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CIVIL & STRUCTURAL
ENGINEERS

SITE SPECIFIC FLOOD RISK ASSESSMENT

EXTENSION TO MILLBROOK MANOR NURSING HOME
CASTLE RD, RATHCOOLE, CO DUBLIN

Reference: 38-89A
Date: 28th October 2021

ENGINEERS IRELAND

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Details

Client Name:	Millbrook Manor Nursing Home
Address:	Castle Rd, Saggart, Co Dublin
Report prepared by:	Ciaran O'Brien

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1 EXECUTIVE SUMMARY

OBA Consulting were appointed by Mr. Ken Byrne MRIAI of Project Design Architects to provide a flood Risk assessment and report for the proposed extension to the existing Nursing home at Millbrook Manor, Saggart, Co Dublin.

This assessment process is based on the classification of the works as a 'minor' or 'infill' development in accordance to Section 5.28 of the FRA guidelines.

The development is an extension of a recently constructed and in use nursing home. The calculated freeboard is 1.34 metres above the calculated 1:100 year flooding level and the proposed floor levels are consistent with the existing.

In addition, the proposed extension works are located outside of Flood Zone A.

Based on the findings below it is our opinion the modest development poses a negligible flood risk.

2 INTRODUCTION

2.1 PROPOSED DEVELOPMENT

An application is to be submitted to South Dublin County Council for the extension to Millbrook Manor nursing home, Castle Road, Saggart, Co Dublin.

The proposed development consists of the provision of 14 No additional units and an extension of the dining hall at the Millbrook Manor Nursing home. The bedroom extensions are located to the Western and southern Elevations. (Refer to Fig 2.1)

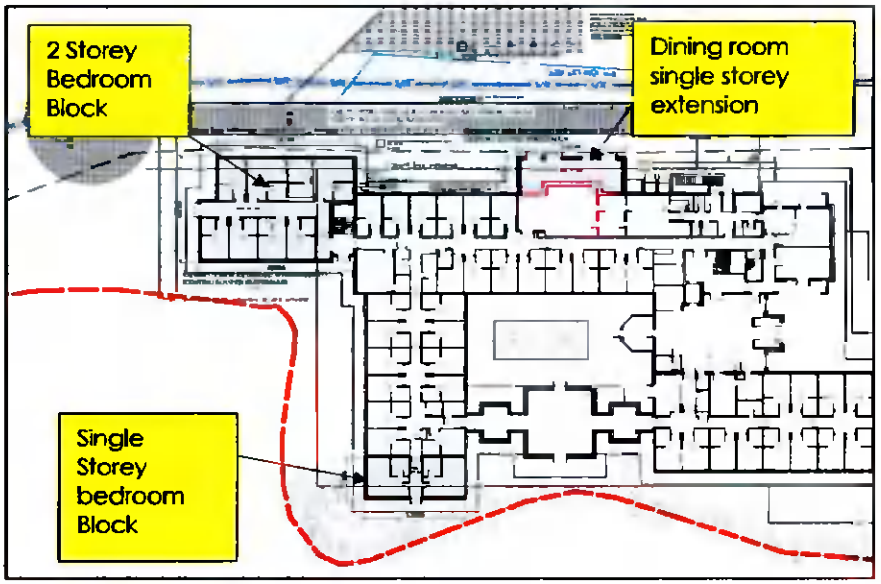

Fig 2.1 Proposed extension

2.2 Flood Risk Assessment Methodology

OBA Consulting Engineers were appointed to provide a site-specific flood risk assessment (FRA) in support of the proposed afore-mentioned development.

This FRA is set out in line with the recommendations contained in the Department of Environment Heritage and Local Government and the Office of Public Works (DEHLG/OPW) Guidelines on The Planning System and Flood Risk Management published November 2009, including identification of risk sources, Pathways, Receptors and Mitigating measures. The basis of this FRA will be site specific.

2.3 Site Location

The existing Millbrook Manor Nursing is located 650 metres South West of Saggart Village on Castle Road. Grid reference 53 16 32.55N Latitude 6 27 4.17W Longitude.

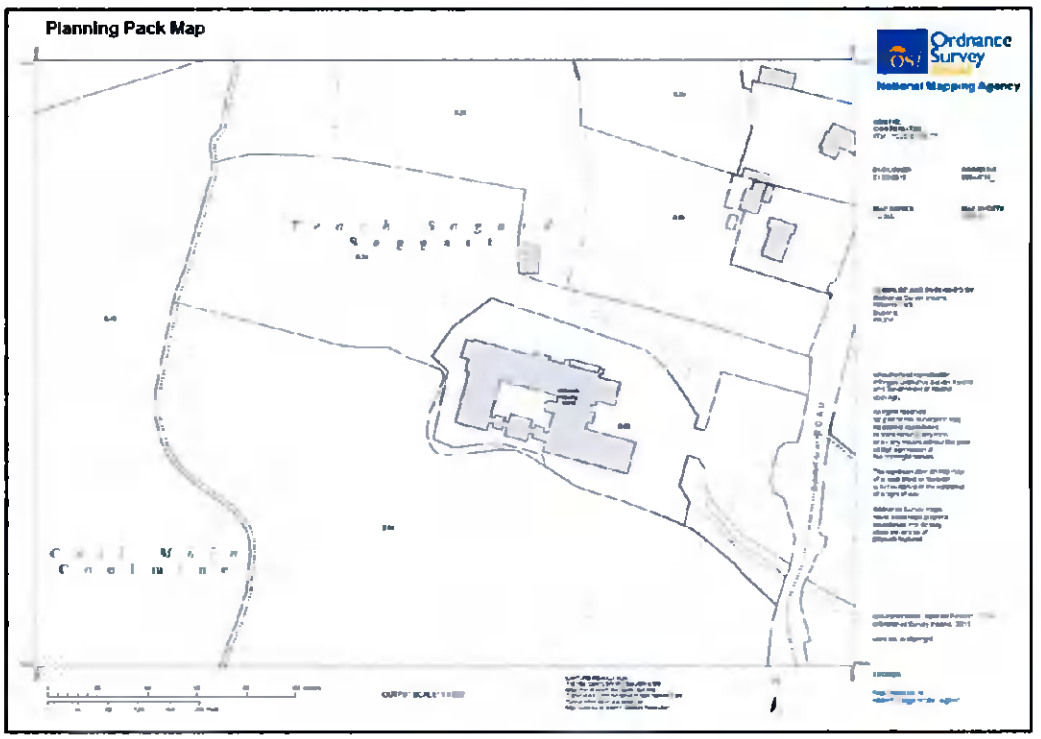

Fig 2.2 OS Map

2.4 Existing Site Usage & Topography

The site is located in a semi-rural setting south of Saggart Village, South County Dublin. The existing development consist of a 59 Unit Nursing Home with an approximate area of 2,450 m2. The building sits on a site of approximately 2 Ha (20,000m2). The site topography falls slightly from the existing nursing home building to the east towards the Camac River and moderately towards the North west of the site at a fall of approximately 1:17.5. See the illustration below in Fig 2.4

The FFL of the existing nursing home is at a datum of 130.68m which sits on the high point of the site. The surrounding landscape outside the site rises to the south towards the townlands of Coolmine & Lugg.

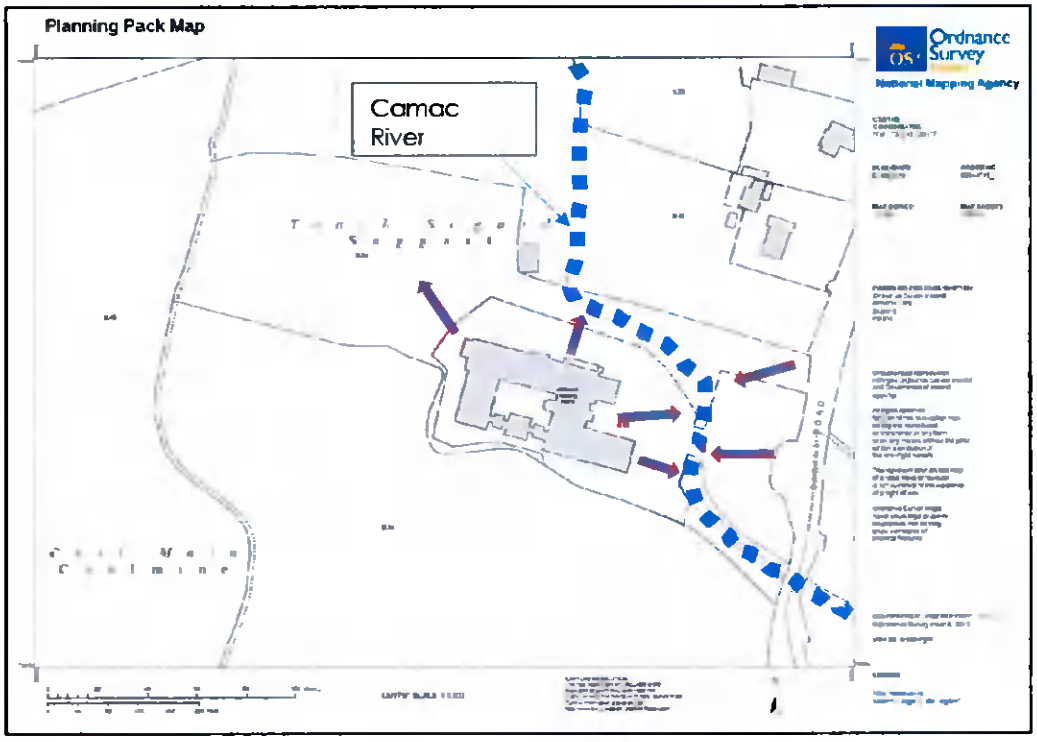

Fig 2.3 Direction of site falls.

2.5 SITE GEOLOGY

Referring to Geotechnical survey Ireland the site is located on a boundary of Quaternary Sediments of Till derived from Lower Palaeozic sandstones and shales (TLPSaS) with a low to moderate ground water vulnerability and Gravels derived from Limestone (GLs) with a high ground water vulnerability. The gravels follow the path of the river and is associated with river deposits. The underlying bedrock is coarse greywacke & shale. (PO). A borehole undertaken as part of the Saggart to Leixlip Watermain in 1985 located 65 metres form the existing building at an approximate level of 126.5m identified no rock to a depth of 5.5 metres below ground level.

Higher lands to the South of the site are greenfield and have an agricultural use. The Southern boundary is defended by a ditch.

