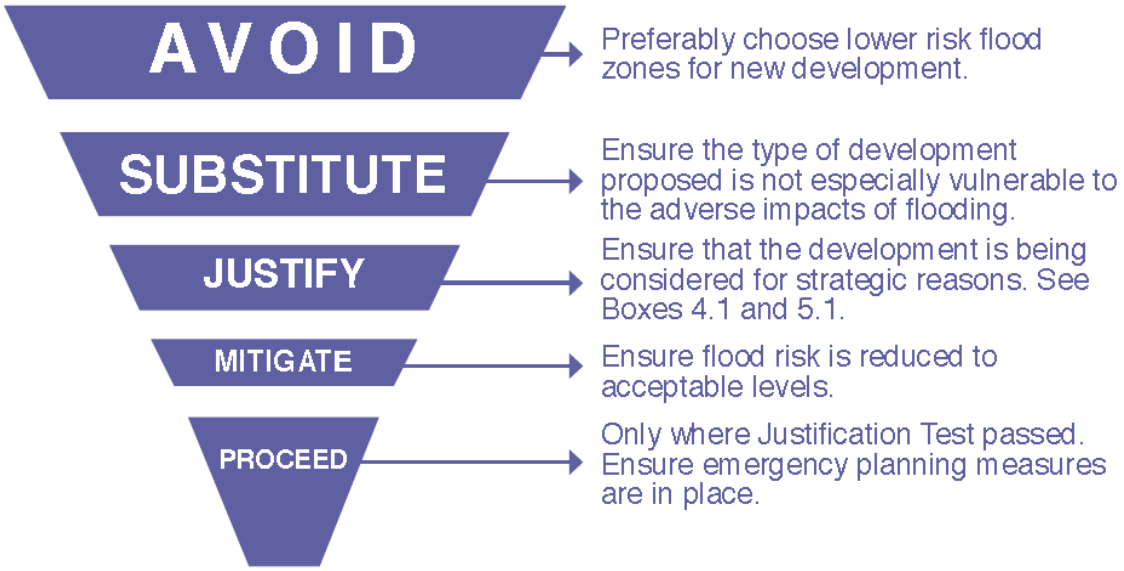


Figure 6.2 Source: The Planning Systems and Flood Risk Management: Guidelines for Planning Authorities November 2009

The sequential approach uses mapped flood zones alongside considerations of the vulnerability of different types of development to give priority to development in zones of low flood probability.

6.3.1 Flood Zones

The flood zones are defined on the basis of flooding from rivers and the sea. The different flood zones recommended in the 2009 Planning Guidelines are:

Flood Zone A – Highest risk area where there is a 1% chance of flooding in any one year from rivers and a 0.5% chance of flooding from the sea.

Flood Zone B – Moderate risk area where the chance of flooding in any one year is 0.1-1% for rivers and 0.1-0.5% for coastal flooding.

Flood Zone C – Low risk area with less than 0.1% chance of flooding from rivers or the sea in any given year.

As described in Section 6.2 above, the flood maps contained within the CFRAM Study indicate that the site is not predicted to flood even during the most extreme (1 in 1000 year) flood events. The development is therefore located within Flood Zone C.

6.3.2 Vulnerability Class of Proposed Development

The vulnerability class of the development is dependent on the land use and type of development proposed. See Figure 6.3 for the vulnerability classes.

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 6.3 Classification of Vulnerability to Flooding for Various Development Types

*(*Source – Table 3.1 Planning System and Flood Risk Management – Guidelines for Planning Authorities DEHLG, OPW, November 2009)

The proposed development includes 35 no. properties which will be used as private dwellings. It therefore constitutes a “highly vulnerable development”.

The 2009 Planning Guidelines presents a matrix of vulnerability versus flood zone to illustrate appropriate development and the requirement of justification tests. That matrix can be seen in Figure 6.4. The proposed development is classified as a highly vulnerable development from Figure 6.3 and it is located within Flood Zone C. The development is therefore considered appropriate with regards to the anticipated flood risk and no further justification test is required.

