

FLOOD RISK ASSESSMENT REPORT

**In connection with a planning application for a
Proposed Kart Track Development**

at

**Cahir Abbey Industrial Estate,
Cahir,
Co. Tipperary**

by Buttimer Engineering

(PL Ref: 18/600140)

Flood Risk Assessment Report

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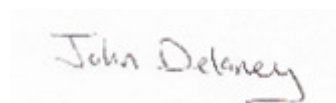
at

Cahir Abbey Industrial Estate,
Cahir,
Co. Tipperary

by

Buttimer
Engineering

Report Writing:



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Date:

18th Dec 2018

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1.0 Introduction

Geoenvironmental Environmental Consultants were commissioned by Howick O'Brien Consultants on behalf of the applicant Buttimer Engineering to carry out a site specific flood risk assessment in response to a request for further information received from Tipperary County Council. The application relates to a proposal to construct a karting track and all other site development works at Cahir Abbey Industrial Estate, Cahir Abbey Lower & Cahir Abbey Upper, Cahir, Co. Tipperary (PL Ref: 18/600140).

Item 2 of the Request for Further Information advises that the site is located on lands identified as at risk of flooding under the CFRAMS study and that the applicant is required to prepare and submit a site specific flood risk assessment for the proposed development site in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities, DEHLG 2009. In addition the applicant is requested to demonstrate that the development would not give rise to flood risk elsewhere through flood water displacement.

2.0 Site Location and Description

The proposed development is located within an established business park (Cahir Abbey Business Park). The entrance to the business park and proposed development will be accessed from Upper Abbey Road in Cahir. The proposed development is located to the north/east of an office building which is currently under construction. There are additional industrial units used by the applicant located to the north east of the proposed development. There are a number of additional industrial and commercial units located further west and closer to the entrance of the Business Park. The former roadstone quarry is located to the east and north/east of the development. There is an existing pond associated with the former quarry works located 100m north from the proposed development. The lands where the proposed karting track is to be located are at a much higher elevation than the former quarry lands to the east and north east. The closest dwellings are located 250m west of the karting track on Abbey Street. Cahir Abbey House is located 150m south of the development. The kart track will be located at a level of between 49.25 and 49.5m AOD. The closest watercourse comprises of a small 1st order stream which flows in a north to south direction close to the entrance of the park. The stream is located 200m west of where the karting track buildings will be located.

3.0 Hydrology

The minor un-named stream rises in the townland of Caherabbey Lower approximately 600m north of the Cahir Abbey Industrial Estate. The stream rises at an elevation of 70m AOD and flows mainly in a southerly direction just to the east of Abbey Road before eventually confluencing with the River Suir approximately 150m up-stream of the new bridge and close to the town centre. The stream is located to the west of the proposed development. The stream is 1.1kms long from source to where it confluences with the River Suir. For the most part the stream is located at a much higher elevation than the river Suir. The stream is located at between 47m and 48m AOD at the development site where as the main Suir Chanel is located at located at an elevation less than 40m AOD some 7-8m lower.

The stream eventually enters the River Suir approximately 550m south of the proposed development. The stream confluences with the River Suir from a much higher elevation than the receiving waters via a number of cascading waterfalls. This ensures that any flood events associated with high discharge levels in the Suir will have no adverse impact on the study stream. The location of the stream and proposed development site are shown in Figure 1.0

Figure 1: Photo Showing Location of Site and route of closest watercourse



5.0 Flood Risk Assessment Approach and CFRAM Program

A flood risk assessment is the identification, quantification and communication of flood risk using the source-pathway-receptor model. It examines the sources of flooding and the pathways by which floodwaters might reach receptors, such as people, property and the environment to determine the likelihood of them being affected by flooding. This report will examine the flood hazards that are likely to arise and the vulnerability of receptors to such hazards. The report will use the source-pathway-target paradigm to assess the flood risk. The assessment will be desk based and therefore rely on available flood source information already.

CFRAM is *'Catchment Flood Risk Assessment and Management'*. The national CFRAM programme commenced in Ireland in 2011. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland. The OPW is the lead agency for flood risk management in Ireland and is the national competent authority for the EU Floods Directive. OPW works in close partnership with all Local Authorities in delivering the objectives of the CFRAM Programme.

The CFRAMS study focuses primarily on developed areas and areas subject to significant development pressure known to have experienced flooding in the past or believed to be at risk of flooding in the future

The CFRAM Programme comprises three phases:

- The Preliminary Flood Risk Assessment (PFRA): 2011
- The CFRAM Studies and parallel activities: 2011-2015
- Implementation and Review: 2016 onwards

6.0 Flood Risk Identification

6.1 Source Pathway Receptor Model

The Source-Pathway-Receptor (S-P-R) Model has become widely used to assess and inform the management of environmental risks. Flood risk assessments require identification and assessment of all three components:

- The probability and magnitude of the source (in this case high river levels within the nearby stream)
- The performance and response of pathways and barriers to pathways such as floodplain areas and flood defence systems; and
- The consequences to receptors such as householders and property owners

The ultimate aim of a flood risk assessment is to combine these components so that the consequences can then be analysed. Flood Risk Assessments (FRAs) need to consider the situation both as it is now and also how it might change in the future. Such consideration should include changes in climate (which impact largely on sources), the construction of flood protection or drainage schemes within the locality by others, the deterioration of existing and proposed defences.

A desk top study and site inspection were undertaken as part of the Flood Risk Assessment. The desk top study entailed an examination of documentary and cartographic sources.

6.2 Sources of flood data

The primary source of flood risk information includes the following;

- Tipperary Co Co On-Line Maps
- County Development Plan & Local Development Plan
- OPW CFRAMS Maps
- OPW flood hazard website
- The Planning System and Flood Risk - Guidelines for Planning Authorities – Department of Environment, Heritage and Local Government & OPW 2009

6.3 Flood History at Cahir Abbey Business Park

There is no anecdotal information available from the OPW to suggest that the proposed development site represents a flood risk. The OPW Flood Hazard Map has recorded no history of flooding within the Cahir Abbey Business Park or anywhere close to the proposed development. The Flood Hazard Map and Report is set out in **Appendix A** of this Report.

6.4 Tipperary County Council On-Line Maps

A Flood risk map layer is available to view on the Tipperary County Council on line mapping system. The information Councils on-line GIS mapping system at <https://www.tipperarycoco.ie/planning>. The extract from Tipperary County Council on-line maps completed by JBA Consulting shows the proposed development location outside of both the fluvial and pluvial flood risk areas indicating that the site is not at risk. There are areas further to the north within the business park shown to be potentially at risk of pluvial flooding. The map is shown in *Figure 2.0*.

6.5 OPW CFRAMS Maps

The Office of Public Works (OPW) is the lead agency for flood risk management in Ireland and is the national competent authority for the EU Floods Directive. The OPW under its CFRAMs '*Catchment Flood Risk Assessment and Management*' project is in the process of preparing Flood Risk maps and associated flood risk plans. The CFRAMS study focuses primarily on developed areas and areas subject to significant development pressure known to have experienced flooding in the past or believed to be at risk of flooding in the future.

Flood Risk Maps are being developed on behalf of the OPW by RPS Consultants. The maps are available to the public through the newly launched OPW website (www.floodinfo.ie). The maps illustrate the extent of areas likely to be impacted by flooding from detailed fluvial modelling of extreme discharge events in surrounding streams and rivers.