2.6 EXISTING WATER COURSES IN THE VICINITY OF THE PROPOSED DEVELOPMENT

The nearest water course runs through the site on the Eastern side of the existing building at a set back of approximately 20 metres at the closest point. The watercourse is the Camac River which runs through Slade valley (the Slade of Saggart) eventually discharges into the River Liffey close to Heuston Station in the City Centre. The alignment of the river through the site was adjusted with the installation of culverts and a deepening of the riverbed to cater for the nursing home development. The realignment was agreed with the OPW which can be found online in submitted planning compliance submissions to South Dublin County Council. Refer to planning references SD06A/0239 & SD08A/0523. The submission was prepared by Fahy Fitzpatrick Consulting Engineers in 2014 when the building works recommenced. Submitted reports and calculations will be reference later in this report.

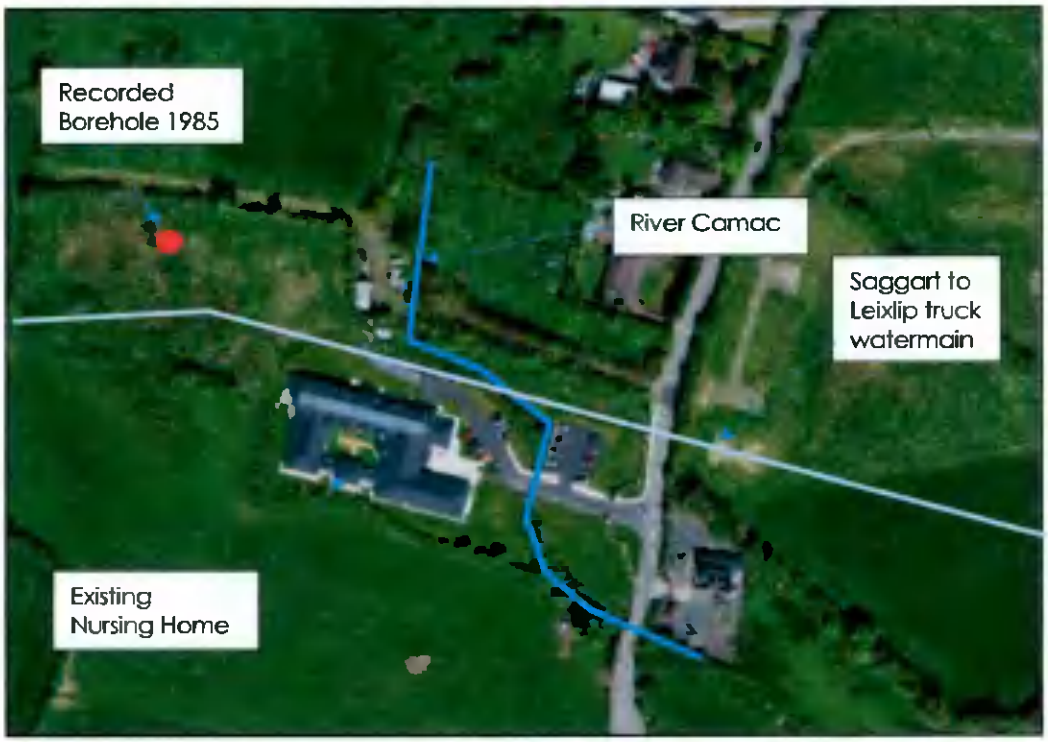

Fig 2.4 OSI Aerial Photograph

2.7 SAGGART TO LEIXLIP TRUNK WATERMAIN

As noted above the Saggart to Leixlip Trunk watermain is located in the vicinity of the existing building. (refer to Fig 2.5 above). The truck main is 1600mm diameter at a depth of 3.6 metres.

3 FLOOD RISK IDENTIFICATION

Historical and predictive information to allow an evaluation of the potential for flooding of the site and proposed building works is available from various sources including state and semi state bodies, recorded planning documentation and local information.

3.1 ASSESSMENT OF FLOOD MAPS/FLOODING HISTORY

3.1.1 FLOODMAPS.IE WEBSITE

The Office of Public Works as part of their remit have developed a national flooding hazard map which collects recorded data and flooding events across the country.

We have reviewed the Flooding.ie web site. There has been no recorded flooding on the site. Two flooding events occurred approximately 1 km to the North of the site on Mill Road, Avoca Road & Canter Lane in Saggart Village on the 24th of October 2011 which was a significant event with widespread flooding in the Leinster area.

Fig 3.1 Extract from OPW website previous flooding events

3.2 PREDICTIVE FLOODING INFORMATION

The Eastern CFRAM study is the most detailed mapping undertaken in the Dublin/Meath region. It commenced in June 2011 with final flood maps issued during 2016. The Eastern CFRAM involves detailed hydraulic modelling of rivers and their tributaries. Following the detailed hydraulic modelling, flood maps were produced for the 10%, 1% and 0.1% AEP flood events.

The CFRAM maps do not indicate coastal flood risk or Pluvial flooding to the site. The site is covered under the CFRAM study for the Camac River. The flooding maps for the site can be reviewed in Appendix A. Extracts from the 1% and 0.1% AEP can be seen below.

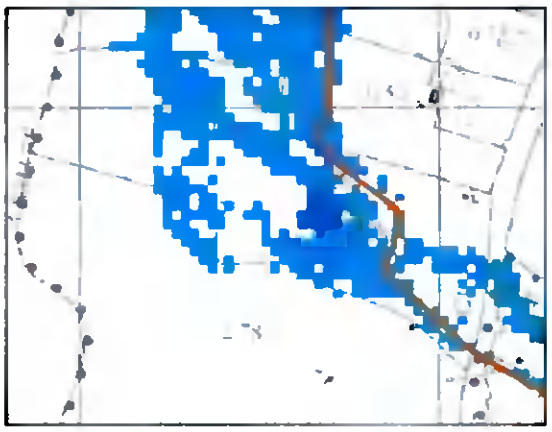

Fig 3.2 1% AEP Map Extract

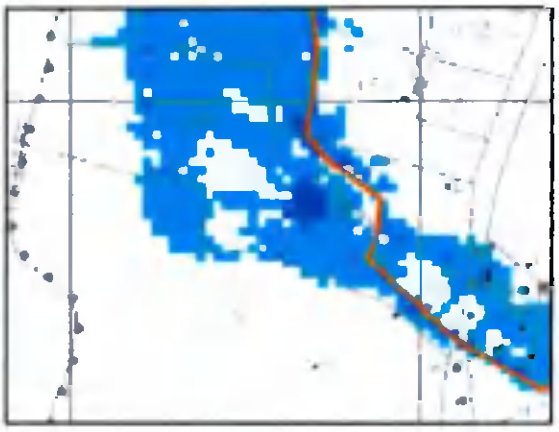

Fig 3.3 0.1% AEP Map Extract

In the context of the site there is little difference between a 1 in 100 year and 1 in 1000-year event.

3.3 SOURCES OF FLOODING

The initial stage of a Flood Risk Assessment requires the identification and consideration of probable sources of flooding. Following the initial phase of this Flood Risk Assessment, it is possible to summarise the level of potential risk posed by each source of flooding. The flood sources are described below.

3.3.1 GROUND WATER.

The Site is located in an areas of high ground water vulnerability with sub soils consisting of gravels derived from Limestone (GLs). As there is no proposed basement as part of the proposed development there is no risk of ground water flooding.

3.3.2 COASTAL

The site is located 17.5 Km from the coast and is at an elevation of 130m OD Malin. Coastal flood risk can be screed out of this report.

3.3.3 PLUVIAL

There is no record of pluvial flooding in the vicinity of the site. The vast majority of the site and surrounding site is greenfield and Agricultural. The site is defended to the south by a field ditch and the location of the building is sitting high on the site with a Water shed in an arc from West to East. There is ramp access to the thresholds with the perimeter ground levels below the proposed FFL which is consistent with the existing building. The buildings will be services by a soakaway infiltration system consistent with Suds located to the North of the site below the proposed floor levels. Pluvial flooding is not considered as presenting a flood risk to the development and is screened out at this stage.

3.3.4 FLUVIAL

The CFRAM maps cover the fluvial flood risk for the site. The nearest CFRAM flood extents to the site are those of the River Camac. The CFRAM mapping indicate a potential risk of 0-250mm in the vicinity of the proposed extension for both the 1% & 0.1% AEP.

We have identified an anomaly in the flood map with a predicted deeper section of potential flooding (0.5-1.0 m dp) in the middle of the site. Refer to darker blue shading in the CFRAM map in Fig 2.6 & Fig 2.7. We have investigated this anomaly and it can be explained by reviewing past Aerial photographs and previous topographic surveys. The development of the original building was partially completed, and a basement excavation was left open for a significant period of time. This can be seen in Fig 2.8 & 2.9 below.

Fig 3.4 OSI Aerial Photo

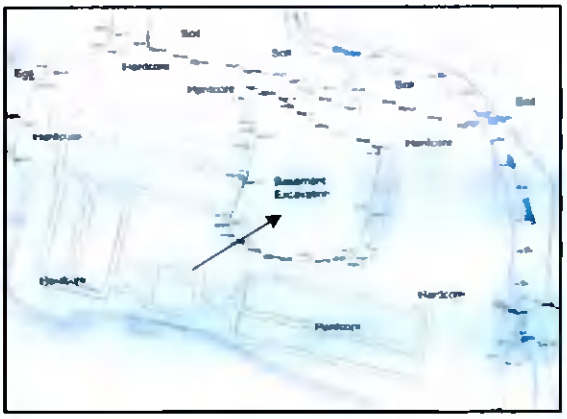

Fig 3.5 Topographic Survey

3.3.5 *Other Sources*

A 1600mm Trunk main runs through the site approximately 13m from the North Elevation of the existing building at a depth of 3.6 metres below ground level. There is a low risk of failure or rupturing of the watermain. The Watermain is serviced by a scour line which discharges into the culvert in a down stream direction. A failure in the main was considered during the planning stage and responded to in the compliance submission to SDCC. The location of the main is downslope of the existing building and proposed extensions. Correspondences in this regard are available online in the planning section of South Dublin County Council website under the planning references SD06A/0239 & SD08A/0523. A breach in this trunk main will flow in the downstream direction of the river as concluded by Fahy Fitzpatrick. The watermain network is continuously monitored.

4 Flood Risk Impact Assessment, Receptors & Mitigation.

Review of the available sources of flooding outlined above confirms that there is no identified historic flooding within the site boundary.

The site is however located within Flood Zone A with a probability of fluvial flooding at greater than 1% AEP.

Section 3 above identified Fluvial flooding as the most likely source of flooding to the site.

The CFRAM maps obtained provides a basis for the initial flooding assessment however the predicted flooding levels do not align with the site topography which has been surveyed. There is level variance of -3.0 metres across the site to the North West from the Building and +2.0/-0.5 metres to the East (towards the vehicular entrance). The predicted flooding levels for 1% AEP is 0-250mm. With the level variance and the significant water shed away from the building we are of the opinion that the CFRAM predicted flooding map is a crude tool to assess the risk.

