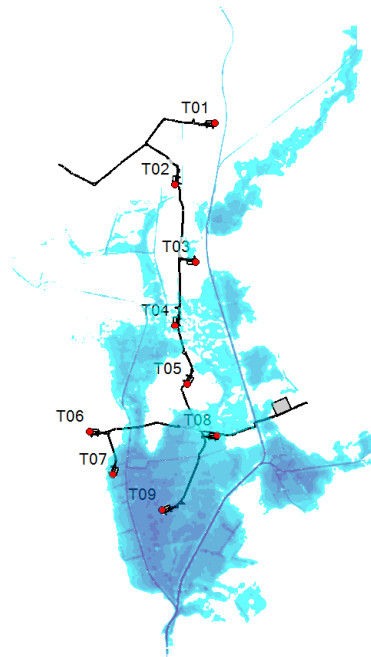




## **APPENDIX 9-1**








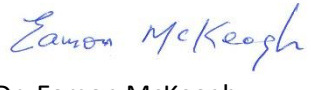
### ***FLOOD RISK ASSESSMENT***

## **Borrisbeg Wind Farm Flood Risk Assessment**



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**November 2023**

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## TABLE OF CONTENTS

1	INTRODUCTION .....	7
1.1	Background and site location .....	7
1.1.1	Development proposal .....	8
1.1.2	Scope and objectives .....	9
1.1.3	Planning and policy framework .....	9
1.1.4	Structure of the Report .....	10
2	METHODOLOGY .....	11
2.1	Source-Pathway-Receptor Model .....	12
2.2	Likelihood of Flooding and Definition of Flood Zones .....	12
2.3	Classification of the Proposed Development and Justification Test .....	13
2.4	Flood Risk Assessment Stages .....	14
3	EXISTING SITE CONDITIONS .....	16
3.1	Subsoil and Hydrogeology .....	16
3.2	Hydrological Features .....	17
4	STAGE 1 - FLOOD RISK IDENTIFICATION .....	20
4.1	OPW historic flood maps .....	20
4.2	Likelihood of flooding from previous studies .....	21
4.2.1	Existing FRA .....	21
4.2.2	SFRA .....	21
4.2.3	Previous FRAs at national/regional, strategic and site-specific scales .....	21
4.2.4	Areas for Further Assessment and Benefiting Lands .....	21
4.3	Sources of flooding .....	23
4.3.1	Fluvial flooding .....	23
4.3.2	Coastal flooding .....	24
4.3.3	Pluvial flooding .....	25
4.3.4	Overland flooding .....	26
4.3.5	Groundwater flooding .....	26
4.3.6	Flooding from artificial drainage systems .....	26
4.3.7	Flooding arising from the failure of infrastructure .....	27
4.4	Other sources .....	27
4.4.1	Flow gauge information .....	27
4.4.2	Local embankments .....	28
4.5	Source-Pathway-Receptor Model and Development Classification .....	28
4.5.1	Mitigation measures .....	28
5	STAGE 2 - INITIAL FLOOD RISK ASSESSMENT .....	29
5.1	Introduction .....	29
5.1.1	Methodology .....	29
5.2	Hydrology .....	30
5.2.1	Catchment Area .....	30
5.2.2	Hydrological Estimation Points - HEPS .....	31
5.2.3	Design Flow Rates .....	33
5.3	Hydraulic model for Existing river system .....	41

5.3.1	Methodology.....	41
5.3.2	Model description .....	41
5.3.3	Model Input data .....	43
5.3.4	Design events in flood risk scoping.....	47
5.3.5	Computer model results for existing river system.....	47
5.4	Flood risk management measures.....	52
5.4.1	Fluvial and coastal flood risk.....	52
5.4.2	Coastal flooding .....	52
5.4.3	Pluvial flooding.....	52
5.4.4	Overland flooding .....	52
5.4.5	Groundwater flooding .....	52
5.4.6	Drainage systems .....	52
6	STAGE 3 – DETAILED FLOOD RISK ASSESSMENT .....	53
6.1	Introduction .....	53
6.1.1	Risk of fluvial flooding.....	53
6.1.2	Risk of coastal flooding .....	53
6.1.3	Risk of pluvial flooding.....	53
6.1.4	Risk of artificial drainage system and groundwater flooding .....	54
6.1.5	Surface water drainage risk .....	54
6.1.6	Risk of flooding due to culvert blockage.....	54
6.2	Hydraulic model for Design River System.....	55
6.2.1	Model Input data .....	55
6.2.2	Design events in flood risk scoping.....	56
6.2.3	Computer model results for design river system .....	56
6.2.4	Longitudinal profiles .....	57
6.2.5	Velocity distribution.....	66
6.2.6	Flood Maps for design System.....	66
6.2.7	On site impact assessment .....	67
6.2.8	Flood Mitigation for design river system .....	67
6.3	Assessment of surface water drainage risk .....	70
6.3.1	Calculations showing the pre- and post-development peak run-off flow rate for the critical rainfall event .....	70
6.4	Potential impact of development on flooding elsewhere .....	71
6.4.1	Water level comparisons .....	71
6.4.2	Q <sub>100cc</sub> MRFS Velocity distributions .....	72
6.4.3	Flood Extent comparisons.....	74
6.4.4	Hydrograph comparisons for Q <sub>100cc</sub> .....	76
6.4.5	Loss of storage .....	79
6.4.6	Increased run-off .....	79
6.5	Residual risks.....	80
6.5.1	Failure scenarios and flood resilient building design.....	80
6.5.2	Access and egress .....	80
6.6	Justification Test .....	82
6.6.1	Part 1 - Plan Making Justification Test.....	82

6.6.2	Part 2 – Development Management Justification Test .....	82
6.7	Flood risk balance sheet .....	85
6.8	Environmental enhancement .....	86
6.9	Conclusions .....	88
7	REFERENCES .....	90
8	APPENDICES .....	8-1
8.1	Annex A - Photos of hydrological features .....	8-2
8.2	Annex B - Existing Flood Maps .....	8-14
8.2.1	Existing Velocity distribution .....	8-15
8.2.2	Existing Flood Maps .....	8-17
8.3	Annex C - Predictive Flood Zones and Flood Maps .....	8-19
8.3.1	Existing Velocity distribution .....	8-20
8.3.2	Existing Flood Maps .....	8-22
8.4	Annex D - Relevant Legislation and Regulations .....	8-28
8.4.1	Arterial Drainage Acts .....	8-28
8.4.2	Environmental Legislation and Regulations .....	8-28
8.4.3	Planning and Development Management .....	8-29
8.5	Annex E - National Flood Policy .....	8-30
8.6	Annex F - Local Policy on Flood Management .....	8-32
8.6.1	Renewable Energy Strategy from Draft Tipperary County Development Plan 2022-2028 .....	8-32
8.6.2	Templemore Flood Relief Scheme .....	8-39
8.6.3	OPW Flood Risk Management Plan for Suir .....	8-40
8.7	Annex G - Lap Zonning / Settlement Map .....	8-41
8.8	Annex H - HEC-RAS output tables .....	8-42
8.8.1	Hec-Ras output tables for $Q_{100cc}$ - Zone A .....	8-42
8.8.2	Hec-Ras output tables for $Q_{1000cc}$ - Zone B .....	8-50
8.9	Annex I – Met Eireann DDF table .....	8-58
8.10	Annex J - FSU Report .....	8-59