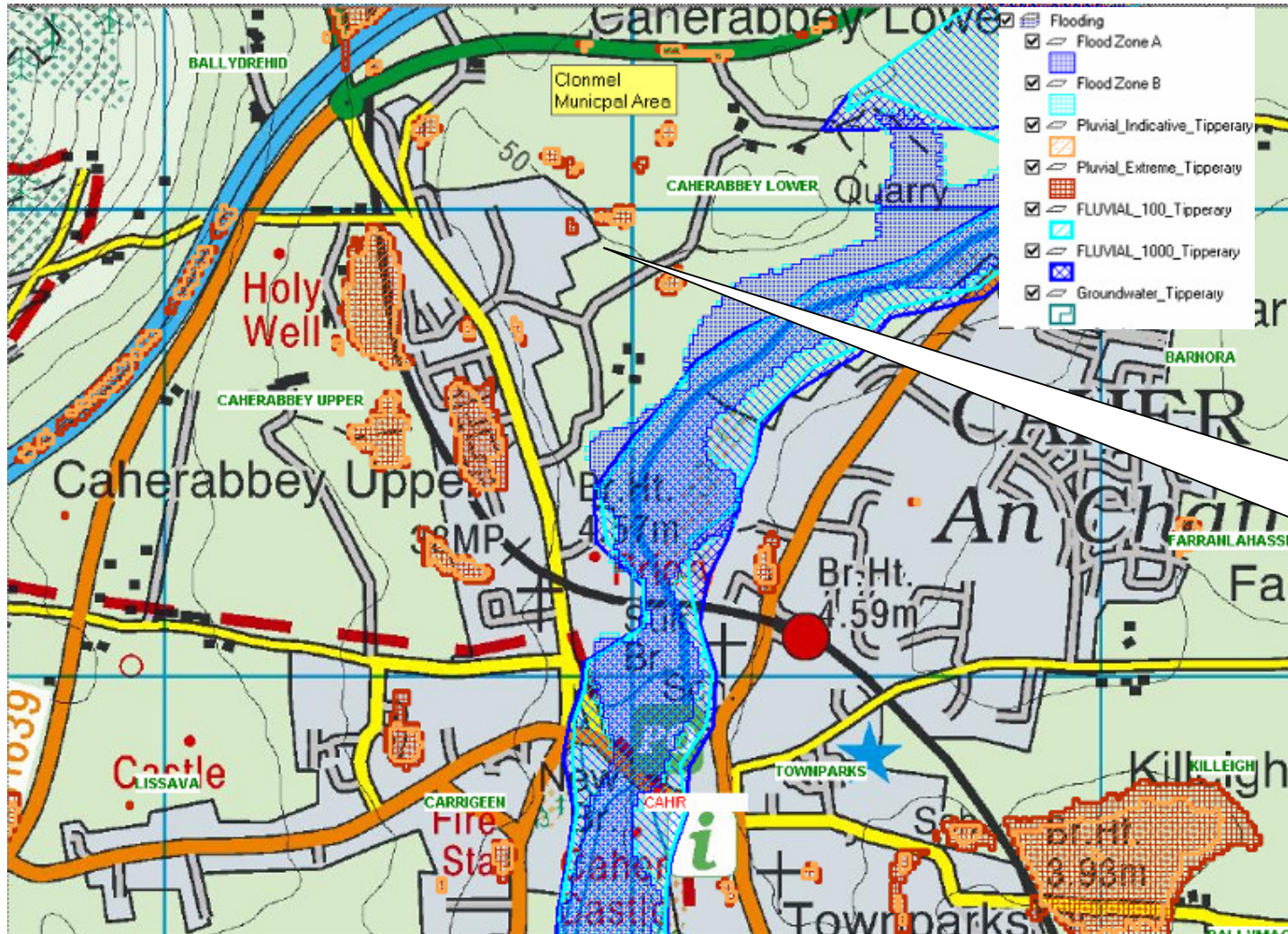
The OPW *Fluvial Flood Extents* map predicts that part the development site within the Cahir Abbey Business Park will be at risk from an extreme fluvial event in the nearby watercourse located close to the entrance of the park.

The recently completed OPW CFRAMS maps site shows that part of the development site to be at risk from a Fluvial Event associated with the nearby stream. The highest risk is shown closer to the eastern boundary where the site is delineated to be at risk from a 1:10 yr event. The area where the karting track developemnt is proposed is shown to be at risk from a 1:100 and 1:1000 year event with the far eastern section of the site outside of the flood risk . Area wide and a more detailed Flood Extent Map showing the proposed development site are set out in Figures 3.0 & 4.0.

6.6 Flood Vulnerability Class

Table 3.2 of Section 3 of the Flood Risk Guidelines sets out the types of development that would be appropriate to comply with a Justification Test. The proposed karting track development in the Abbey Business Park falls under the category of Buildings used for retail, leisure, warehousing, commercial, industrial and non-residential institutions. The development is therefore categorised as less vulnerable than residential developments and would therefore be seen as more acceptable in areas which may be more susceptible to flooding than more sensitive Residential developments.