The proposed extensions are located outside the predicted CFRAM flooding.

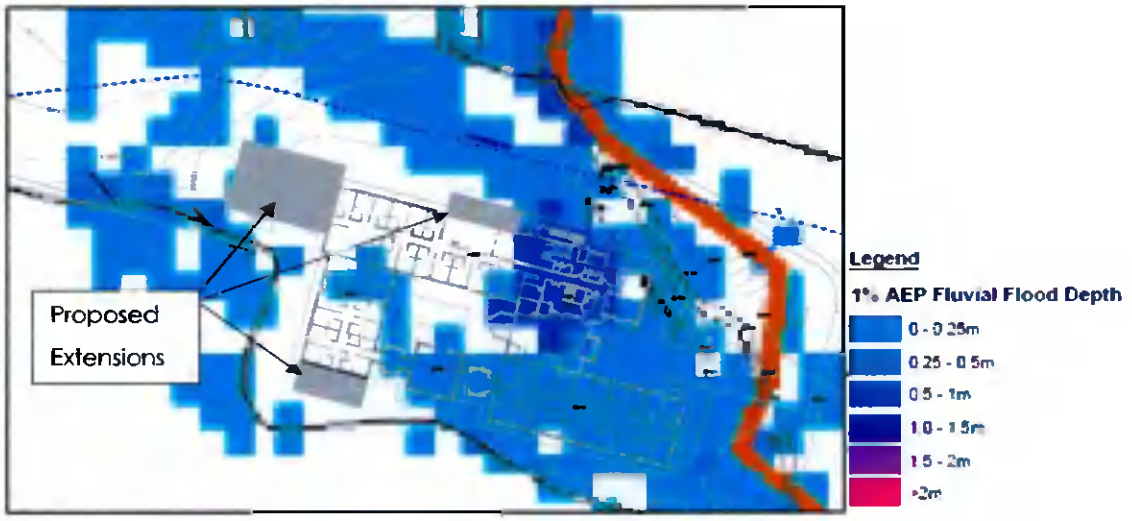

Fig 4.1 Overlay of CFRAM 1%AEP Map, existing building, and proposed blocks.

A significant assessment of the River and the diversion of same through the site was undertaken by Fahy Fitzpatrick Consulting Engineers as part of the planning compliance submitted in April 2014.

The reports, calculations and correspondences are available online in the planning section of South Dublin County Council website under the planning references SD06A/0239 & SD08A/0523.

Condition 4 h of SD06A/0239 requested that the

> *h) Finished floor levels for the proposed building shall be located at least 500mm above highest known flood levels.*

The submitted cover response is set out below.

h) Noted. See response to item (d) above and the copy of the Section 50 licence application located in Appendix B. The site has been infilled by several metres as part of works already carried out on site by the previous developer. It is proposed to reduce the bed level of the stream by approximately 1m where it passes to the front of the proposed building. The proposed finished floor level is 130.68m OD and the proposed stream level is 127.94m OD at the proposed culvert, a difference of 2.75m

d) It has been agreed with Dublin City Council that the discharge of the scour pipe will be incorporated into the newly aligned watercourse and point in a downstream direction with a new flap valve. Whilst the watermain is 1,600mm diameter the discharge from the scour is limited by the diameter of the scour pipe. This is to be directly to the open watercourse at the downstream boundary of the site and, as such, will not present a substantial flood risk to the development. The level of the discharge point of the scour pipe is circa 3.25m below the ground floor level of the proposed building. Measures to ensure the protection of the development from flooding were referenced in the Section 50 Application to the OPW. Should the design capacity of the culvert be exceeded the water will back up on the upstream side of the culvert to the headwall level of 130.60m OD. This greater head will further increase the capacity of the culvert which has a soffit level of 129.64m OD (i.e. an increase of 1m in head). Should water overtop the proposed head wall and retaining walls it will flow overground in a North Westerly direction before discharging back into the open stream (refer to OPW Section 50 Application drawings). The proposed floor level is 130.68m OD and the bank levels downstream as the existing stream leaves the site are to be retained at and below 129.20m OD. Ground levels further downstream of the development drop consistently to 126.40m over the next 100m, which is over 4m below the proposed floor level.

Condition 3 d of SD08A/0523 requested that

> *d) "The applicant has proposed to divert and culvert the existing stream. Prior to commencement of development full details of the proposed culverting shall be submitted. These details shall include all levels, plans, and cross-sections of any proposed work. Full design calculations for the culvert shall be included. These will clearly show that flow in the river will not be constricted or reduced during any major storm event. This design shall be approved by OPW and applicant must submit written confirmation that the proposed culvert design complies with their requirement. In addition the applicant shall ensure that the proposed structure is not within 1 l m of the proposed culvert"*

The submitted cover response is set out below.

d) **Full copy of the report, accompanying drawings and calculations for the proposed culvert, as submitted to the Office of Public Works with an application for a Section 50 Licence is located in Appendix B. Any additional requirements of the OPW in respect of this licence will be submitted in further compliance along with the licence itself, once granted. No works on the culvert will be commenced prior to the issuing of a Section 50 Licence. We confirm that the design will ensure that the proposed building is at least 11m from the proposed culvert. This is illustrated on the drawings. Note the drawings included with this compliance report are based on the drawings submitted to the OPW with the section 50 Application.**

The Section 50 Application & calculations prepared by Fahy Fitzpatrick Consulting Engineers submitted to the OPW East Region Section (Refer to Appendix B) on the 4th April 2014 identified the 1 in 100 year flood level at 129.34m OD. The calculations included a 1.2 factor for climate change.

This level provides a freeboard of 1.34 metres.

The Fahy Fitzpatrick detail calculation of the flow and capacity in the river is a more accurate assessment of the predicted flood level and is therefore being used in this report.

4.1 FLOOD RISK & MITIGATING MEASURES.

A.

Source	Fluvial flooding from Camac
Receptor	Proposed Extension Blocks.
Likelihood	Low. 1.34m Freeboard provided. Proposed blocks outside CFRAM predicted flood zone. No increase in risk. Modest Extension development.
Mitigation	None required.

B.

Source	Surface Water run-off from roof and road.
Receptor	Proposed Extension Blocks
Likelihood	Low.
Mitigation	Provision of stormwater system in compliance with GDSDS Provision of 150mm step from external ground level to the proposed finished floor level. Ramped access at thresholds as required. External downpipes provided. Regular maintenance of drainage pipework and gutters.

C.

Source	Surcharge backup from foul drainage.
Receptor	Proposed Extension Blocks.
Likelihood	Negligible. Pump station GL below FFL.
Mitigation	On-going maintenance of Pumping station recommended

D.

Source	Ground Water.
Receptor	Proposed Extension Blocks.
Likelihood	Negligible. No Basement proposed.
Mitigation	None Required

E.

Source	Breach in truck watermain
Receptor	Proposed Extension Blocks.
Likelihood	Negligible
Mitigation	None Required

F.

Source	Surface Water run-off from adjoining lands
Receptor	Proposed Extension Blocks
Likelihood	Low. Boundary defended with ditch. Lands in Agri use.
Mitigation	Regular clearing out of ditch to allow unrestricted flow of surface run off.
	Provision of 150mm step from external ground level to the proposed finished floor level. Ramped access at thresholds as required

4.2 IMPACT ON ADJOINING PROPERTIES.

The extension blocks are outside the predicted flooding areas based on the CFRAM maps. There is therefore no displacement effect. Surface water run-off from the extended areas is accommodated in a proposed soakaway to the West of the proposed extension. The closest neighbouring building is approx100 metres from the proposed works and is positioned at approx. 133m OD.

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5 CONCLUSION

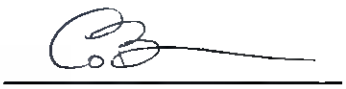
- No OPW record of flooding on the site or in the immediate vicinity of the site.
- The proposed extensions are located outside the predicted CFRAM flooding zone.
- Site has moderate fall (watershed) towards the Camac River.
- There are no foreseen effects on the adjoining neighbouring properties.
- Proposed development is an extension of an existing facility. No greater risk. Proposed levels consistent with the existing levels. There is no proposed basement
- Calculations submitted to the OPW show Freeboard of 1.34m for 1:100 year event (with factor of 1.2 for Climate change.)
- The proposed extensions are located outside of Flood zone A

Given the findings above it is our opinion that the site and development pose negligible flood risk.

The assessment is a desk top study based on the best available data, this report provides, in our view, the best available assessment of the effect of flooding at the site. In using the DEHLG/OPW Guidelines it is determined that the proposed development works are located outside of Flood Zone A.

References

1. National Flood Hazard Mapping, www.floodmaps.ie, OPW.
2. Eastern CFRAM Study, Flood Maps, www.floodinfo.ie/map/floodmaps/ OPW.
3. SDCC on-line planning search. www.sdublincoco.ie/Planning/Applications
4. Greater Dublin Strategic Drainage Strategy; and
5. Greater Dublin Regional Code of Practice for Drainage Works.