## LIST OF TABLES

Table 2.1:	Matrix of Vulnerability Versus Flood Zone [1] .....	14
Table 3.1.	Culvert details .....	18
Table 4.1:	Source-Pathway-Receptor Analysis .....	28
Table 5.1.	Contributing catchment area for each HEP .....	31
Table 5.2.	Catchment characteristics for gauge 16004 on Suir, Thurles. ....	33
Table 5.3.	Flood Frequency analysis for Station 16004 – Thurles. ....	34
Table 5.4.	Flow frequency for gauge No 16004 Thurles .....	35
Table 5.5.	Adjustment of flow rates for the proposed bridge location (factor 0.419522854 used). ....	36
Table 5.6.	Flood Frequency Analysis flows for HEPs – $Q_{100cc}$ .....	36
Table 5.7.	FSU Input parameters .....	37
Table 5.8.	Growth factors from FSU analysis. ....	37
Table 5.9.	FSU design flows. ....	38
Table 5.10.	Summary table comparing design $Q_{100cc}$ flows .....	39

Table 5.11. Summary table comparing design $Q_{100cc}$ and $Q_{1000cc}$ flow rates for MRFS.....	40
Table 5.12. Input design flows for the hydraulic model.....	45
Table 5.13. Design Events used in flood risk scoping.....	47
Table 6.1. Design Events used in flood risk scoping.....	56
Table 6.2. Proposed new bridges and culverts with description and location.....	67
Table 6.3. Wind turbine hardstands Finished Ground levels. ....	69
Table 8.1. HEC-RAS results showing water levels and velocities for Existing and Design Systems for $Q_{100cc}$ (Zone A).....	8-42
Table 8.2. HEC-RAS results showing water levels and velocities for Existing and Design Systems for $Q_{1000cc}$ (Zone B).....	8-50

## LIST OF FIGURES

Figure 1.1. Site location.....	7
Figure 1.2. Proposed wind farm development.....	8
Figure 2.1: Sequential Approach Mechanism [1]. ....	11
Figure 2.2: Source-Pathway- Receptor Model [1]. ....	12
Figure 2.3. Indicative flood zone map.....	13
Figure 2.4: Flood risk assessment stages required per scale of study undertaken [1]. ....	14
Figure 3.1 Soils Characteristics.....	16
Figure 3.2. Karst features in Suir Catchment.....	17
Figure 3.3. Hydrological Features.....	19
Figure 4.1. OPW flood hazard mapping [6]. ....	20
Figure 4.2. Indicative Flood Maps (floodinfo.ie).....	22
Figure 4.3. CFRAM Fluvial flood extent for 1% and 0.1% AEP (source: www.floodinfo.ie).....	23
Figure 4.4. NIF Fluvial flood extent for 1% and 0.1% AEP (source: www.floodinfo.ie). ....	24
Figure 4.5. The GSI Winter 2015/2016 Surface Water Flooding map. ....	25
Figure 4.6. OPW Maintenance of Arterial Drainage Scheme (www.floodinfo.ie). ....	27
Figure 5.1. Catchment area delineation for all HEPs. ....	30
Figure 5.2. Location of HEPs.....	32
Figure 5.3. Amax series for OPW gauge No 16004 – Thurles on Suir.....	33
Figure 5.4. Flood Frequency analysis for the EPA [3] gauge No 16004 Thurles. ....	35
Figure 5.5. Overlay of the Survey points and satellite images. ....	43
Figure 5.6. Digital Terrain Model of the existing model area.....	44
Figure 5.7. Unit hydrograph. ....	45
Figure 5.8. Resulting hydrographs for $Q_{100cc}$ . ....	46
Figure 5.9. Resulting hydrographs for $Q_{100cc}$ . ....	46
Figure 5.10. Suir Longitudinal profile showing water levels in the river channel for Existing River System for $Q_{100cc}$ and $Q_{1000cc}$ . ....	48
Figure 5.11. Eastwood Longitudinal profile showing water levels in the river channel for Existing River System for $Q_{100cc}$ and $Q_{1000cc}$ . ....	49
Figure 5.12. Suir Longitudinal profile showing flow velocity in the river channel for Existing River System for $Q_{100cc}$ and $Q_{1000cc}$ . ....	50
Figure 5.13. Eastwood Longitudinal profile showing flow velocity in the river channel for Existing River System for $Q_{100cc}$ and $Q_{1000cc}$ . ....	51
Figure 6.1. Digital Terrain Model of the design model area.....	55
Figure 6.2. Suir Longitudinal profile showing water levels in the river channel for Design River System for $Q_{100cc}$ and $Q_{1000cc}$ . ....	58

Figure 6.3. Suir Longitudinal profile comparing water levels in the river channel for Existing and Design River System for $Q_{100cc}$ .....	59
Figure 6.4. Suir Longitudinal profile comparing water levels in the river channel for Existing and Design River System for $Q_{1000cc}$ .....	60
Figure 6.5. Eastwood Longitudinal profile showing water levels in the river channel for Design River System for $Q_{100cc}$ and $Q_{1000cc}$ .....	61
Figure 6.6. Eastwood Longitudinal profile comparing water levels in the river channel for Existing and Design River System for $Q_{100cc}$ .....	62
Figure 6.7. Eastwood Longitudinal profile comparing water levels in the river channel for Existing and Design River System for $Q_{1000cc}$ .....	63
Figure 6.8. Suir Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for $Q_{100cc}$ and $Q_{1000cc}$ .....	64
Figure 6.9. Eastwood Longitudinal profile showing flow velocity in the river channel for Design River System for $Q_{100cc}$ and $Q_{1000cc}$ .....	65
Figure 6.10. New culvert locations.....	68
Figure 6.11. Wind turbine Hardstands location and typical close-up layout. ....	69
Figure 6.12. Suir Longitudinal profile showing water levels in the river channel for Existing and Design River System for $Q_{100cc}$ .....	71
Figure 6.13. Eastwood Longitudinal profile showing water levels in the river channel for Existing and Design River System for $Q_{100cc}$ .....	72
Figure 6.14. Suir Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for $Q_{100cc}$ .....	73
Figure 6.15. Eastwood Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for $Q_{100cc}$ .....	73
Figure 6.16. Hydrograph comparison locations for $Q_{100cc}$ design flow.....	76
Figure 6.17. Hydrograph comparisons at the above locations for $Q_{100cc}$ design flow. ....	77
Figure 6.18. Layout of emergency access and egress road .....	81
Figure 6.19. Environmental enhancement of Eastwood River reach. ....	87
Figure 8.1. Flow Velocity distribution for Existing River System for $Q_{100cc}$ .....	8-15
Figure 8.2. Flow Velocity distribution for Existing River System for $Q_{1000cc}$ .....	8-16
Figure 8.3. Flood map with water depths for Existing River System and $Q_{100cc}$ design flow.....	8-17
Figure 8.4. Flood map with water depths for Existing River System and $Q_{1000cc}$ design flow.....	8-18
Figure 8.5. Flow Velocity distribution for Design River System for $Q_{100cc}$ .....	8-20
Figure 8.6. Flow Velocity distribution for Design River System for $Q_{1000cc}$ .....	8-21
Figure 8.7. Flood map with water depths for Design River System and $Q_{100cc}$ design flow – Zone A. ....	8-22
Figure 8.8. Flood map with water depths for Design River System and $Q_{1000cc}$ design flow – Zone B. ....	8-23
Figure 8.9. Comparison of Existing and Design River System flood extent (Flood extent for Design System is shown in red hatch) for $Q_{100cc}$ design flow – Zone A. ....	8-24
Figure 8.10. Comparison of Existing and Design River System flood extent (Flood extent for Design System is shown in red hatch) for $Q_{1000cc}$ design flow – Zone B. ....	8-25
Figure 8.11. Comparison of Existing and Design River System water levels for $Q_{100cc}$ design flow – Zone A (negative values – green show lower WL in Design). ....	8-26
Figure 8.12. Comparison of Existing and Design River System water levels for $Q_{1000cc}$ design flow – Zone B (negative values – green show lower WL in Design). ....	8-27
Figure 8.13. Suitability of wind farm development for Tipperary Co. Co.....	8-37
Figure 8.14. Map 2 Wind Energy Policy Areas.....	8-38