Figure 2.0: Extract from Tipperary County Council On-Line Maps



Location of proposed Development Site within Caherabbeey Business Park

Figure 3.0: OPW CFRAMS Fluvial Flood Risk Extent Map

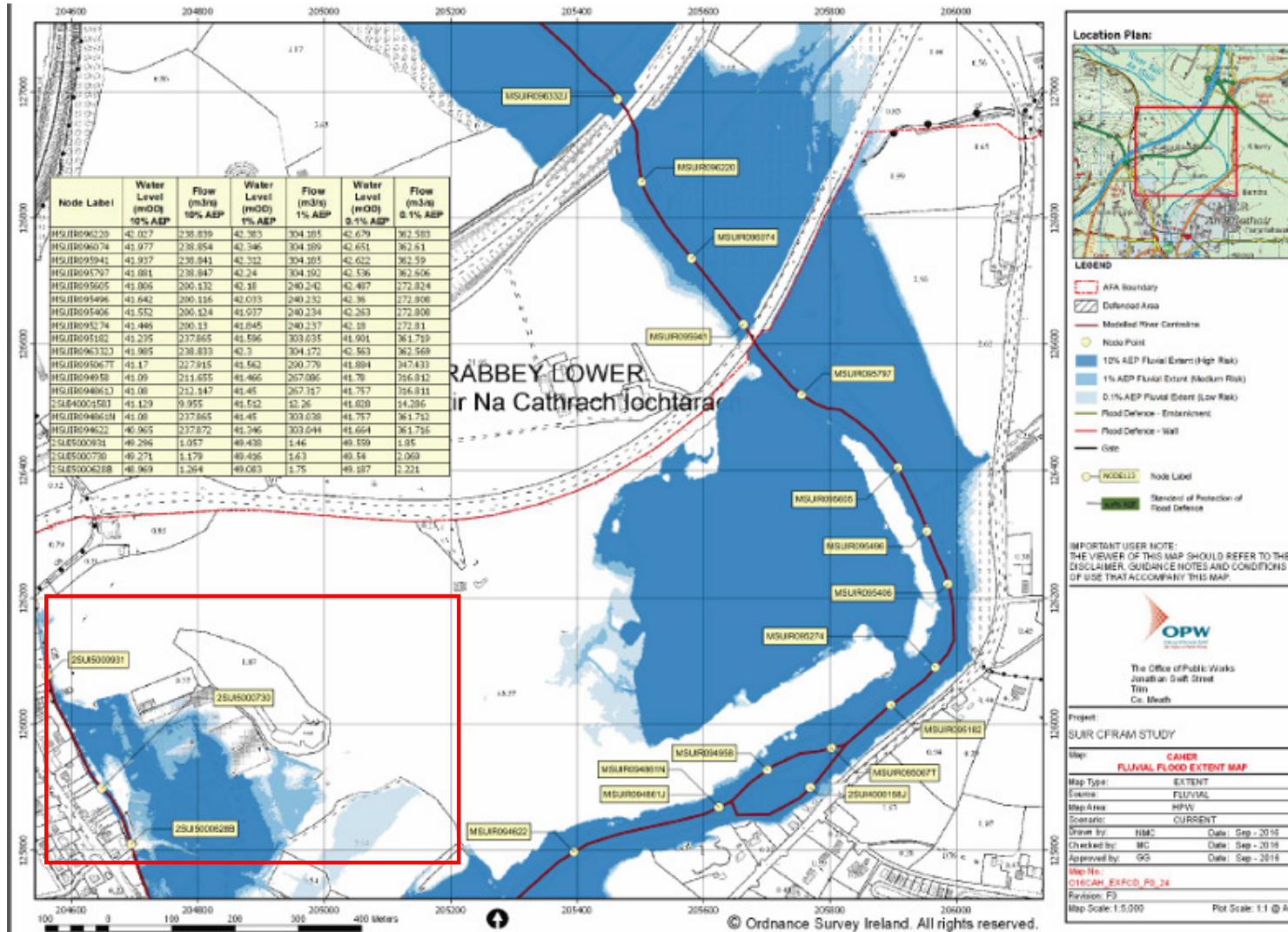
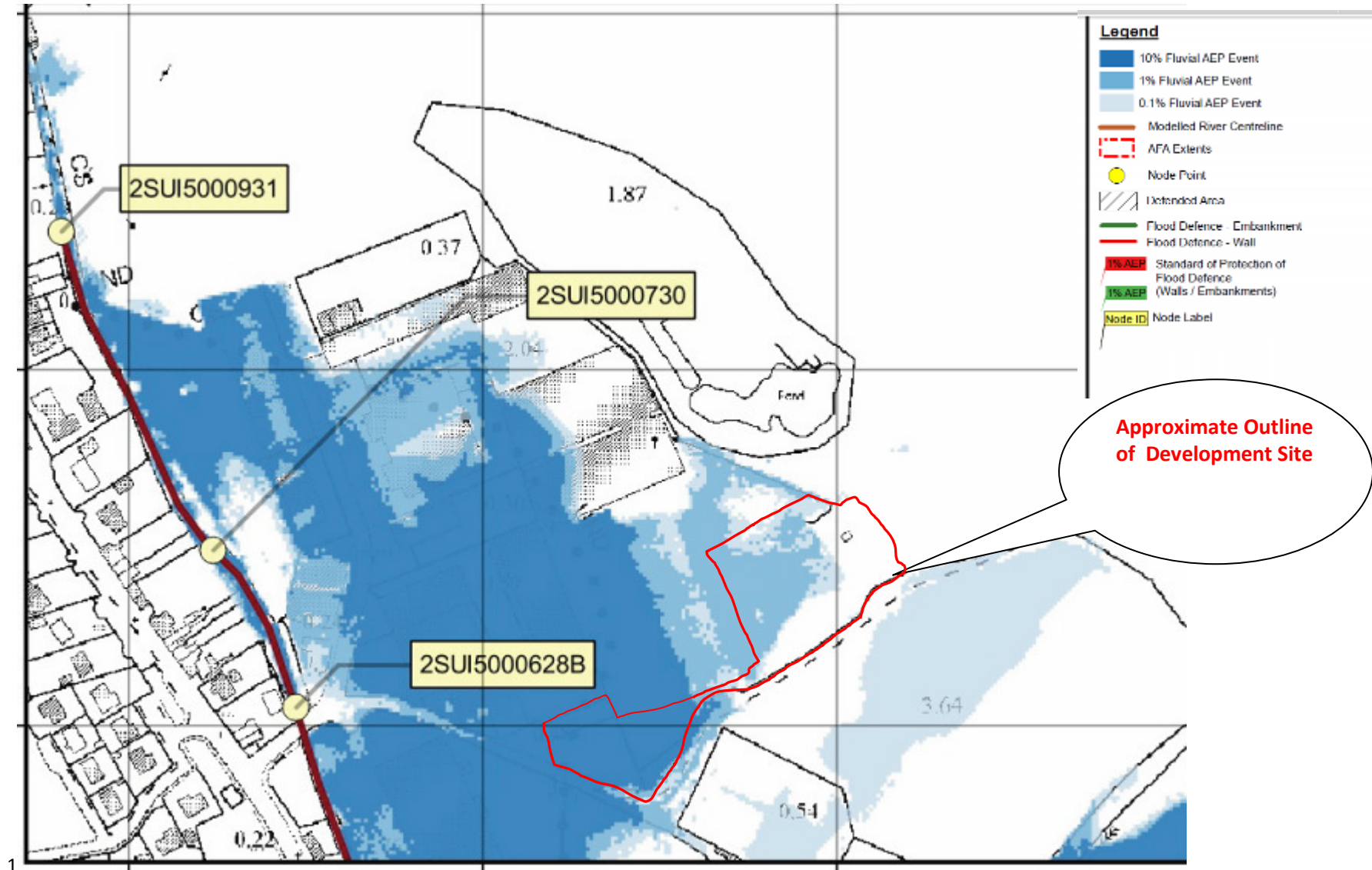


Figure 4.0: Extract from OPW CFRAMS Fluvial Flood Risk Extent Map showing proposed development site



7.0 Flood Predictions and Stream Flood Discharge Calculations

7.1 Flood Forecasting

Flood frequency analyses are used to predict design floods for sites along a river. The technique involves using observed annual peak flow discharge data to calculate statistical information such as mean values, standard deviations, skewness, and recurrence intervals. These statistical data are then used to construct frequency distributions, which are graphs and tables that tell the likelihood of various discharges as a function of recurrence interval or exceedence probability.

Flood forecasts are determined by examining past occurrences of flooding events, determining recurrence intervals of historical events, and then extrapolating to future probabilities. The term "a one-hundred year flood" is actually a misnomer. What is really meant by this term is a flood with recurrence interval of 100 years - one that has a 1% chance of occurring in any given year. Similarly the 1:1000 yr indicates a 0.1% change of occurring in any one year. In the absence of a hydrometric station within the river catchment the 1000 yr discharge volumes in the nearby Stream located close to the entrance to the business park study location were calculated using the methodology set out in the Institute of Hydrology Report No. 124 (Flood Estimation for Small Catchments).