Ciaran O'Brien

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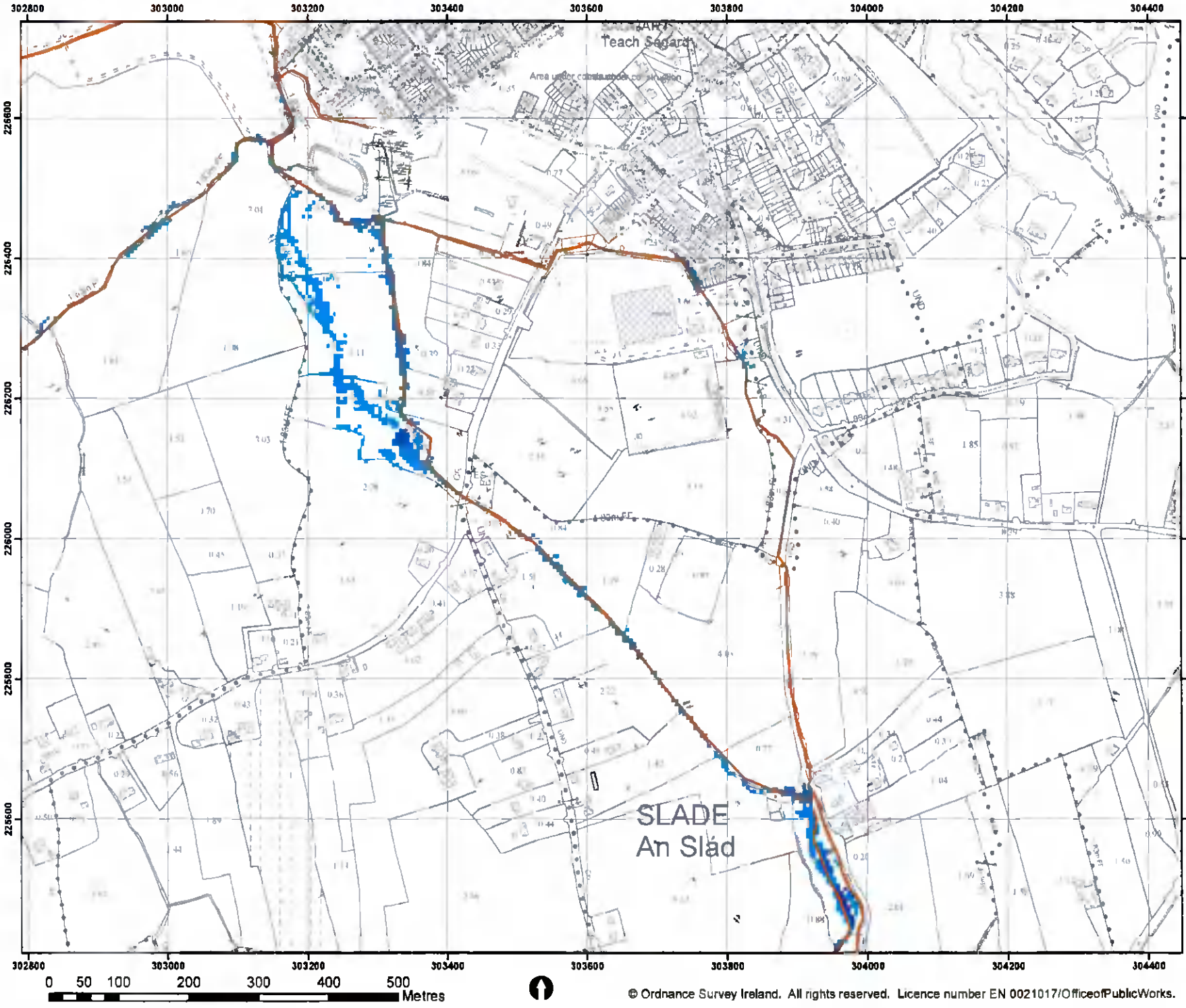
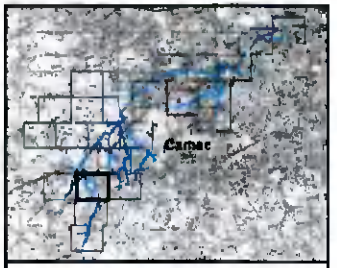
6 APPENDIX A OPW FLUVIAL CFRAM STUDY MAPS





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% AEP Fluvial 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

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Map:	Camac Fluvial Flood Depths
Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By :	C.C. Date : 27 October 2017
Checked By :	A.S. Date : 27 October 2017
Approved By :	S.P. Date : 27 October 2017
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Map Series	Page 3 of 24
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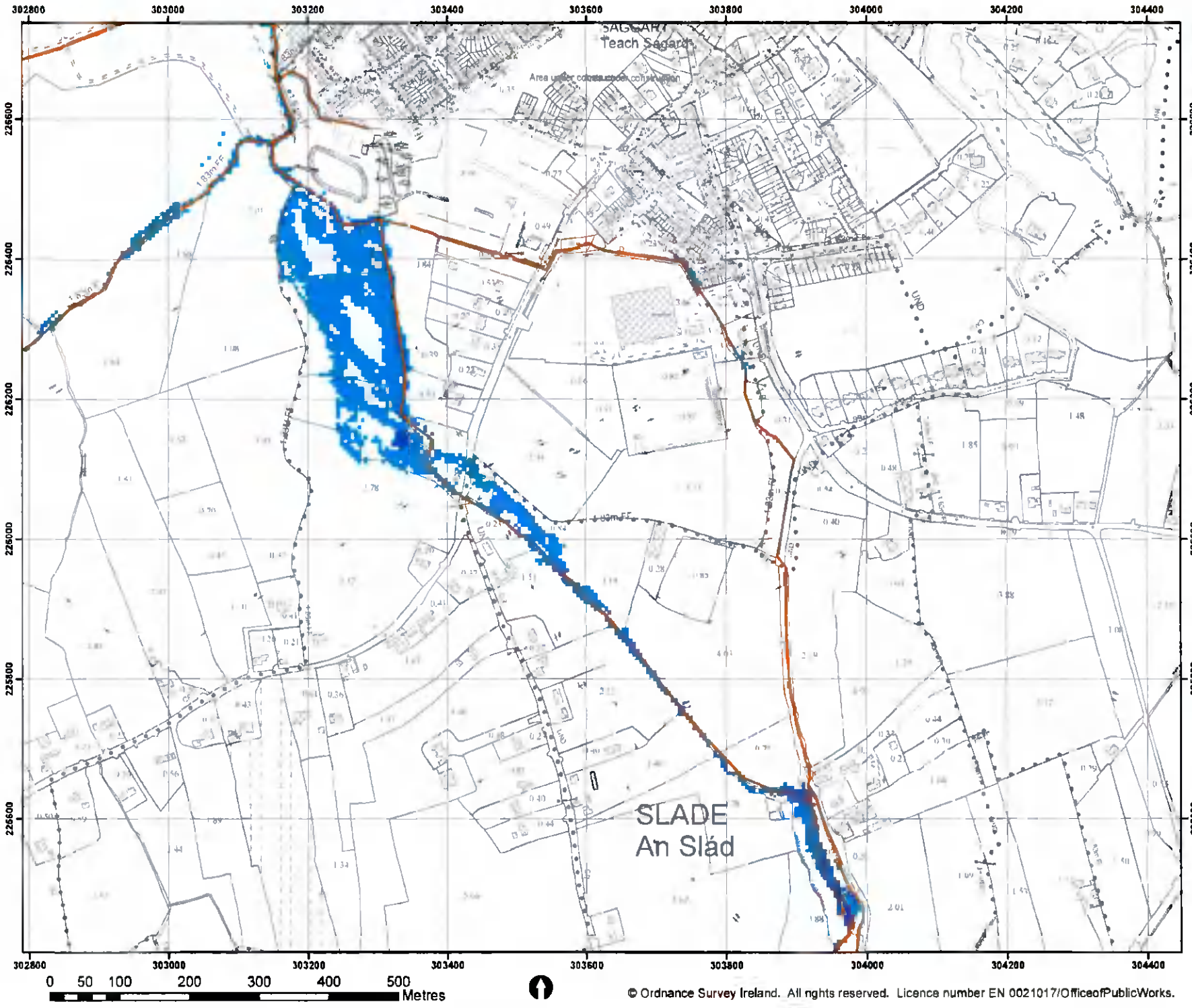

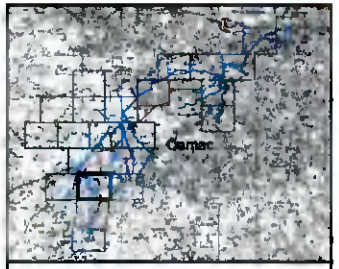

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Legend

1% AEP Fluvial 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

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Map	Camac Fluvial Flood Depths
Map Type:	DEPTH
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By	C.C. Date : 27 October 2017
Checked By :	A.S. Date : 27 October 2017
Approved By :	S.P. Date : 27 October 2017
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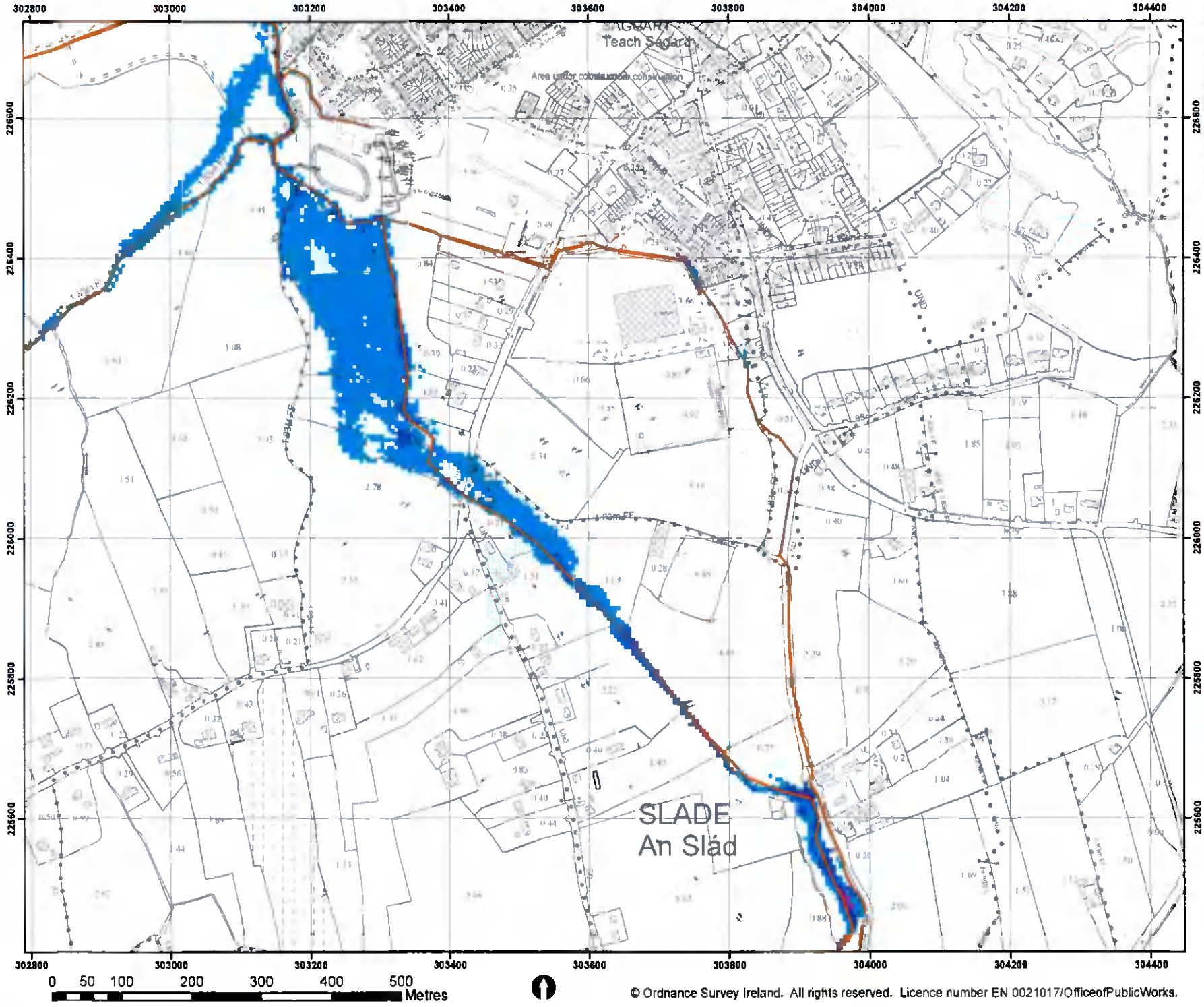