# 1 Introduction

## 1.1 BACKGROUND AND SITE LOCATION

Fluvio R&D Ltd. was commissioned by Buirios Limited, to undertake a Flood Risk Assessment (FRA) for a wind farm development at Borrisbeg, Co. Tipperary, Ireland.

This report will assess the flooding risk to the development and adjoining lands in accordance with the guidelines published by the OPW and DHELG in November 2009 "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" [1]. Additional hydraulic assessment of stream restoration works of 240(299)<sup>1</sup>m reach of River Eastwood was done and is elaborated in the Fluvio Report [2]. The assessment [2] concluded that stream restoration works do not affect flood flows / runoff downstream of works and locally improve / lower flood levels by enabling additional storage for flood flows.

The site is located east of the N62 and the townland of Borrisbeg, and north-east of Templemore in Co. Tipperary as shown in Figure 1.1.

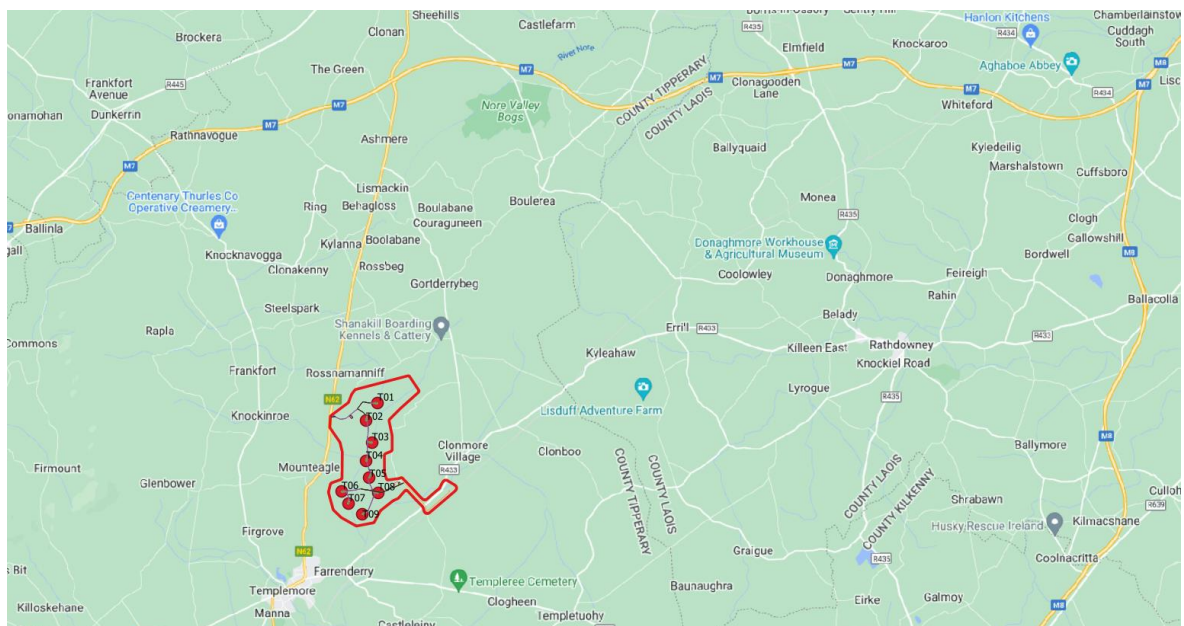


Figure 1.1. Site location.

<sup>1</sup> The length of existing channel is 240 which will be extended to 299m

### 1.1.1 Development proposal

The proposed Wind Farm (WF) (Figure 1.2) consists of nine wind turbines with hardstands and a road network. The site is bounded on the east and west sides by two main rivers – the River Suir on the east and the River Eastwood on the west. Access to the WF road network is from the N62 and a local road the L7039, both of which are not subject to flooding. Hardstands for turbines are designed with finished ground levels above the flood levels for both flood Zones A and B and the WF road network is retained at existing ground levels in order to avoid flood plain flow blockage of pre-construction flood flow paths.