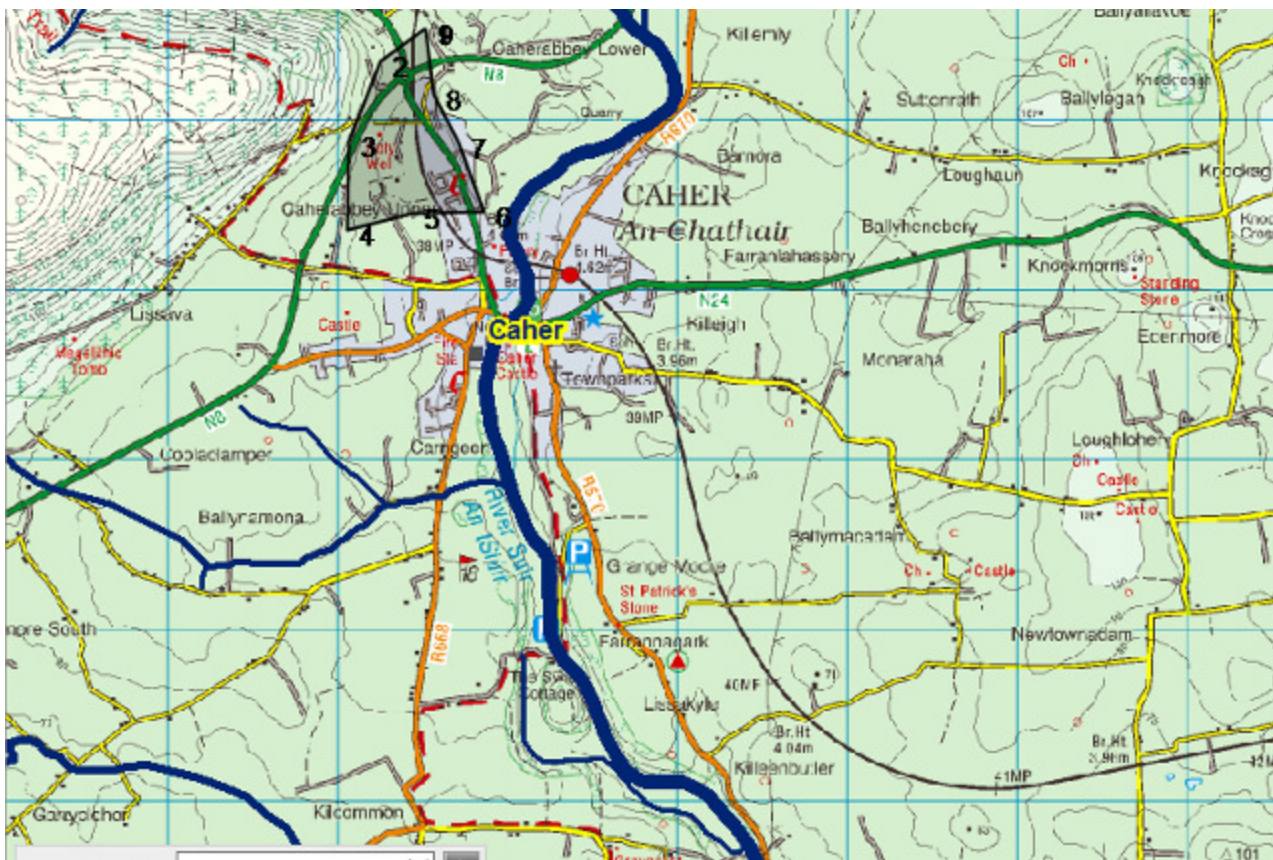
Table 2: Flood Frequency Factors & Projected Flood Levels

Return Periods	Frequency Factors (Ireland)	Climate Change Factor
1		0.81
2	0.96	0.78
5	1.2	0.97
10	1.35	1.09
25	1.55	1.26
50	1.7	1.38
100	1.84	1.49
1000	2.16	1.75

7.2 Catchment Description

The study stream has a catchment area of less than 5kms and therefore the area cannot be calculated using the EPA Hydronet tool. Instead the area is calculated by drawing a polygon around the stream using the topography of area to estimate the total catchment area of the stream. The calculated area of the stream to the study location at Cahir Abbey Industrial Estate is **0.560 sqm**. The catchment area of the stream is shown in Figure 5.0 below.

Figure 5.0: Map showing Calculated Area of Catchment of Stream



7.3 Flood Discharge Calculations

The catchment size of the nearby stream to the study location in the Cahir Abbey Industrial Estate is **0.560km²**. Using the Institute of Hydrology Report No. 124 (Flood Estimation for Small Catchments), the mean annual flood flow (QBAR) was calculated as follows.

$$QBAR_{rural} = 0.00108AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

$$\text{AREA} = 0.560\text{km}^2$$

$$\text{SAAR (Standard Annual Rainfall for the area)} = 949\text{mm}$$

SOIL INDEX = 80.% of catchment is regarded as well drained

$$\text{Soil Index} = 0.4$$

$$= 0.0006446308706 * 3043.697 * 0.136921037$$

$$\Rightarrow \text{QBARrural} = 0.268647434 \text{ m}^3/\text{sec}$$

The 100 yr & 1000 yr return periods are calculated using the projected multiplier growth factors for Ireland listed in Table 6 of the Cawley & Cunnane Paper entitled 'Comment On Estimation Of Greenfield Runoff Rates'.

$$\text{A10} = 0.362674035 \text{ m}^3/\text{sec} \quad (\text{Freq Factor 1.35})$$

$$\text{Q100} = 0.494311278 \text{ m}^3/\text{sec} \quad (\text{Freq Factor 1.84})$$

$$\text{Q1000} = 0.580278457 \text{ m}^3/\text{sec} \quad (\text{Freq Factor 2.16})$$

Applying the climate change factors of 1.49 & 1.75 respectively as set out in Table 2 results in the following discharge volumes which are used in the hydraulic modeling exercise

$$\text{Q10} = 0.395314699 \text{ m}^3/\text{sec} \quad (\text{Climate Change Freq Factor 1.09})$$

$$\text{Q100} = 0.736523805 \text{ m}^3/\text{sec} \quad (\text{Climate Change Freq Factor 1.49})$$

$$\text{Q1000} = 1.015487301 \text{ m}^3/\text{sec} \quad (\text{Climate Freq Factor 1.75})$$

8.0 Survey Data and Modelling Outputs

A topographical survey of the site and surrounded area was carried out by John Howick O'Brien. Four cross-sections which intercept the small stream were plotted across the business park to include the existing stream and proposed development site. The cross-sections traverse at 10m intervals. The information assists in establishing the channel profile, the level of the stream embankments and to identify any constrictions in the stream channel.

The topographic survey conducted shows that the elevations of the base of the stream within each of the sections are similar at between 48.44m at cross section #1 and 48.74m at cross-section 4. The ground levels over the extent of the karting track will all be in excess of 49m.

A model of stream channel and surrounding lands were created using HEC-RAS river modeling software. An analysis of possible flooding predicted using the calculated 1:1000 yr hydraulic flow discharge of 1.015 was carried out. The critical depth was applied to the upstream and downstream boundary conditions within the model. The survey sheet and section drawings are set out in **Appendix B**.

The cross section drawings show that the projected 1:1000 yr discharge flow of 1.015 m³/sec in the nearby stream will not impact on the proposed development. The flood waters will reach a projected **49.08m** during the predicted 1:1000 yr event at x-sections 3 & 4. The modelling outcome demonstrates that the flood waters will be retained within the confines of the stream channel and there will be no impact on the proposed kart development site. The proposed development which includes the karting track will be located at or above **42.08m**. The extent of the stream reach and modelled cross-sections are set out in **Appendix C**.

9.0 Justification Test

Section 3.5 of the DOELG Flood Risk Management Guidelines for Planning Authorities requires that any developments and land-use types including commercial developments should be subject to a justification test. The planning authority must be satisfied that it can clearly demonstrate on a solid evidence base that the zoning or designation for development will satisfy the Justification Test. The proposed development is located within an established Business Park close to Cahir Town Centre.

A Stage One Flood Risk Assessment has been undertaken in support of the Cahir Local Area Plan. The information gathered and outcomes of the Stage One Flood Risk Assessment has informed the Land Use Zoning **Map 1** included in this LAP. The LAP has adopted the precautionary approach and lands subject to flooding have been zoned for amenity land use.

These amenity zoned lands will only be viewed as suitable for appropriate less vulnerable development and water-compatible development as described in Section 3.5 of the Flood Risk Management Guidelines where same uses are acceptable under the Land Use Zoning Matrix and other relevant policies and objectives of the LAP. It is considered that using this methodology the avoidance principle of the sequential approach has been met and there is no requirement to proceed to Stage Two or Stage Three Flood Risk Assessment. However Policy INF 14 of the Plan states that *‘The Council will require a comprehensive Flood Risk Assessment for proposals in an area at risk of flooding, adjoining same or where cumulative impacts may result in a flood risk elsewhere, in low lying areas and in areas adjacent to streams’*.

The Stage 1 plan acknowledges that the Lower River Suir may overflow its banks on an intermittent basis. However a precautionary approach has been adopted under the Cahir LAP and new development has been directed away from the flood plain area to minimise potential flood risk.