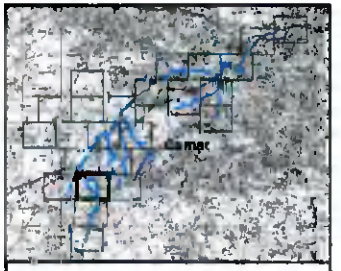

IMPORTANT USER NOTE
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Legend

0.1% AEP Fluvial 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

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Map	Camac Fluvial Flood Depths
Map Type:	DEPTH
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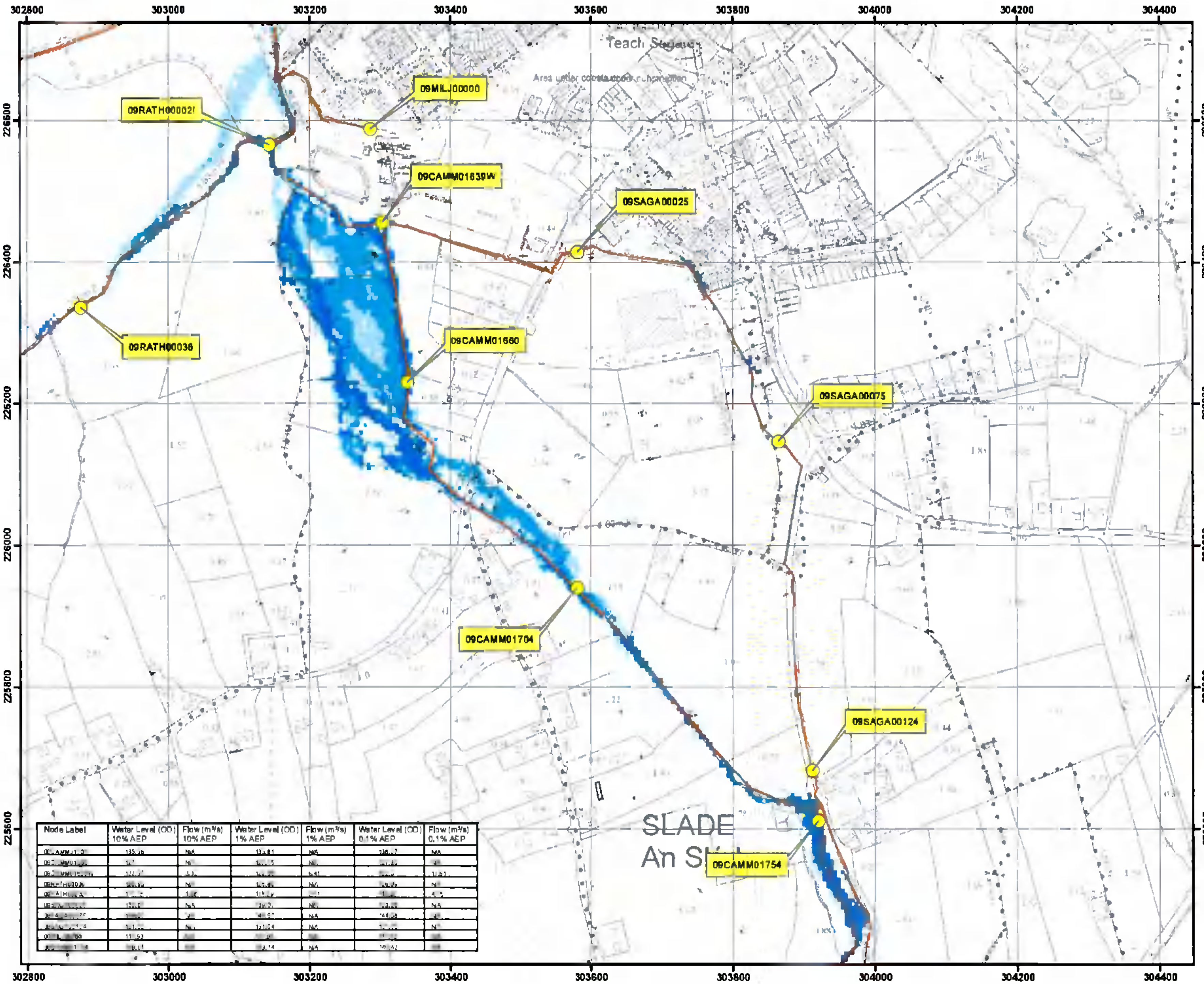

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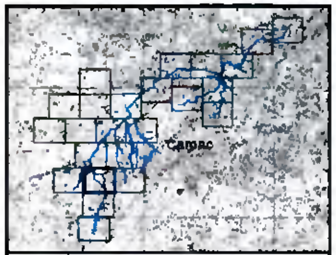
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	N/A	[illegible]	[illegible]	[illegible]	N/A
[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]



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
- Standard of Protection of Flood Defence (Walls / Embankments)
- Node Point
- Node ID Node Label

FINAL

REV	NOTE	DATE
01	SOP (text) updated (Pg 20) Removal of Def. Area (Pg 21)	13/11/2017

CFRAM

OPW
The Office of Public Works
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Map:	Camac Fluvial Flood Extents
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By:	C.McG. Date: 13 November 2017
Checked By:	A.S. Date: 13 November 2017
Approved By:	S.P. Date: 13 November 2017
Drawing No.:	E09CAM_EXFCD_F1_03
Map Series:	Page 3 of 24
Drawing Scale:	1:5,000 @A3

OBA | CONSULTING CIVIL & STRUCTURAL ENGINEERS

7 APPENDIX B EXTRACTS OF RIVER CULVERT CALCULATIONS

(Inc correspondences from OPW)

Fahy Fitzpatrick
CONSULTING ENGINEERS

Shane Hayes

Arterial Drainage Maintenance
OPW East Region
Newtown
Trim
County Meath

4th April 2014

Our Ref: lp/2589
Project Number: 2589
Project: Nursing Home, Slade Road, Saggart County Dublin

Re: Your Ref 0751-2013
Section 50 Application; Slade Road, Saggart, Dublin

Dear Shane,

We made a Section 50 application to you on the 8th October last year in relation to the culverting of a short section of stream at Slade Road, Saggart County Dublin. This was part of an overall development of a Nursing Home. Since then the project has been on hold, however we have recently been instructed to continue with this application.

We received a response from yourself by email on the 15th October raising several issues which you requested we addressed. We have now carried out a detailed review of what was submitted and now enclose a revised application for your consideration. This includes revised calculations for the design 1:100 year flow and the culvert sizing.

In relation to the specific issues you raised in your email:

1) We have revised our design and calculations to include 300mm of freeboard as requested.
2) The 1 in 100 year design flood level has been revised to 129.34m OD which is 1.34m below the proposed floor level of 130.68m OD. This has been a result of a revised culvert design.
3) The factor for climate change has been increased to 1.2 for the calculation of the design 1:100 year flow.

Please find enclosed the following

- Revised and updated application form
- Supporting Hydrological information
  - Flow estimation based on Flood Studies Report procedure (Revised April 2014)
  - Capacity calculations of proposed culvert (Revised April 2014)

- Full set of revised drawings as per drawing transmittal sheet.
- Drawing Transmittal Sheet
- Photographical Survey
- Copy of planning permissions SD06A0239 & SD08A0523

The purpose of the culvert is to provide access to the development across the watercourse. In summary, the calculations enclosed illustrate that for the 1 in 100 year estimated flow a culvert with dimensions 4m wide by 1.5m deep is sufficient to cater for the requirements. The corresponding estimated flood level is 129.34m OD which provides 300mm of freeboard and is 1.34m below the proposed floor level of 130.68m OD.

The sizing of the culvert is based on a hydrological analysis for projected flows with an annual exceedance probability of 1% (1 in 100 years). The proposed culvert has been sized to cater for the projected flows, resulting in the requirement for a 4m wide x 1.5m high culvert (6m2 flow area). Upstream of the development on the boundary with the site there is an existing stone arch bridge with smaller dimensions of 3.3m wide x 1.5m high (4.3m2 flow area). This bridge is listed in the National Inventory of Architectural Heritage. Downstream of the development there is a 1.2m diameter pipe providing a crossing to farm buildings, however this is set close to the existing ground level and as such in times of flood would be readily overtopped. Further downstream (approx. 1.3km) where the watercourse crosses the Naas Road, 2 culverts with dimensions of 3.3m x 1.5m (flow area 5m2) are installed. Note all of these structures are smaller than the proposed culvert.

As part of the design, consideration has been made to the impact of this development should the capacity of the culvert be exceeded or the flow restricted for whatever reason. If the 1 in 100 year projected flows are exceeded, water will overtop the proposed head wall and retaining walls and flow overground in a North Westerly direction (refer to drawings). The layout and levels of the site between the culvert and the proposed building will be such that water will flow back into the open watercourse downstream of the proposed culvert. The proposed floor level is 130.68m OD and the bank levels downstream as the existing stream leaves the site are to be retained at and below 129.20m OD. Ground levels further downstream drop consistently to 126.40m over the next 100m.

A low flow channel has been incorporated into the design of the culvert to facilitate the typical background flow and ensure the approximate size of the existing stream bed is retained. The installation of the culvert requires the bed of the stream to be lowered and as part of this process the banks of the stream will be graded back to the existing ground level and the banks landscaped.

Should you have any queries in relation to the application please contact the undersigned.

Yours Faithfully,

Laurie Pitt

Fahy Fitzpatrick Consulting Engineers

FAHY FITZPATRICK LTD
3057 CITYWEST CAMPUS, NAAS ROAD, DUBLIN 24
TEL (01) 4660566 FAX (01) 4660567 E-Mail mailroom@fahyfitz.com

AF50 Rev1107

OPW

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945

Project Name	Nursing Home, Slade Road, Saggart	Structure Ref No	1 of 1

Applicant (Correspondence will issue to agent)

Company or Organisation Name:
ESS CONSTRUCTION

Postal Address:
1 DELTA VIEW
MANNORCUNNINGHAM
LETTERKENNY
CO DONEGAL

Contact Person:
ROBERT MCGUIGAN

Phone: 0044 7591126819 Fax:

E-mail: ESSCONSTRUCT@GMAIL.COM **Nursing Home, Slade Road, Saggart**

Agent (Correspondence will issue to this party)

Company or Organisation Name:
FAHY FITZPATRICK CONSULTING ENGINEERS

Postal Address:
2057 CASTLE DRIVE, CITYWEST, DUBLIN 24

Contact Person:
LAURIE PITT

Phone: 01 4030 164 Fax: 01 4660566

E-mail:
LPITT@FAHYFITZ.COM

Location and Parameters of crossing

Watercourse: SLADE STREAM (ASSUMED NAME) Catchment: **Nursing Home, Slade Road, Saggart**

Address (Townland – County):
COOLMINE, COUNTY DUBLIN

Grid Reference X: 703313 Y: 726145

Hydrometric Station(s) utilized (including reference number): n/a

Area of Contributing Catchment: **9** Km^2 Road Referenc **Slade Road**

Design Flood Flow: **17.3** m^3/s Annual Exceedance Probability (AEP): **1%**

Signature of Applicant

I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.