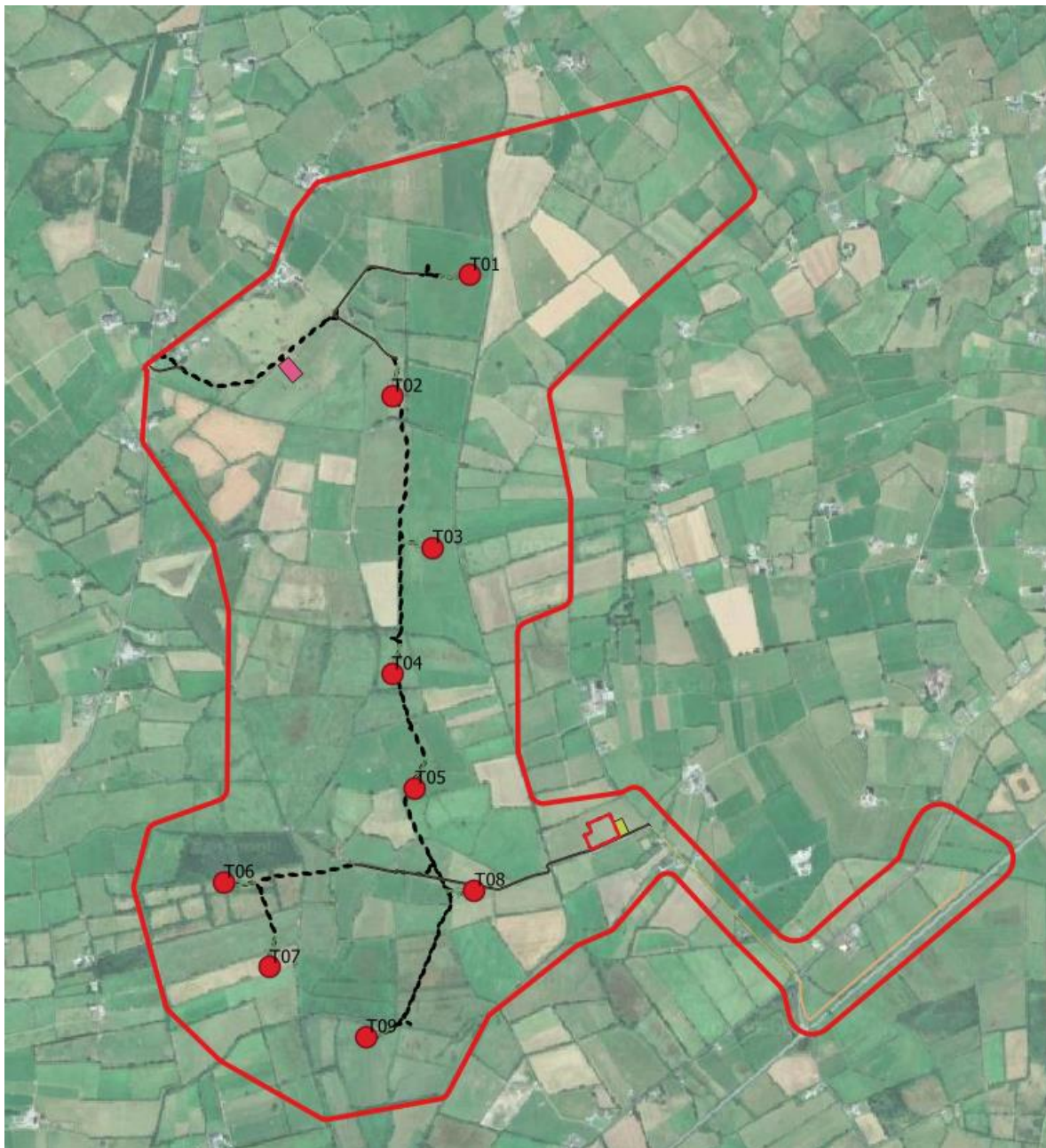


Figure 1.2. Proposed wind farm development.

### 1.1.2 Scope and objectives

The scope of this report is to provide the information necessary for a planning application by the WF developer, to discharge their responsibilities under the OPW Planning and Development Flood Policy with regard to flood risk constraints and to ensure that the development complies with the flood risk policies within Tipperary County Council's Development Plan [11]. This report has been prepared in accordance with "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" published by OPW and the Department of the Environment, Heritage and Local Government in November 2009 [1]. The aim of the FRA is to:

- Identify the flooding issues at and adjacent to the site,
- Identify and carry out the studies required to assess these.
- Design mitigation and flood alleviation measures for the development.

The risk assessment covers all sources of flooding, including the effects of run-off from the development on flood risk to the vicinity, environs and downstream of the development site. The study involves a hydrological assessment to estimate extreme river flows and examines the effect of the proposed development on these and assesses if this will have any significant impact on flooding elsewhere.

### 1.1.3 Planning and policy framework

In this Report the following Planning Framework documents were considered:

- Relevant legislation and regulations
- Irish National policy on flooding
- Local policy

#### 1.1.3.1 Relevant legislation and regulations

Relevant legislation and regulations include *Arterial Drainage Acts*, *Environmental Legislation and Regulations* and *Planning and Development Management* which are presented in Annex D.

#### 1.1.3.2 Irish National policy on flooding

The current Irish National policy on flood risk is outlined in the OPW document *OPW Planning and Development Flood Policy* published on [www.flooding.ie](http://www.flooding.ie). The details of the policy are presented in the Annex E.

Borrisbeg WF is not within any local area plans, as shown in Annex G. However, Tipperary County Development plan 2022-2028 Renewable Energy Strategy [12] applies to the site.

#### 1.1.4 Structure of the Report

The Flood Risk Assessment (FRA) is central to the implementation of the OPW Guidelines [1]. A FRA may be undertaken over a large area, or for a particular site to:

- identify whether and the degree to which flood risk is an issue,
- identify flood zones (if not already identified),
- inform decisions in relation to spatial zoning and planning applications,
- develop appropriate flood risk mitigation and management measures for developments sited in flood risk areas.

This Report is undertaken in a sequential manner in three stages, which represent increasing levels of detail, which are: Stage 1 – Flood Risk Identification, Stage 2 – Initial Flood Risk Assessment and Stage 3 – Detailed Flood Risk Assessment. Only assessments that are needed for the purposes of decision making were carried out.

FRA's can be undertaken at a range of scales relevant to the planning process. This Report is a full FRA with a Site-Specific Flood Risk Assessment, i.e. for an individual site planning application. In accordance with the OPW Guidelines for the assessment of flood risk, the source-pathway-receptor model has been adopted. In the report, the probability of flooding occurring was calculated, the hazards that will arise were assessed, and the vulnerability of the receptors of those hazards was examined. These assessments were carried out using computer simulations of the rivers and floodplains system for existing and post-development scenarios.