Furthermore lands at risk of flooding have been zoned for amenity land use within the plan. The plan states that the Planning Authority is satisfied that there is no potential flood risk identified in areas planned for growth in Cahir based on an assessment of all the sources listed above and bearing in mind a precautionary approach. The Cahir LAP Land Zoning Map is set out in Figure 6.0. The proposed development site is located within a zone designated as Light Industry & Employment.

Section 5.1 of the DOE Guidelines refers to Justification Test criteria for development management to be submitted by the applicant). *The 2nd Criteria requires **that the proposal has been subject to an appropriate flood risk assessment that demonstrates:***

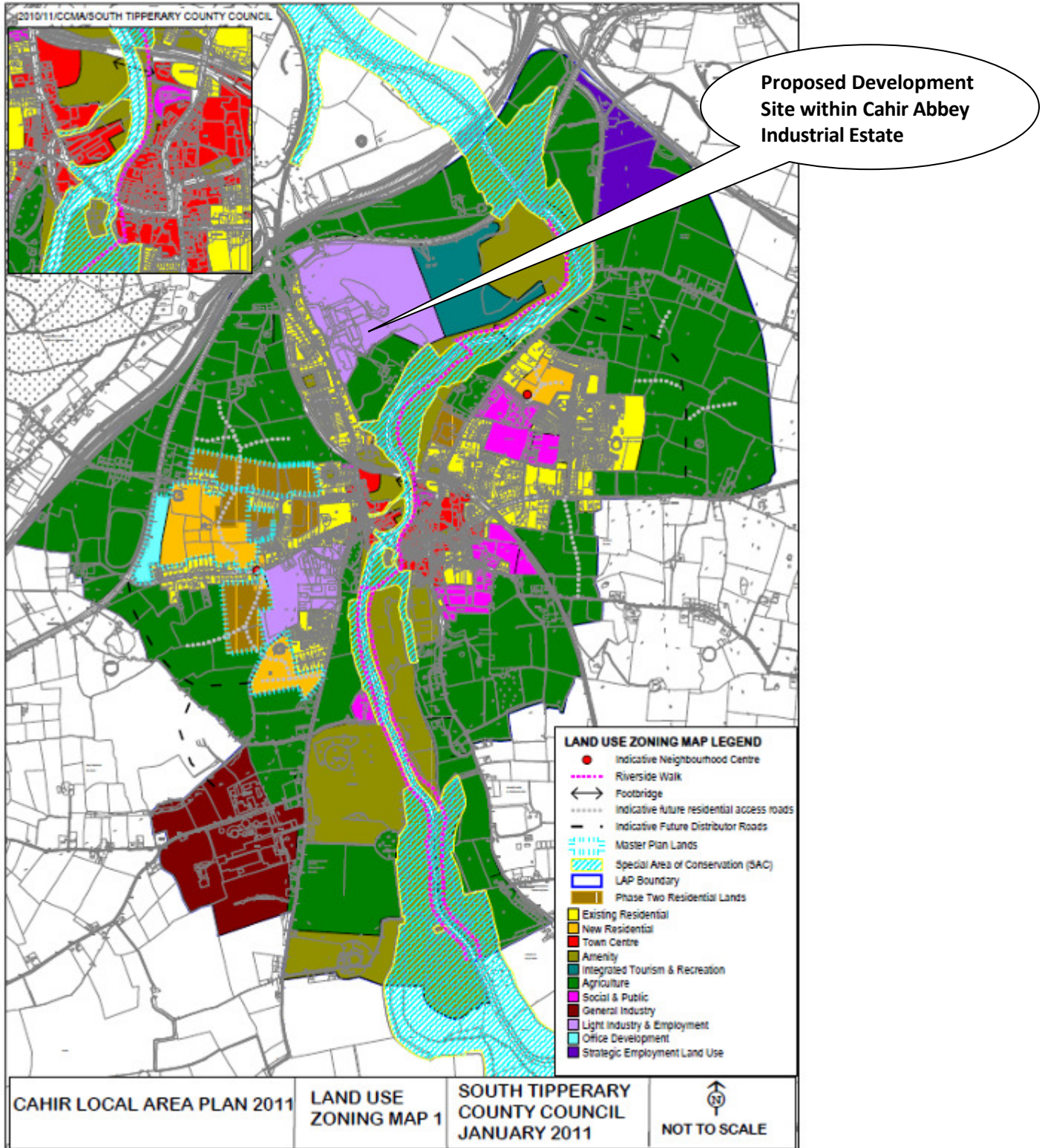
- *The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;*
- *The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;*

- *The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and*
- *The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.*

The Anecdotal evidence shows that there is no history of flooding at the proposed development site within the Cahir Abbey Industrial Estate and that the site has not flooded previously. However the OPW CRFAMS maps developed in 2016 shows part of the site to be at risk from an extreme fluvial event in the nearby stream which flows in a southerly direction close to the west boundary of the site. The site specific modelling shows that the nearby stream will not overflow its bank in the case of a 1:1000 year discharge event and that there will be no fluvial risk to the proposed development.

There will be no increased risk of flooding as a result of the proposed kart track development. The site specific modelling has demonstrated that there will be no increased risk of flooding either within the site or to third parties from the proposed development. There will be no discharge of surface water runoff to the nearby stream from the proposed development. All surface water generated from the proposed kart track development will be discharged to ground via a suitably designed surface water soakaway/Aqua cell. The surface water cell will be designed in accordance with SUDS principles. No additional flood prevention or mitigation measures are required in this case as the development is shown not to be at risk.

Figure 6.0: Cahir Local Area Plan – Zoning Objectives



10.0 Conclusions

The report was compiled in response to a request for further information received from Tipperary County Council in relation to planning application on behalf of the applicant Buttimer Engineering to construct a karting track and all other site development works at Cahir Abbey Industrial Estate, Cahir Abbey Lower & Cahir Abbey Upper, Cahir, Co. Tipperary.

Item 2 of the FI Request required the applicant to prepare and submit a site specific flood risk assessment for the proposed development site in accordance with the Planning System and Flood Risk Management Guidelines for Planning Authorities, DEHLG 2009. In addition the applicant is requested to demonstrate that the development would not give rise to flood risk elsewhere through flood water displacement.

The evidence available shows that there is no history of flooding within the Cahir Abbey Business Park. However, the OPW Fluvial extent map published in 2016 shows that part of the site to be at risk from an extreme fluvial event associated with a nearby stream located close to access to the park on Abbey Street. The map shows that the site will not be impacted from any fluvial event associated with the larger River Suir which is located approximately 500m to the south/east of the site.

A topographical survey of the site was conducted the results of which were incorporated into a hydraulic model. A model of stream channel and surrounding lands was created using HEC-RAS river modeling software. Floodwater elevations associated with the stream were predicted using the calculated 1:1000 yr hydraulic flow discharge of $1.015 \text{ m}^3/\text{sec}$. The model predicts that the flood waters will reach a projected **49.08m** during the predicted 1:1000 yr event at x-sections 3 & 4. The outcome shows that the flood waters will be retained within the confines of the stream channel and that there will be no flood impact on the proposed kart development site. The proposed development which includes the kart track will be located at or above **42.08m**.

The report shows that there will be no increased risk of flooding either within the site or to third parties from the proposed development. Surface water run-off from the proposed development will be diverted to an underground Aquacell SUDS system. The attenuation system which will be adequately sized to manage the run-off from an extreme rainfall event. The proposed development will not obstruct flood paths, reduce the flood plain storage. No additional flood prevention or mitigation measures are required in this case as the development is shown not to be at risk.