Name: **LAURIE PITT**
Company/Organisation: **FAHY FITZPATRICK ENGINEERS**
Signature:
Date: **07/04/13**

If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

Application Check List	
COMPLETED APPLICATION FORM	☐
SUPPORTING HYDROLOGICAL AND HYDRAULIC INFORMATION	☐
PHOTOGRAPHS COVERING SITE OF ALL PROPOSED WORKS	☐
SCALED PLAN OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☐
SCALED CROSS SECTION OF BRIDGE/CULVERT/APPROACH EARTHWORKS	☐
SCALED LONG SECTION OF CHANNEL THROUGH BRIDGE/CULVERT	☐
DETAILS OF RELEVANT EXISTING STRUCTURES	☐
COMPLETED STATEMENT OF AUTHENTICITY	☐
PLAN OF CATCHMENT AREA	☐
COPY OF NOTICE OF GRANT OF PLANNING PERMISSION WITH CONDITIONS *1	☐

For OPW use only	*Date of Receipt*						
OPW Drainage Maintenance Region	*East* ☐	*South East* ☐	*South West* ☐	*West* ☐			
Correspondence Number	*OPW Register No:*						
	Consent Issued ☐						

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied			Factors Applied	
Method Used	Tick box if used or state other	Flow *2 (m^3/sec)	Type of Factor	Value Used
6 - Variable FSR Catchment Characteristics	X☐	17.3m3/sec	Factor for Standard Error	
3 - Variable FSR Catchment Characteristics	☐		Climate Change	1.2
IH 124	☐		Irish Growth Curve	
Gauged Flow	☐		Drained Channel	
Unit Hydrograph	☐		Other	
Other	☐		Tidal ☐	
Other	☐			
Comments				

Hydraulic Structure Details

Description of Structure *3 **4m x 1.5m box culvert for proposed road crossing, 12m long with low flow channel**

Effective Conveyance Area *4	6.35 m^2		
Upstream Invert Level	127.94 mOD	Downstream Invert Level	127.82 mOD
Upstream Soffit Level	129.64 mOD	Downstream Soffit Level	129.52m OD
Upstream Design Flood Level	129.34 mOD	Downstream Design Flood Level	129.11 mOD

If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

FAHY FITZPATRICK
CONSULTING ENGINEERS
Unit 2057
Citywest
Naas Road
Dublin 24
tel. 01 466 0566

JOB NO: 2589
JOB TITLE: Nursing Home at Saggart
DATE: 02/10/2013
BY: LP
REVISION Rev B 04/04/2014

HYDRAULIC CALCULATIONS FOR CULVERT DESIGN
Carried out in accordance with CIRIA 689 Culvert Design

CULVERT DESIGN DETAILS

Barrell Height	D =	1.50 m
Barrel Width	B =	4.00 m
Bed level at inlet	Z_{bi} =	128.14 mOD
Bed level at outlet	Z_{bo} =	128.02 mOD
Soffit Level at Inlet	Z_{si} =	129.64 mOD
Soffit level at outlet	Z_{so} =	129.52 mOD
Embankment Crest (Top of Headwall and Retaining Wall)	Z_w =	130.60 mOD
Length of Culvert	L =	12 m
Freeboard Culvert (0.3 or D/4)	F =	0.3 m
Freeboard Crest	F =	0.15 m
Max Headwater Level (free flow)	WLhmax =	129.34 mOD
Max Headwater Level (submerged flow)	WLhmax =	130.45 mOD

NOTE: LEVELS AND DIMENSIONS ASSUME NO LOW FLOW CHANNEL WHICH IS 200MM DEEP. ACTUAL CULVERT INVERT AND SOFFIT LEVELS ARE THEREFORE 200MM LOWER, AS PER DRAWINGS. TAILWATER AND HEADWATER LEVELS CAN BE CONSIDERED TO BE LOWER THAN CALCULATED.

CALCULATE TAILWATER LEVEL

Design Discharge	Q_D	17.3 m3/s
Width of Invert	B =	4.00 m
Bed Slope	S_o	0.01
Roughness Coefficient	n =	0.02
Estimate Water Depth	y =	[illegible] m (adjust to get y_{DC})
Area downstream of culvert (open channel, retaining wall both sides)	A =	4.36 m2
Wetted Perimeter	P =	6.18 m
Radius	R =	0.71 m
Flow	Q =	17.28 m3/s

Check Design Q_D with actual Q	=	Q_D-Q	
	=	[redacted]	(iterate to 0)
=>	y_{DC} =	1.09 m	

CALCULATE TAILWATER ELEVATION

Velocity	V_{DC} =	Q/A m/a
		3.97 m/s
	H_t =	$Z_{bo} + y_{DC} + V_{dc}2/2g$
		129.91 m OD
	WL_t =	$Z_{bo} + y_{DC}$
		129.11 m OD

Check Tailwater level relative to soffit of culvert outlet:

Soffit level at outlet	Z_{so}	129.52
Tailwater Level at outlet	WL_t =	129.11
=>		0.41

Positive value so tailwater level below outlet soffit level and slope is mild
=> Proceed to review outlet control

HEADLOSS AT OUTLET		
Area at culvert outlet	A_b =	By
		6.00 m2
Velocity at culvert outlet	V_b =	2.88 m/s
Velocity downstream of culvert	V_{dc} =	Q/A_{dc}
		3.97 m/s
Outlet coefficient	k_0	0.75
Headloss	h_0	-0.28
HEADLOSS AT BENDS		
N/A		0.00
HEADLOSS DUE TO FRICTION		
Tailwater Depth	y =	1.09 m
Depth of Culvert	D =	1.50 m
Width culvert	B =	4.00 m
Cross sectional area of flow	A =	6 m2
Wetted perimeter	P =	6.18 m
Radius	R =	0.97 m
Roughness Culvert	n =	0.02
Length Culvert	L =	12 m
Flow	q =	17.3 m3/s
Bed Slope	S_0	0.01
Healdoss due to friction	h_f	L(nQ/AR^2/3)2
		0.04 m
Friction Slope	S_f	0.003
Change in flow depth	Δy =	L(Sf-S0)
		-0.08 m
=> Estimated Depth at Inlet		1.01 m
HEADLOSS AT INLET		
Depth of water at inlet	y_i	1.01 m
Width Culvert	B =	4.00 m
Flow Area	A =	4.05 m2
Flow	Q/A =	17.30 m3/s
Velocity	V =	Q/A
		4.28 m/s
Headloss coefficient (Nr 23 Table 1.4)	K_i	0.20
Headloss at inlet	h_i =	kiVb2/2g m
		0.19 m

CALCUALTE HEADWATER LEVEL FOR OUTLET CONTROL

Bed Level at inlet	Z_{bi}	128.14
Flow depth (y)	Y_o	1.09
	Y_i	1.01
Headloss at Outlet	h_o	-0.28
Headloss at Bends	h_{bm}	0.00
Headloss due to friction	h_f	0.04
Headloss at inlet	h_i	0.19

Check max flow depth against barrell height to confirm free or full flow

Max flow depth	y =	1.01
Barell depth	D =	1.50
	=>	0.49 FREE FLOW
Headwater Level	H_{hoc} =	Zi+yi+hi+hs mOD
		129.34 mOD

Check against permissible levels:

Max Headwater Level (free flow)	Wlhmax =	129.34 mOD
Max Headwater Level (submerged flow)	Wlhmax =	130.45 mOD

=> OK

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Unit 2057
Citywest
Naas Road
Dublin 24
tel. 01 456 0566

JOB NO. 2589
JOB TITLE: Nursing Home at Slade Road, Saggart
DATE 24.06.13 - REV B (Revised 04.04.13)
BY LP

CALCULATION OF DESIGN UNIT HYDROGRAPH WITH PEAK OF 1:2 YEAR RETURN PERIOD

Catchment Area (A)	[redacted] km2	Measured on map	Catchment Map
Length of main Stream (L)	[redacted] km	Measured on map	Catchment Map
Elevation at 85%	[redacted] m	Measured 85% along stream length up from outlet	Catchment Map
Elevation at 10% from outlet along L (H10%)	[redacted] m	Measured 10% along stream length up from outlet	Catchment Map
Channel Slope (S) = (H85%-H10%)/(0.75*L)			
Channel Slope (S) =	20.00 m/km		
Average Annual Rainfall (SAAR)	[redacted] mm	FSR Maps II 3 1.	AutoCAD Map
RSMD Calculation:		Net 1 day rainfall 5yr return period (RSMD)	
M5-2 Day	[redacted] mm	Taken from Figure II3.2	AutoCAD Map
Ratio(r) = M5-60/M5-2Day	[redacted] %	Taken from Figure II3.5	AutoCAD Map
M5-24 Hours/M5-2 Day	[redacted] %	Taken from table II3.10 using (r) against 24 hours	II Page 32
M5-24 Hours	60 mm		
Conversion Factor	1.11	Taken from table II3.1	
M5-1 Day	54.05 mm		
Areal Reduction Factor 1 day (ARF 1day)	[redacted]	Taken from Fig II5.1	II Page40
SMD (SMDBAR)	[redacted] mm	Taken from Figure I.4 19	AutoCAD Map
RSMD = (M5-1 Day x ARF) - SMDBAR			
RSMD	46.20 mm		
Urban Percentage of Catchment (URB)	[redacted] %	Estimate based on mapping	Catchment Map
Urban Percentage Variable (URBT)	1.008		
Time to Peak (Tp) = (46.6L^0.14)x(S^-0.38)x(URBT^-1.99)x(RSMD^-0.4)		Time to peak of 1 hour unit hydrograph	
==>Tp =	4.16 hours		
Tp corrected	[redacted] hours	Adjust if estimate of LAG is available. Tp = 0.9 x LAG	Site Data
Data Interval (T) = Tp/5	0.832884593 hours		
==>Round up / down (T)	[redacted] hours	Round up/down to one decimal place	Rounded figure
Tp (new) = Tp (old) + (T-1)/2	4.06 hours	Adjusts Tp for application to T hr unit hydrograph	
Storm Duration (D) = (1+SAAR/1000)Tp	7.93 hours	Reccommended Design Storm Duration	
Flood Return Period (SRP)	[redacted] years		Chosen return
Required Storm Return Period	[redacted] years	See Fig I6.61	I Page 464
M5(D) / M5-2 Day	[redacted]	From Table II 3.10, using D, r (or I6.21)	II Page 32
M5-2 Day	75.00 mm	Calculated earlier	
M5(D)	39 mm		
Growth Factor MT/M5	[redacted]	From Tables II.2 9	II Page 17
==> Estimate for M2	30.81 mm		
ARF	[redacted]	Obtained from Figure II.5.1 Using Storm Duration (D)	II Page 40
Storm return period rain in D hours (P) = ARF x MT	29.58 hours		
Catchment Wetness Index (CWI)	[redacted]	From Figure I.6.62	I Page 465