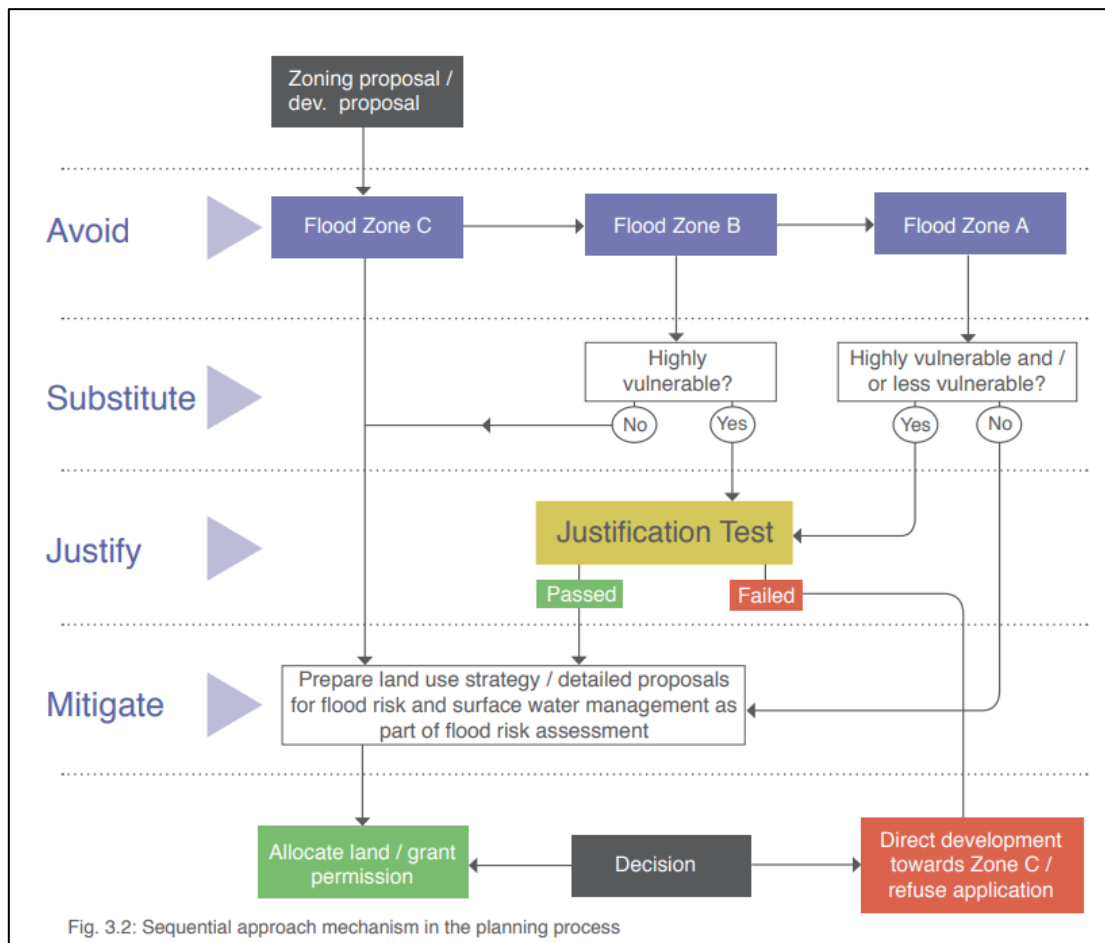
## 2 Methodology

This report has been prepared in accordance with "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" published by OPW and the Department of the Environment, Heritage and Local Government in November 2009 [1].

The *Guidelines for Planning Authorities* [1] and its Technical Appendices outline the requirements for a SSFRA. The *Guidelines for Planning Authorities* requires that works:

- Avoid development in areas at risk of flooding.
- Substitute less vulnerable uses, where avoidance is not possible.
- Mitigate and manage the risk, where avoidance and substitution are not possible.

The key principles of the *Guidelines for Planning Authorities* are to apply the **Sequential Approach** to the planning process. Figure 2.1 of this report describes the mechanism of the sequential approach for use in the planning process.



**Figure 2.1: Sequential Approach Mechanism [1].**

## 2.1 SOURCE-PATHWAY-RECEPTOR MODEL

The assessment of flood risk requires a thorough understanding of:

- The sources of flood water (e.g. intense or prolonged rainfall leading to runoff and increased flow in rivers).
- The pathways by which the flood water reaches those receptors (e.g. river channels, river and coastal floodplains, drains, sewers and overland flow).
- The people and assets affected by flooding (known as the receptors).

The Source-Pathway-Receptor (S-P-R) Model illustrated in Figure 2.2 has become widely used to assess and inform the management of environmental risks.

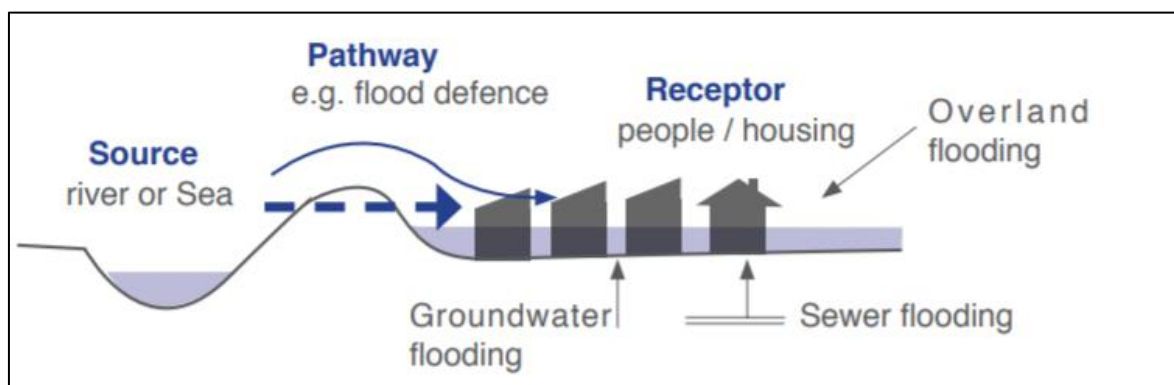


Figure 2.2: Source-Pathway- Receptor Model [1].

## 2.2 LIKELIHOOD OF FLOODING AND DEFINITION OF FLOOD ZONES

The *Guidelines for Planning Authorities* [1] define the likelihood of flooding as the percentage probability of a flood of a given magnitude occurring or being exceeded in any given year. Likelihood of flooding is expressed as a return period or annual exceedance probability (AEP).

Flood Zones are geographical areas within which the likelihood of flooding is in a particular range. They are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. These flood zones are split into three categories in the *Guidelines for Planning Authorities*.

There are three types or levels of flood zones (Figure 2.3) in accordance with the guidelines published by the OPW and DHELG in November 2009 "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" [1].



Figure 2.3. Indicative flood zone map

### 2.2.1.1 Flood Zone A

Is the zone where the probability of flooding from rivers and the sea is highest (greater than 1% AEP or 1 in 100 for river flooding or 0.5% AEP or 1 in 200 for coastal flooding).

### 2.2.1.2 Flood Zone B

Is the zone where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding);

### 2.2.1.3 Flood Zone C

Flood zone C is where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

## 2.3 CLASSIFICATION OF THE PROPOSED DEVELOPMENT AND JUSTIFICATION TEST

The *Guidelines for Planning Authorities* categorises all types of development as either:

- Highly Vulnerable (Garda stations, ambulance stations, schools, hospitals, dwelling houses, student halls...).
- Less Vulnerable (buildings used for: retail leisure, warehousing, commercial, industrial, and non-residential institutions,...).
- Water Compatible (flood control infrastructure, docks, marinas, amenity open spaces,...).

Full list of types of development and related vulnerability classes are provided in Table 3.1 of the *Guidelines for Planning Authorities*. Uses which are not listed in the table are considered on their own merits.

The Sequential Approach restricts development types to occur within the flood zone appropriate to their respective vulnerability classes. Table 2.1 identifies the types of development appropriate for each flood zone and those that will require a Justification Test.

**Table 2.1: Matrix of Vulnerability Versus Flood Zone [1].**

	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

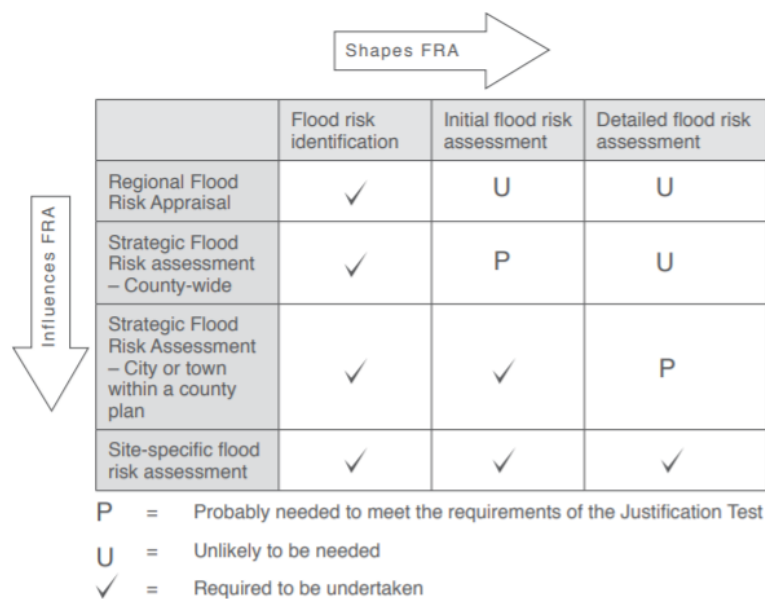
The Justification Test has been designed to rigorously assess the appropriateness of developments that are being considered in areas of moderate or high flood risk. There are two types of the Justification Test:

- The first is the Plan-making Justification Test which is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test which is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

## 2.4 FLOOD RISK ASSESSMENT STAGES

The *Guidelines for Planning Authorities* outline that a staged approach should be adopted when carrying out a SSFRA. These stages, see also Figure 2-3 below are:

- Stage 1 Flood Risk Identification.
- Stage 2 Initial Flood Risk Assessment.
- Stage 3 Detailed Flood Risk Assessment.



**Figure 2.4: Flood risk assessment stages required per scale of study undertaken [1].**



**Stage 1: Flood risk identification** – to identify whether there may be any flooding or surface water management issues relating to the proposed development site that may warrant further investigations. Flood risk identification stage uses existing information to identify whether there may be any flooding or surface water management issues related to the site. Flood risks identified in this stage are then addressed in Stage 2.

**Stage 2: Initial flood risk assessment** – to confirm sources of flooding that may affect the development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of data addressed in Stage 1. Data where the flood risk at the site is recognized as being low is screened out and it is not further addressed in the report, data which recognized the flood risk on the site to be medium or high is further analysed in the report.

**Stage 3: Detailed flood risk assessment** – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or newly developed hydraulic model which represents a wide enough area to appreciate the overall catchment-wide impacts and hydrological process involved.

### 3 Existing site conditions

The subject site is located in Borrisbeg, Co. Tipperary, Ireland. The site is located east of the N62 road and the townland of Borrisbeg and north-east of Templemore in Co. Tipperary as shown in Figure 1.1.

The site is surrounded by two main rivers – the Suir on the east and the Eastwood on the west and it is in a zone which is subject to flooding. The access to the windfarm road network is from the N62 road and the local road L7039 which are not subject to flooding.

The site itself is approximately 10.0 ha.

#### 3.1 SUBSOIL AND HYDROGEOLOGY

The soil in general vicinity of the site is predominately river alluvium and Peat with some loamy drift with limestones and coarse loamy drift. The general vicinity of the site is underlain by limestone till (Carboniferous) (TLs) and Cutover peat (Cut) with some Alluvium undifferentiated (A), Rock (Rck), Limestone sands and gravels (Carboniferous) (GLs) and Lake sediments undifferentiated (L) according to the Geological Survey of Ireland (GSI). This is show on Figure 3.1.

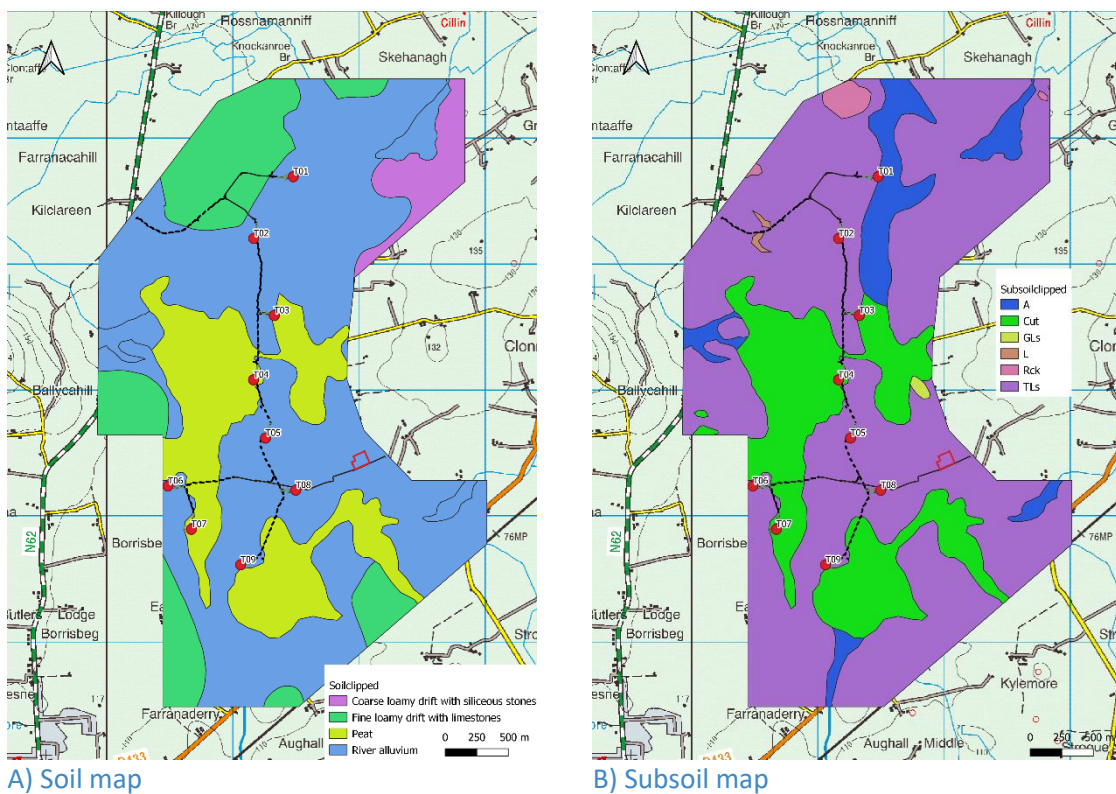


Figure 3.1 Soils Characteristics

There are no karst features located within the site. The nearest one is approximately 1 km south west in Templemore and it is classified as borehole, see Figure 3.2 below.