11.0 References

A. M. Cawley & C. Cunnane - *“Comment On Estimation Of Greenfield Runoff Rates”*; **2002**

Dept of Environment, Heritage and Local Government (2009) – *“The Planning System and Flood Risk Guidelines for Local Authorities ”*, **November 2009**

Dr. Michael Bruen with the assistance of Mr. Fasil Gebre (2005) - *“An investigation of the Flood Studies Report ungauged catchment method for Mid-Eastern Ireland and Dublin”*; **July, 2005**

EPA Hydrometric Data – www.epa.ie & EPA Hydrometric Tool - watermaps.wfdireland.ie

Environment Agency, *‘Flood Risk Assessment Guidance for New Development’*, **Oct 2005**

HEC-RAS – River Analysis System Software

Institute of Hydrology (1994) – *“Flood estimation for small catchments”* - Report No. 124; **June 1994**

Institute of Hydrology (1995) – *“Hydrology of soil types”* - Report No. 126; **Nov 1995**

OPW CFRAMS Website – www.opw.ie/cframs

OPW Hydrometric Website – www.opw.ie/hydro

OPW National Flood Hazard Mapping Site – www.floodmaps.ie

Tipperary County Council – *“Cahir Local Area Plan; 2011*

Tipperary County Council – www.tipperarycoco.ie/planning

12.0 Appendices

- Appendix A: OPW Flood Hazard Map Report
- Appendix B: Topographic Survey and Sections
- Appendix C: HEC RAS Reach and Cross-Sections

Appendix A: OPW Flood Hazard Map Report

Summary Local Area Report

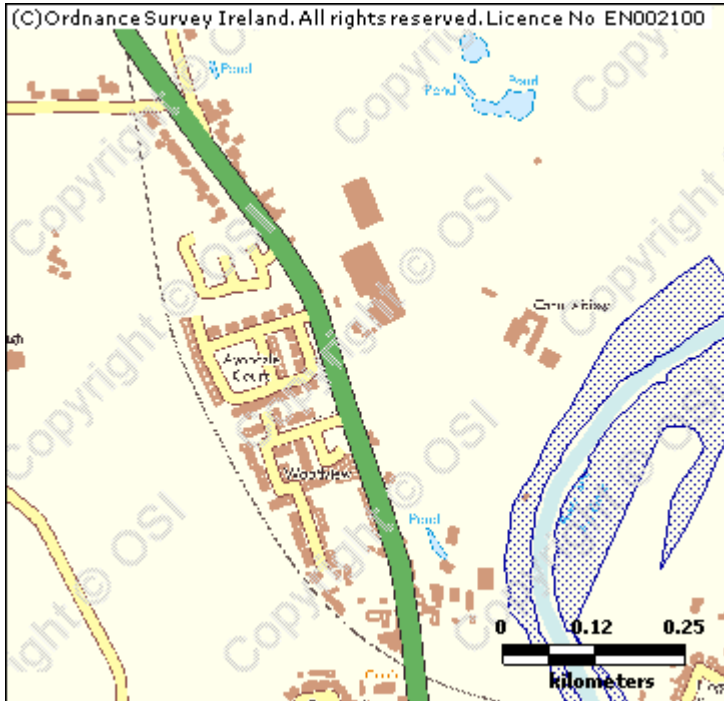
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Tipperary

NGR: S 047 256

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:10,338

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. Their purpose and scope is explained in the Glossary.

1 Result



1. Suir Flood Jan 2008

County: Tipperary, Waterford

Additional Information: [Reports \(1\)](#) [More Mapped Information](#)