Soil Index (SOIL) = (0.15xS1 + 0.30xS2 + 0.40xS3 + 0.45xS4 + 0.50xS5)/(1-Su)			
S1 S2 S3 S4 S5 Su		Take values from Figure I4.18	AutoCAD Map
==>SOIL =	0.50		
Standard Percentage Runoff (SPR) = 95.5 x SOIL + 0.32 x URB	47.85 %		
Percentage Runoff (PR) = SPR + 0.22(CWI)	49.36 %		
Calculate Peak Flow (Qbar)			
D/T	9.91		
Tp/T	5.08		
Curve Number (CN)	[redacted]	Read from Figure I.6.64 using D/T & Tp/T	I Page 466
Qbar = (CN x A x P x PR) / (10^5 x T)	5.42 m3/s		
Average non-separated flowper km2 (ANSF) = (0.00033(CWI-125) + (0.00074 x RMSD) + 0.003 ==>	0.037 m3/s/km2 0.329 m3/s		
Total Flow =	5.7 m3/s	for 1 in 2 year event	
Allowance for Climate Change	[redacted]		
TOTAL FLOW (ADJUSTED)	6.9 m3/s		

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tel. 01 466 0566

JOB NO: 2589
JOB TITLE: Nursing Home at Slade Road, Saggart
DATE: 24.06.13 - REV B (Revised 04.04.13)
BY: LP

CALCULATION OF DESIGN UNIT HYDROGRAPH WITH PEAK OF 1:30 YEAR RETURN PERIOD

Catchment Area (A)	9 km2	Measured on map	Catchment Map
Length of main Stream (L)	7 km	Measured on map	Catchment Map
Elevation at 85%	265 m	Measured 85% along stream length up from outlet	Catchment Map
Elevation at 10% from outlet along L (H10%)	160 m	Measured 10% along stream length up from outlet	Catchment Map
Channel Slope (S) = (H85%-H10%)/(0.75*L)			
Channel Slope (S) =	20.00 m/km		
Average Annual Rainfall (SAAR)	950 mm	FSR Maps II 3.1.	AutoCAD Map
RSMD Calculation-		Net 1 day rainfall 5yr return period (RSMD)	
M5-2 Day	75 mm	Taken from Figure II3.2	AutoCAD Map
Ratio(r) = M5-60/M5-2Day	22.5 %	Taken from Figure II3.5	AutoCAD Map
M5-24 Hours/M5-2 Day	80 %	Taken from table II3.10 using (r) against 24 hours	II Page 32
M5-24 Hours	60 mm		
Conversion Factor	1.11	Taken from table II3.1	
M5-1 Day	54.05 mm		
Areal Reduction Factor 1 day (ARF-1day)	0.975	Taken from Fig II5.1	II Page40
SMD (SMDBAR)	6.5 mm	Taken from Figure I.4.19	AutoCAD Map
RSMD = (M5-1 Day x ARF) - SMDBAR			
RSMD	46.20 mm		
Urban Percentage of Catchment (URB)	0.8 %	Estimate based on mapping	Catchment Map
Urban Percentage Variable (URBT)	1.008		
Time to Peak (Tp) = [46.6L^0.14]x[S^-0.38]x[URBT^-1.99]x[RSMD^-0.4]		Time to peak of 1 hour unit hydrograph	
<=>Tp =	4.16 hours		
Tp corrected	4.164422964 hours	Adjust if estimate of LAG is available. Tp = 0.9 x LAG	Site Data
Data Interval (T) = Tp/5	0.832884593 hours		
==>Round up / down (T)	0.8 hours	Round up/down to one decimal place	Rounded figure
Tp (new) = Tp (old) + (T-1)/2	4.06 hours	Adjusts Tp for application to T hr unit hydrograph	
Storm Duration (D) = (1+SAAR/1000)Tp	7.93 hours	Reccommended Design Storm Duration	
Flood Return Period (SRP)	[illegible] years		Chosen return
Required Storm Return Period	[illegible]30 years	See Fig I6.61	I Page 464
M5(D) / M5-2 Day	52.00%	From Table II 3.10, using D, r (or I6.21)	II Page 32
M5-2 Day	75.00 mm	Calculated earlier	
M5(D)	39 mm		
Growth Factor MT/M5	[illegible]1.56	From Tables II.2.9	II Page 17
==> Estimate for M30	60.84 mm		
ARF	0.96	Obtained from Figure II.5.1	II Page 40
Storm return period rain in D hours (P) = ARF x MT	58.41 hours		
Catchment Wetness Index (CWI)	123	From Figure I.6.62	

Soil Index (SOIL) = 0.15xS1 + 0.30xS2 + 0.40xS3 + 0.45xS4 + 0.50xS5)/(1-Su)			
S1	0	Take values from Figure I4.18	AutoCAD Map
S2	0		
S3	0		
S4	0		
S5	1		
Su	0		
==>SOIL=	0.50		
Standard Percentage Runoff (SPR) = 95.5 x SOIL + 0.12 x URB	47.85 %		
Percentage Runoff (PR) = SPR + 0.22(CWI)	52.25 %		
Calculate Peak Flow (Qbar)			
D/T	9.91		
Tp/T	5.08		
Curve Number (CN)	33	Read from Figure I.6.64 using D/T & Tp/T	I Page 466
Qbar = (CN x A x P x PR) / (10^5 x T)	11.33 m3/s		
Average non-separated flowper km2 (ANSF) = 0.00033(CWI-125) + (0.00074 x RMSD) + 0.003	0.037 m3/s/km2		
==>	0.329 m3/s		
Total Flow =	11.7 m3/s	for 1 in 30 year event	
Allowance for Climate Change	1.2		
TOTAL FLOW (ADJUSTED)	13.9 m3/s		

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JOB NO: 2589
JOB TITLE: Nursing Home at Slade Road, Saggart
DATE: 24.06.13 - REV B (Revised 04.04.13)
BY: LP

CALCULATION OF DESIGN UNIT HYDROGRAPH WITH PEAK OF 1:100 YEAR RETURN PERIOD

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Length of main Stream (L)	7 km	Measured on map	Catchment Map
Elevation at 85%	265 m	Measured 85% along stream length up from outlet	Catchment Map
Elevation at 10% from outlet along L (H10%)	160 m	Measured 10% along stream length up from outlet	Catchment Map
Channel Slope (S) = (H85%-H10%)/(0.75*L)			
Channel Slope (S) =	20.00 m/km		
Average Annual Rainfall (SAAR)	950 mm	FSR Maps II.3.1.	AutoCAD Map
RSMD Calculation:		Net 1 day rainfall 5yr return period (RSMD)	
M5-2 Day	75 mm	Taken from Figure II3.2	AutoCAD Map
Ratio(r) = M5-60/M5-2Day	22.5 %	Taken from Figure II3.5	AutoCAD Map
M5-24 Hours/M5-2 Day	80 %	Taken from table II3.10 using (r) against 24 hours	II Page 32
M5-24 Hours	60 mm		
Conversion Factor	1.11	Taken from table II3.1	
M5-1 Day	54.05 mm		
Areal Reduction Factor 1 day (ARF-1day)	0.975	Taken from Fig II5.1	II Page40
SMD (SMDBAR)	6.5 mm	Taken from Figure I.4.19	AutoCAD Map
RSMD = (M5-1 Day x ARF) - SMDBAR			
RSMD	46.20 mm		
Urban Percentage of Catchment (URB)	0.8 %	Estimate based on mapping	Catchment Map
Urban Percentage Variable (URBT)	1.008		
Time to Peak (Tp) = (46.6L^0.14)x(S^-0.38)x(URBT^-1.99)x(RSMD^-0.4)		Time to peak of 1 hour unit hydrograph	
==>Tp =	4.16 hours		
Tp corrected	4.164422964 hours	Adjust if estimate of LAG is available Tp = 0.9 x LAG	Site Data
Data Interval (T) = Tp/5	0.832884593 hours		
==>Round up / down (T)	0.8 hours	Round up/down to one decimal place	Rounded figure
Tp (new) = Tp (old) + (T-1)/2	4.06 hours	Adjusts Tp for application to T hr unit hydrograph	
Storm Duration (D) = (1+SAAR/1000)Tp	7.93 hours	Reccommended Design Storm Duration	
Flood Return Period (SRP)	[redacted] years		Chosen return
Required Storm Return Period	[redacted] years	See Fig I6.61	I Page 464
M5(D) / M5-2 Day	52.00%	From Table II.3.10, using D, r (or I6.21)	II Page 32
M5-2 Day	75.00 mm	Calculated earlier	
M5(D)	39 mm		
Growth Factor MT/M5	[redacted]	From Tables II.2.9	II Page 17
==> Estimate for M100	74.10 mm		
ARF	0.96	Obtained from Figure II.5.1	II Page 40
Storm return period rain in D hours (P) = ARF x MT	71.14 hours		
Catchment Wetness Index (CWI)	123	From Figure I.6.62	

Soil Index (SOIL) = (0.15xS1 + 0.30xS2 + 0.40xS3 + 0.45xS4 + 0.50xS5)/(1-Su)			
S1	0	Take values from Figure I4.18	AutoCAD Map
S2	0		
S3	0		
S4	0		
S5	1		
Su	0		
==>SOIL =	0.50		
Standard Percentage Runoff (SPR) = 95.5 x SOIL + 0.12 x URB	47.85 %		
Percentage Runoff (PR) = SPR + 0.22(CWI)	53.52 %		
Calculate Peak Flow (Qbar)			
D/T	9.91		
Tp/T	5.08		
Curve Number (CN)	33	Read from Figure I.6.64 using D/T & Tp/T	I Page 466
Qbar = (CN x A x P x PR) / (10^5 x T)	14.13 m3/s		
Average non-separated flowper km2 (ANSF) = (0.00033(CWI-125) + [0.00074 x RMSD) + 0.003 ==>	0.037 m3/s/km2 0.329 m3/s		
Total Flow =	14.5 m3/s	for 1 in 100 year event	
Allowance for Climate Change	1.2		
TOTAL FLOW (ADJUSTED)	17.3 m3/s		