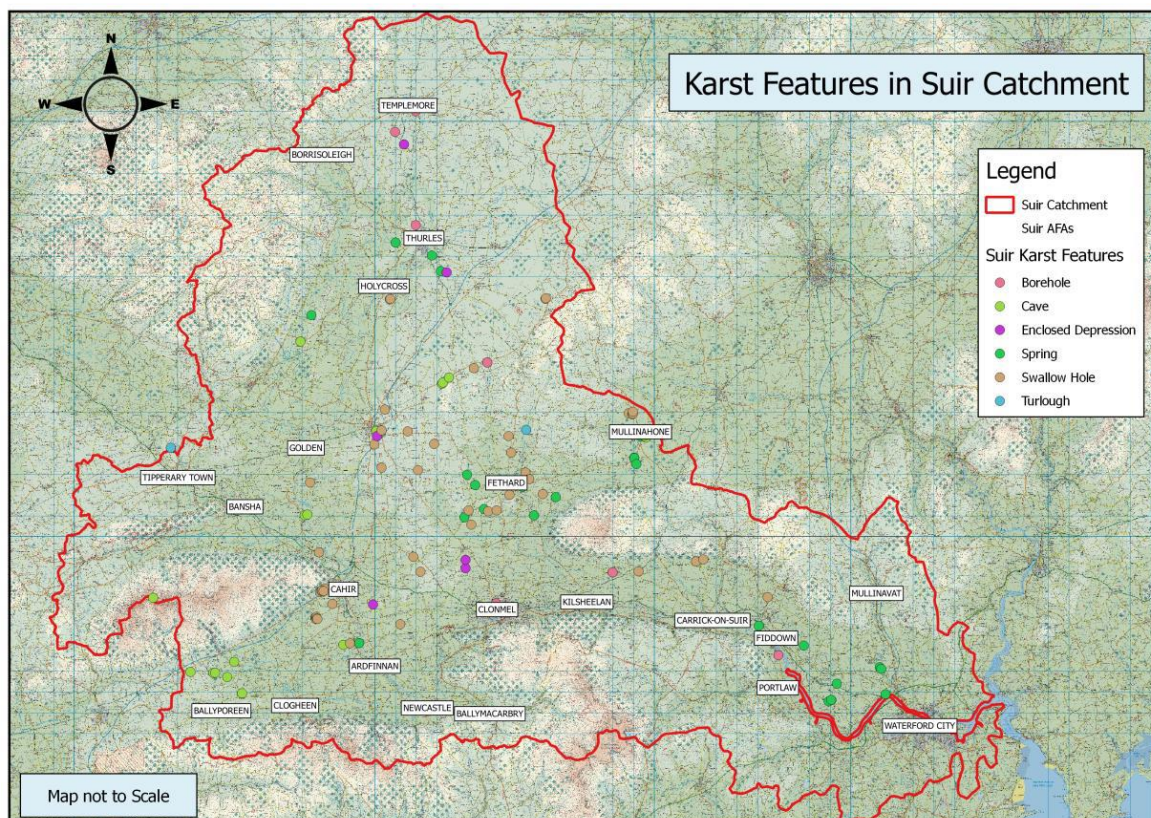


Figure 3.2. Karst features in Suir Catchment.

### 3.2 HYDROLOGICAL FEATURES

A site walkover survey was carried out in April 2022 to establish the pattern of existing drainage and to record existing hydrology features. The site has a gentle slope in a north – south direction. The surface runoff percolates underground while the excess water is collected by the River Suir, Eastwood Stream and field drains along the site. Photos associated with the site walkover are provided in Annex A. Identified hydrological features are shown on Figure 3.3.

In total 22 stream/river crossings have been identified within the site and adjacent to the site boundary and a single levee, these are marked on Figure 3.3 below. Property access culverts/bridges are marked from ‘1’ to ‘22’. Culvert/Bridge characteristics are provided in Table 3.1. The highest ground level is at the northern part of the site, 113mOD, and the lowest point is in the south-western corner of the site, 107mOD. No local low points were identified during the site walkover. Some marsh areas with surface water ponding are located at the south side of the site where the two rivers become closer and eventually the Eastwood merges with river Suir.

Table 3.1. Culvert details

No	Type	Detail
1	Culvert	12-Farm Access Culvert 600mm pipe
2	Culvert	13-N62 road bridge North 770x1000mm box old stone culvert
3	Culvert	14-Farm Access Culvert 600mm pipe
4	Culvert	15-Farm Access Culvert 600mm pipe
5	Culvert	16-Farm Access Partially collapsed old stone box culvert 850x500mm
6	Bridge	08-Single span 4m Arch Stone Road bridge L7039
7	Bridge	09-Fishing mobile metal bridge single span
8	Bridge	10-College Bridge - N62 road Two span (2m) arch stone bridge
9	Bridge	11-Farm wooden deck single span bridge
10	Bridge	17-Farm Access road concrete bridge single span c. 4m wide
11	Bridge	18-Farm Access road concrete bridge single span 2m wide
12	Bridge	19-Cattle Access metal bridge single span 3.2m wide
13	Bridge	20-Farm Access Bridge single span 2.2m wide
14	Bridge	21-Farm Access Bridge single span 3m wide
15	Bridge	22-Metal mobile bridge single span
16	Bridge	01-Knockanroe Bridge L3248 road – Three span Arch 2.3m, Beam 3m and 2.2m Arch
17	Bridge	02-Single span 6m concrete bridge Downstream of confluence with Shanakill Stream
18	Bridge	03-Farmer Crossing Single Span beam 4m wide bridge
19	Bridge	04-Farmer Crossing Single Span beam 5m wide bridge
20	Bridge	05-Site Road at the bend Single Span beam 4m wide bridge
21	Bridge	06-Metal bridge with stone abutments single span 5m wide
22	Bridge	07-Knocknageragh Bridge R433 road arch stone 7m wide span
23	Levee	Levee 0.5m high and 0.5m width