Start Date: 10/Jan/2008

Flood Quality Code: 2

Appendix B: Topographic Survey and Sections

Source of
spring / stream

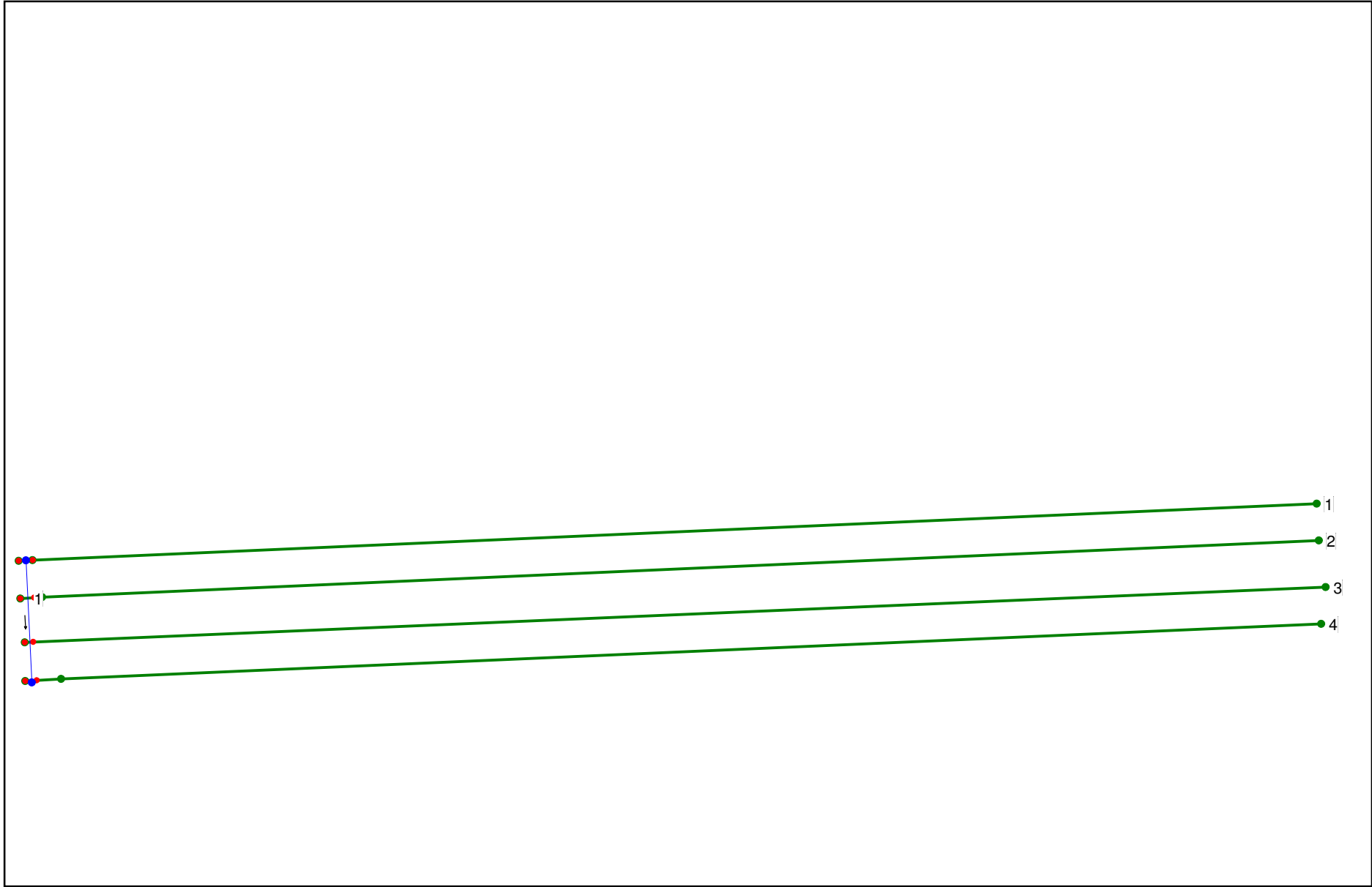


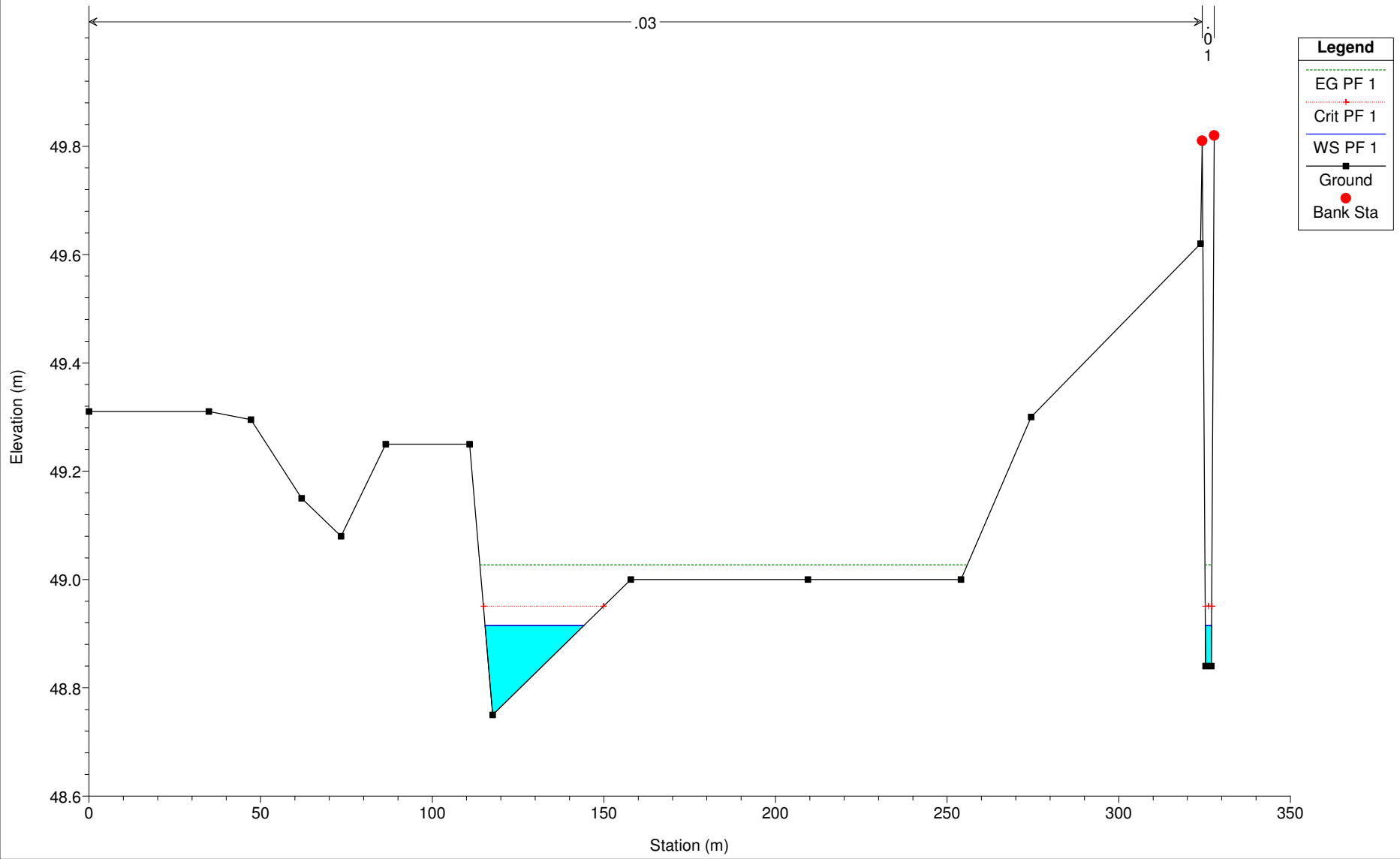
Waterfall
approx 3m.