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

Figure 6.4 - Matrix of Vulnerability vs. Flood Zone

*(*Source – Table 3.1 Planning System and Flood Risk Management – Guidelines for Planning Authorities DEHLG, OPW, November 2009)

APPENDIX A – ATTENUATION CALCULATIONS

Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 1166 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	0.380	0.380	0.0	2.4	2.4	145.9	O K
30 min Winter	0.508	0.508	0.0	2.4	2.4	195.1	O K
60 min Winter	0.636	0.636	0.0	2.6	2.6	244.0	O K
120 min Winter	0.765	0.765	0.0	2.9	2.9	293.9	O K
180 min Winter	0.840	0.840	0.0	3.0	3.0	322.7	O K
240 min Winter	0.891	0.891	0.0	3.1	3.1	342.0	O K
360 min Winter	0.956	0.956	0.0	3.2	3.2	367.2	O K
480 min Winter	0.995	0.995	0.0	3.3	3.3	382.1	O K
600 min Winter	1.019	1.019	0.0	3.3	3.3	391.1	O K
720 min Winter	1.032	1.032	0.0	3.3	3.3	396.4	O K
960 min Winter	1.042	1.042	0.0	3.4	3.4	400.0	O K
1440 min Winter	1.030	1.030	0.0	3.3	3.3	395.7	O K
2160 min Winter	1.000	1.000	0.0	3.3	3.3	384.1	O K
2880 min Winter	0.957	0.957	0.0	3.2	3.2	367.4	O K
4320 min Winter	0.861	0.861	0.0	3.1	3.1	330.6	O K
5760 min Winter	0.768	0.768	0.0	2.9	2.9	294.9	O K
7200 min Winter	0.682	0.682	0.0	2.7	2.7	261.7	O K
8640 min Winter	0.601	0.601	0.0	2.6	2.6	230.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	80.534	0.0	139.8	19
30 min Winter	54.133	0.0	181.1	33
60 min Winter	34.245	0.0	247.9	62
120 min Winter	21.049	0.0	304.0	122
180 min Winter	15.710	0.0	339.3	180
240 min Winter	12.729	0.0	365.1	238
360 min Winter	9.448	0.0	401.9	354
480 min Winter	7.635	0.0	424.8	470
600 min Winter	6.468	0.0	435.8	584
720 min Winter	5.646	0.0	439.0	694
960 min Winter	4.554	0.0	441.2	908
1440 min Winter	3.362	0.0	443.0	1142
2160 min Winter	2.480	0.0	652.0	1604
2880 min Winter	1.999	0.0	699.2	2076
4320 min Winter	1.474	0.0	753.1	2980
5760 min Winter	1.187	0.0	834.8	3856
7200 min Winter	1.002	0.0	881.4	4688
8640 min Winter	0.873	0.0	921.1	5528

Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	0.526	0.526	0.0	2.4	2.4	201.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	0.777	0.0	955.2	6352

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	15.800	Shortest Storm (mins)	15
Ratio R	0.330	Longest Storm (mins)	10080
Summer Storms	No	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.873

Time (mins) From:	To:	Area (ha)
0	4	0.873

Model Details

Storage is Online Cover Level (m) 2.000

Cellular Storage Structure

Invert Level (m) 0.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.60
Infiltration Coefficient Side (m/hr) 0.00000