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JOB NO: 2589
JOB TITLE: Nursing Home at Slade Road, Saggart
DATE: 24.06.13 - REV B (Revised 04.04.13)
BY: LP

CALCULATION OF DESIGN UNIT HYDROGRAPH WITH PEAK OF 1:1000 YEAR RETURN PERIOD

Catchment Area (A)	9 km2	Measured on map	Catchment Map
Length of main Stream (L)	7 km	Measured on map	Catchment Map
Elevation at 85%	265 m	Measured 85% along stream length up from outlet	Catchment Map
Elevation at 10% from outlet along L (H10%)	160 m	Measured 10% along stream length up from outlet	Catchment Map
Channel Slope (S) = (H85%-H10%)/(0.75*L)			
Channel Slope (S) =	20.00 m/km		
Average Annual Rainfall (SAAR)	950 mm	FSR Maps II.3.1	AutoCAD Map
RSMD Calculation:		Net 1 day rainfall 5yr return period (RSMD)	
MS-2 Day	75 mm	Taken from Figure II3.2	AutoCAD Map
Ratio(r) = MS-60/MS-2Day	22.5 %	Taken from Figure II3.5	AutoCAD Map
MS-24 Hours/MS-2 Day	80 %	Taken from table II3.10 using (r) against 24 hours	II Page 32
MS-24 Hours	60 mm		
Conversion Factor	1.11	Taken from table II3.1	
MS 1 Day	54.05 mm		
Areal Reduction Factor 1 day (ARF-1day)	0.975	Taken from Fig II5.1	II Page40
SMD (SMDBAR)	6.5 mm	Taken from Figure I.4.19	AutoCAD Map
RSMD = (MS-1 Day x ARF) - SMDBAR			
RSMD	46.20 mm		
Urban Percentage of Catchment (URB)	0.8 %	Estimate based on mapping	Catchment Map
Urban Percentage Variable (URBT)	1.008		
Time to Peak (Tp) = (46.6L^0.14)x(S^-0.38)x(URBT^-1.99)x(RSMD^-0.4)		Time to peak of 1 hour unit hydrograph	
-->Tp =	4.16 hours		
Tp corrected	4.164422964 hours	Adjust if estimate of LAG is available. Tp = 0.9 x LAG	Site Data
Data Interval (T) = Tp/5	0.832884593 hours		
==>Round up / down (T)	0.8 hours	Round up/down to one decimal place	Rounded figure
Tp (new) = Tp (old) + (T-1)/2	4.06 hours	Adjusts Tp for application to T hr unit hydrograph	
Storm Duration (D) = (1+SAAR/1000)Tp	7.93 hours	Reccommended Design Storm Duration	
Flood Return Period (SRP)	[redacted] years		Chosen return
Required Storm Return Period	[redacted] years	See Fig I6.61	I Page 464
MS(D) / MS-2 Day	52.00%	From Table II.3.10, using D, r (or I6.21)	II Page 32
MS-2 Day	75.00 mm	Calculated earlier	
MS(D)	39 mm		
Growth Factor MT/MS	[redacted]	From Tables II 2.9	II Page 17
<--> Estimate for M1000	106.08 mm		
ARF	0.96	Obtained from Figure II.5.1	II Page 40
Storm return period rain in D hours (P) = ARF x MT	101.84 hours		
Catchment Wetness Index (CWI)	123	From Figure I.6.62	

Soil Index (SOIL) = (0.15xS1 + 0.30xS2 + 0.40xS3 + 0.45xS4 + 0.50xS5)/(1-Su)			
S1	0	Take values from Figure I4.18	AutoCAD Map
S2	0		
S3	0		
S4	0		
S5	1		
Su	0		
==>SOIL =	0.50		
Standard Percentage Runoff (SPR) = 95.5 x SOIL + 0.12 x URB	47.85 %		
Percentage Runoff (PR) = SPR + 0.22(CWI)	56.59 %		
Calculate Peak Flow (Qbar)			
D/T	9.91		
Tp/T	5.08		
Curve Number (CN)	33	Read from Figure I.6.64 using D/T & Tp/T	I Page 466
Qbar = (CN x A x P x PR) / (10^5 x T)	21.39 m3/s		
Average non-separated flowper km2 (ANSF) = 0.00033(CWI-125) + (0.00074 x RMSD) + 0.003 ==>	0.037 m3/s/km2 0.329 m3/s		
Total Flow =	21.7 m3/s	for 1 in 1000 year event	
Allowance for Climate Change	1.2		
TOTAL FLOW (ADJUSTED)	26.0 m3/s		

OPW

The Office of Public Works
Oifig na nOibreacha Poibli

Ceann Oifig
Sráid Jonathan Swift
Baile Átha Trom
Co na Mi

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Suíomh greasáin/website: www.opw.ie

Our Ref: 0751-2013

Ms. Laurie Pitt,
Fahy Fitzpatrick Consulting Engineers.
2057 Castle Drive,
Citywest Campus,
Naas Road,
DUBLIN 24.

Re: Section 50 Application Slade Road, Saggart, Dublin

Dear Ms. Pitt,

I refer to your correspondence dated 4th April 2014 in relation to the above matter.

The documentation submitted has been examined and I am to confirm that the consent of the Commissioners of Public Works under Section 50 of the Arterial Drainage Act, 1945 is given to the proposal as set out below.

12m of 4000mm wide *1700mm high culvert (effective conveyance area 6.35m^2) at a grade of 1 in 100 as per that detailed in drawings,

Drawing No 2589-407 Rev A
Drawing No 2589-405 Rev A

All new culverts should be of a size equal to or greater than existing applicable culverts.

It should be noted that consent is given only for the purposes of Section 50 and does not absolve the recipient of responsibility for any adverse affects caused as a result of this installation to any third party.

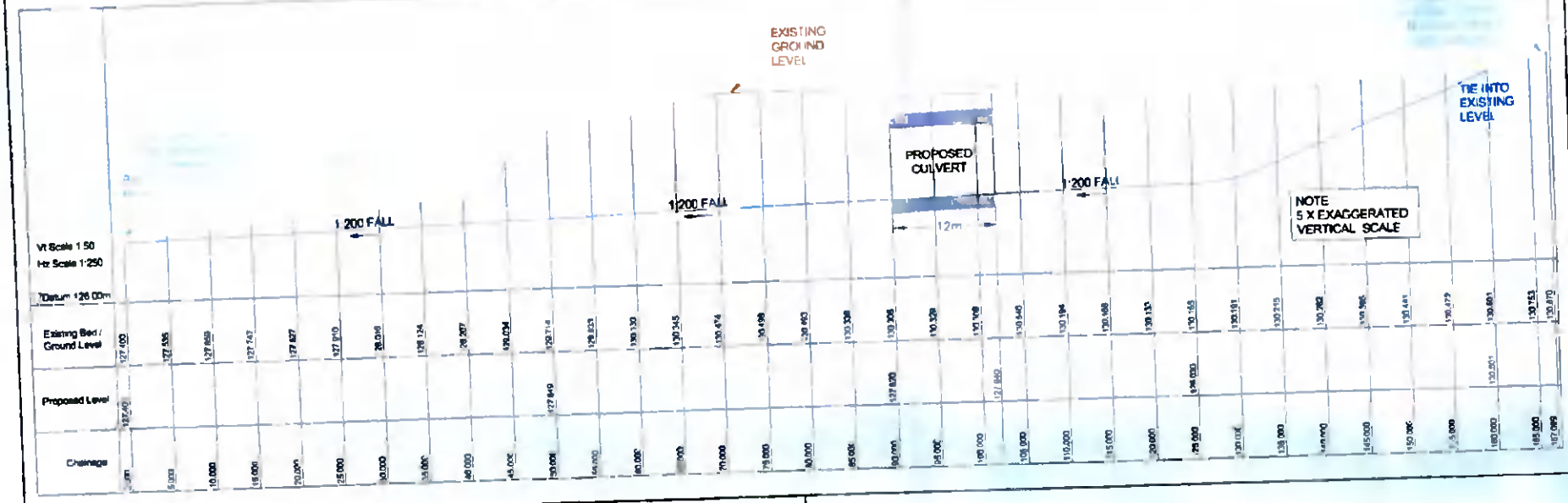
The Commissioners of Public Works are not responsible and accept no liability for any loss or damage whatsoever as a result of this development.

Yours sincerely,

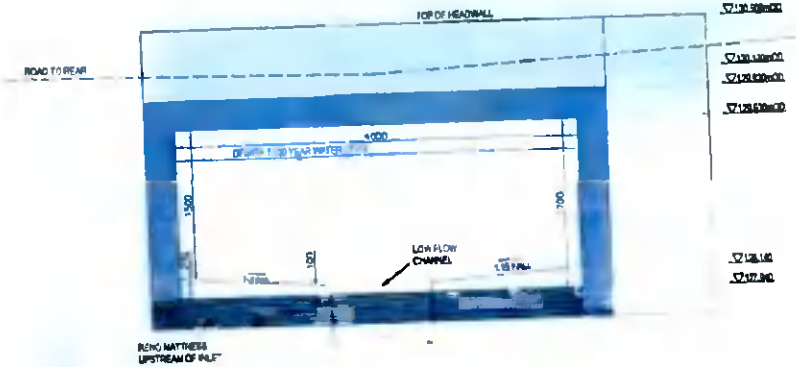
Shirley Crosbie

Shirley Crosbie,
Engineering Services Administration Unit.

26th May 2014.



SECTION B-B
THROUGH CULVERT



SCALE 1:25

SECTION D-D
THROUGH STREAM

SCALE 1:50

SECTION A-A
THROUGH STREAM

SCALE 1:50

SECTION C-C
THROUGH STREAM

SCALE 1:50

NOTES A1

1 Figured Dimensions Only to be Taken from this Drawing. All Dimensions to be Checked on Site

2 This drawing to be read in Conjunction with all other Architectural & Engineering drawings & all other relevant drawings & Specification

FOR INFORMATION ONLY

Ess Construction Ltd

NURSING HOME AT COOLMINE, SAGGART, COUNTY DUBLIN

LONG SECTION & CROSS SECTION

ISO 9001:2000

Fahy Fitzpatrick
CONSULTING ENGINEERS

Drawn By LP	Scale AS SHOWN
Checked By –	Date 01/10/13
Dwg No 2589-407	A