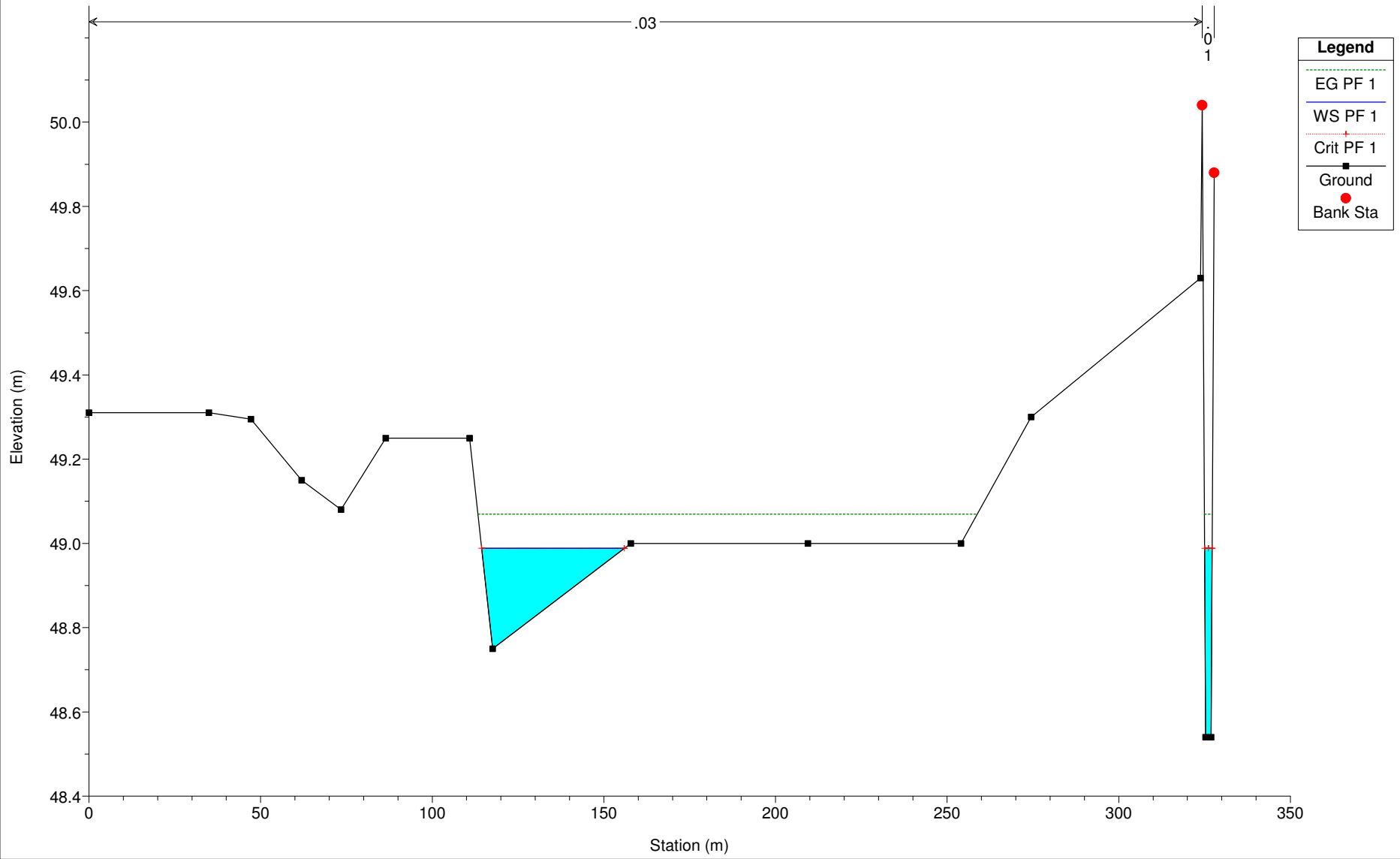
Spring / Stream
enters R. Suir

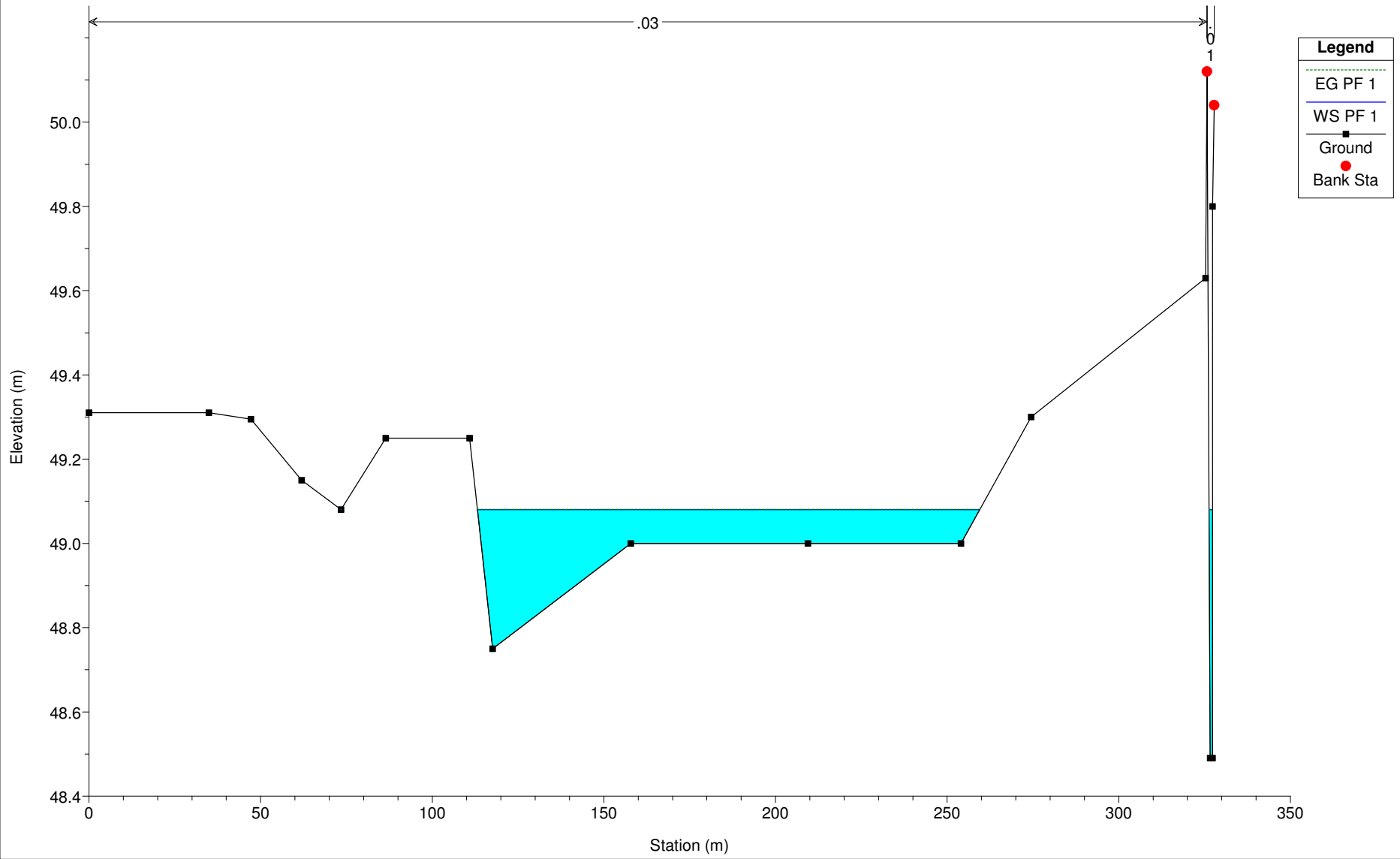


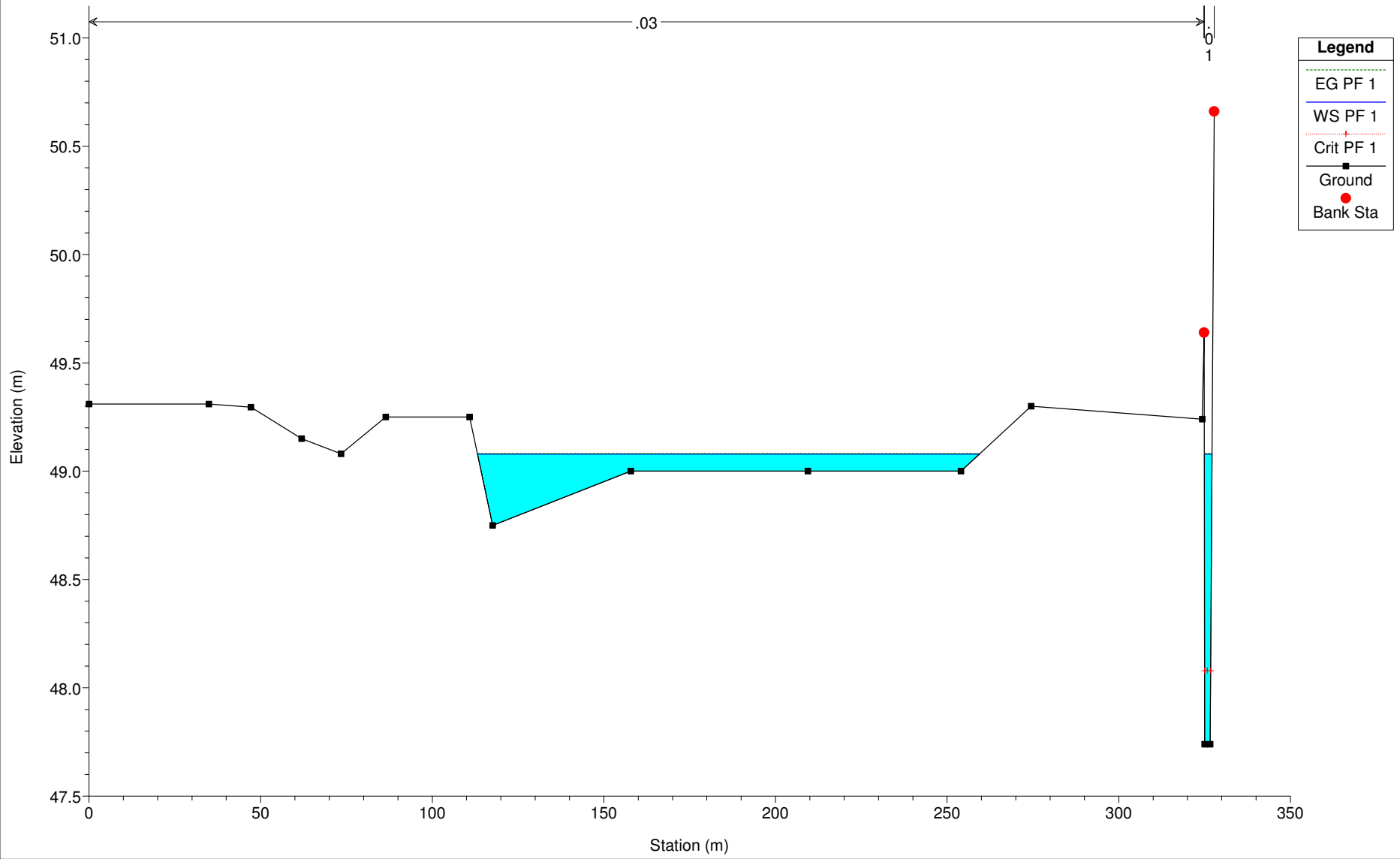
Appendix C: HEC RAS Reach and Cross-Sections














Legend	
	WS PF 1
	Ground
	Bank Sta