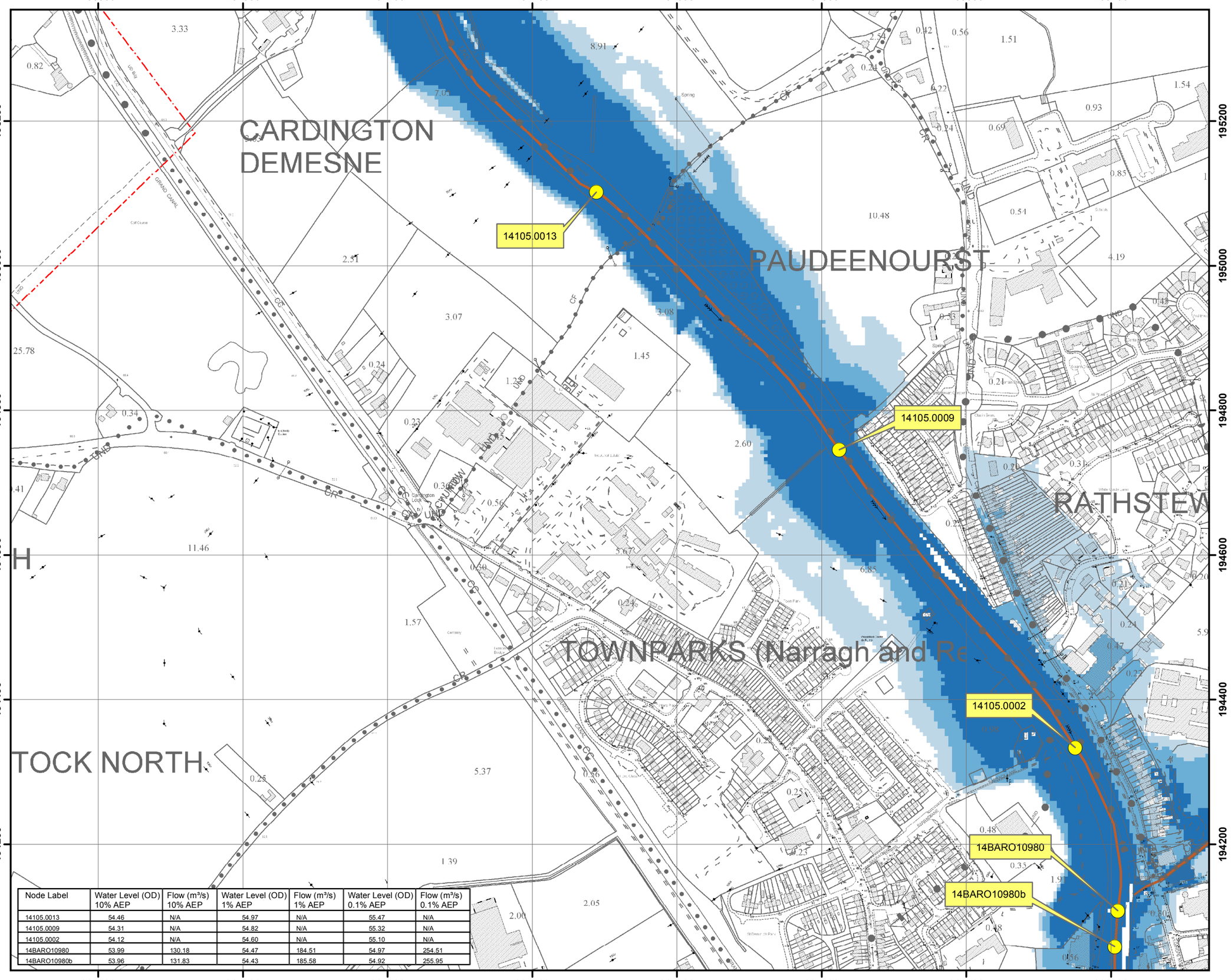
Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	640.0	640.0	1.200	0.0	754.4
1.100	640.0	754.4			

Hydro-Brake® Outflow Control

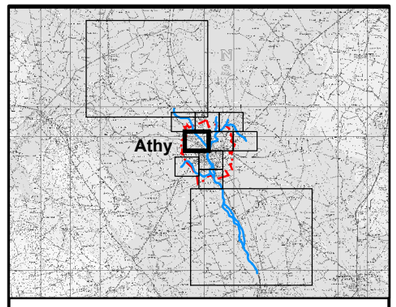
Design Head (m) 1.100 Hydro-Brake® Type Md6 SW Only Invert Level (m) 0.000
Design Flow (l/s) 3.5 Diameter (mm) 76

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.6	3.000	5.7	7.000	8.7
0.200	2.4	1.400	3.9	3.500	6.2	7.500	9.0
0.300	2.2	1.600	4.2	4.000	6.6	8.000	9.3
0.400	2.2	1.800	4.4	4.500	7.0	8.500	9.6
0.500	2.4	2.000	4.7	5.000	7.4	9.000	9.9
0.600	2.6	2.200	4.9	5.500	7.7	9.500	10.2
0.800	3.0	2.400	5.1	6.000	8.1		
1.000	3.3	2.600	5.3	6.500	8.4		

APPENDIX B – CFRAM FLOOD MAPPING



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
14105.0013	54.46	N/A	54.97	N/A	55.47	N/A
14105.0009	54.31	N/A	54.82	N/A	55.32	N/A
14105.0002	54.12	N/A	54.60	N/A	55.10	N/A
14BARO10980	53.99	130.18	54.47	184.51	54.97	254.51
14BARO10980b	53.96	131.83	54.43	185.58	54.92	255.95



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
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:

SOUTH EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW Oifig na nOibreacha Poiblí The Office of Public Works
RPS

The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map: Athy Fluvial Flood Extents

Map Type:	EXTENT		
Source:	FLUVIAL		
Map Area:	HPW		
Scenario:	CURRENT		
Drawn By :	F.M.C.	**Date :**	18 July 2016
Checked By :	T.D.	**Date :**	18 July 2016
Approved By :	S.P.	**Date :**	18 July 2016

Drawing No. : O14ATY_EXFCD_F0_03

Map Series : Page 3 of 11

Drawing Scale : 1:5,000 @A3