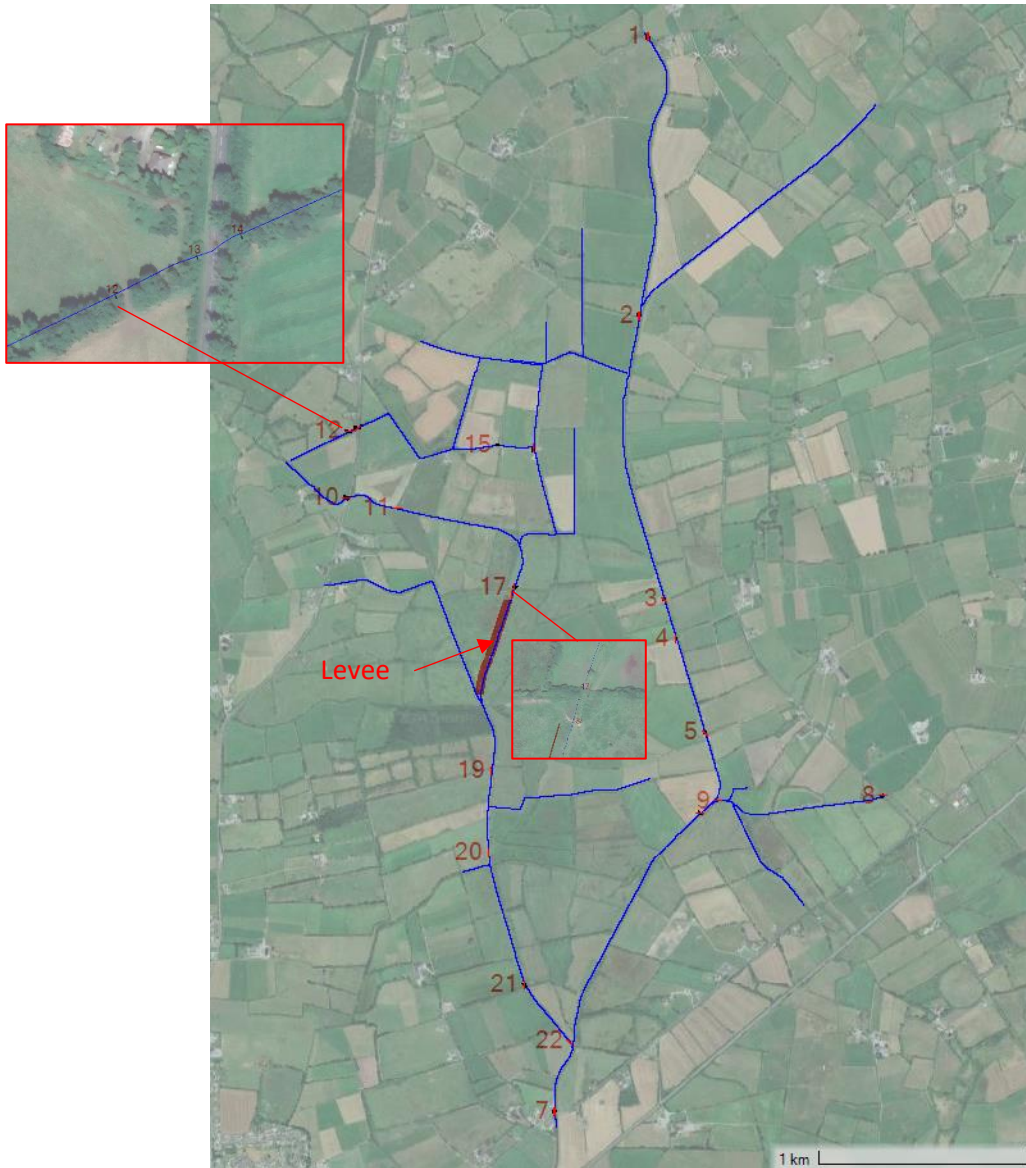


Figure 3.3. Hydrological Features

# 4 Stage 1 - Flood Risk Identification

Flood Risk Identification is the process for deciding whether a plan or project requires a Flood Risk Assessment (FRA). It is conducted in order to identify whether there are any flooding or surface water management issues related to a proposed development site that may warrant further investigation.

## 4.1 OPW HISTORIC FLOOD MAPS

Flooding around the site area was reported on 10<sup>th</sup> June 2008 and the Winter of 2015/2016 Surface Water Flooding; see blue hatch in Figure 4.1 below. Only one wind turbine (T9) is affected by this. Benefiting lands also suggest risk of flooding along the site area.

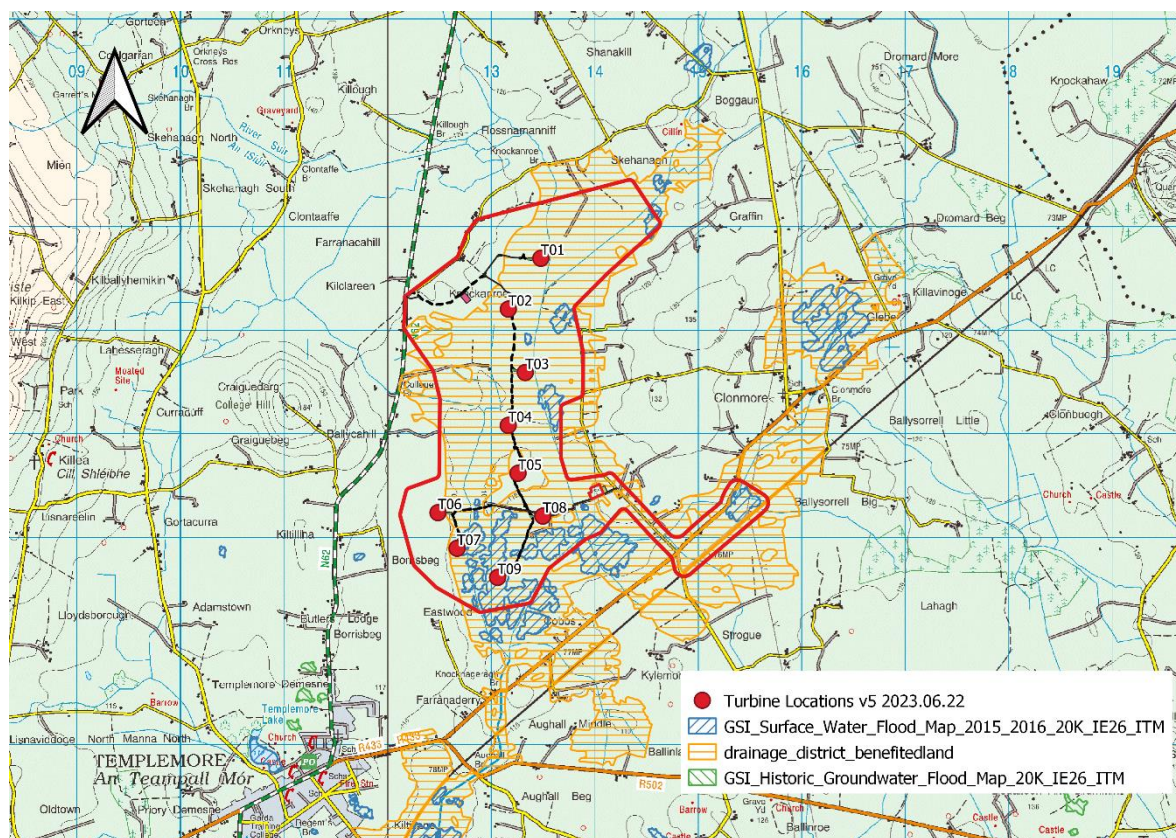


Figure 4.1. OPW flood hazard mapping [6].

The history of site flooding (10<sup>th</sup> June 2008) combined with the OPW indicative flood maps have resulted in the need for a detailed Flood Risk Assessment of the wind farm development.

## 4.2 LIKELIHOOD OF FLOODING FROM PREVIOUS STUDIES

### 4.2.1 Existing FRA

N/A

### 4.2.2 SFRA

The most recent Strategic Flood Risk Assessment (SFRA) draft plan [11] for Tipperary Co. Co does not cover the proposed site area.

### 4.2.3 Previous FRAs at national/regional, strategic and site-specific scales

No previous FRA available.

### 4.2.4 Areas for Further Assessment and Benefiting Lands

The National Catchment Flood Risk Management (CFRAM) Programme has examined the flood risk, and possible mitigation measures to address the risk in 300 communities throughout the country at potentially significant flood risk. These communities were identified through the Preliminary Flood Risk assessment (PFRA), which was a national screening assessment of flood risk. The communities recognized as being at the significant flood risk are called Areas for Further Assessment (AFA). For the AFAs a detailed hydraulic modelling has been carried out to produce indicative flood maps (CFRAM Maps).

The subject site is not directly within an AFA (Figure 4.2) and the closest AFA is AFA160238 – Templemore [13]. Templemore AFA is not included in the Suir CFRAM as the OPW is to implement a Flood Relief Scheme [14].

The proposed site is under the OPW Maintenance of Arterial Drainage Scheme (see Annex F). The proposed wind farm is located adjacent to the River Suir and is in a zone which is subject to flooding. Indicative flood maps (Figure 4.2) produced by the OPW are available for the site and these show flooding potential at a number of locations throughout the site as shown below. The Local Authority is charged with responsibility to maintain Drainage Districts. According to the OPW database, the site drains are part of the drainage district.

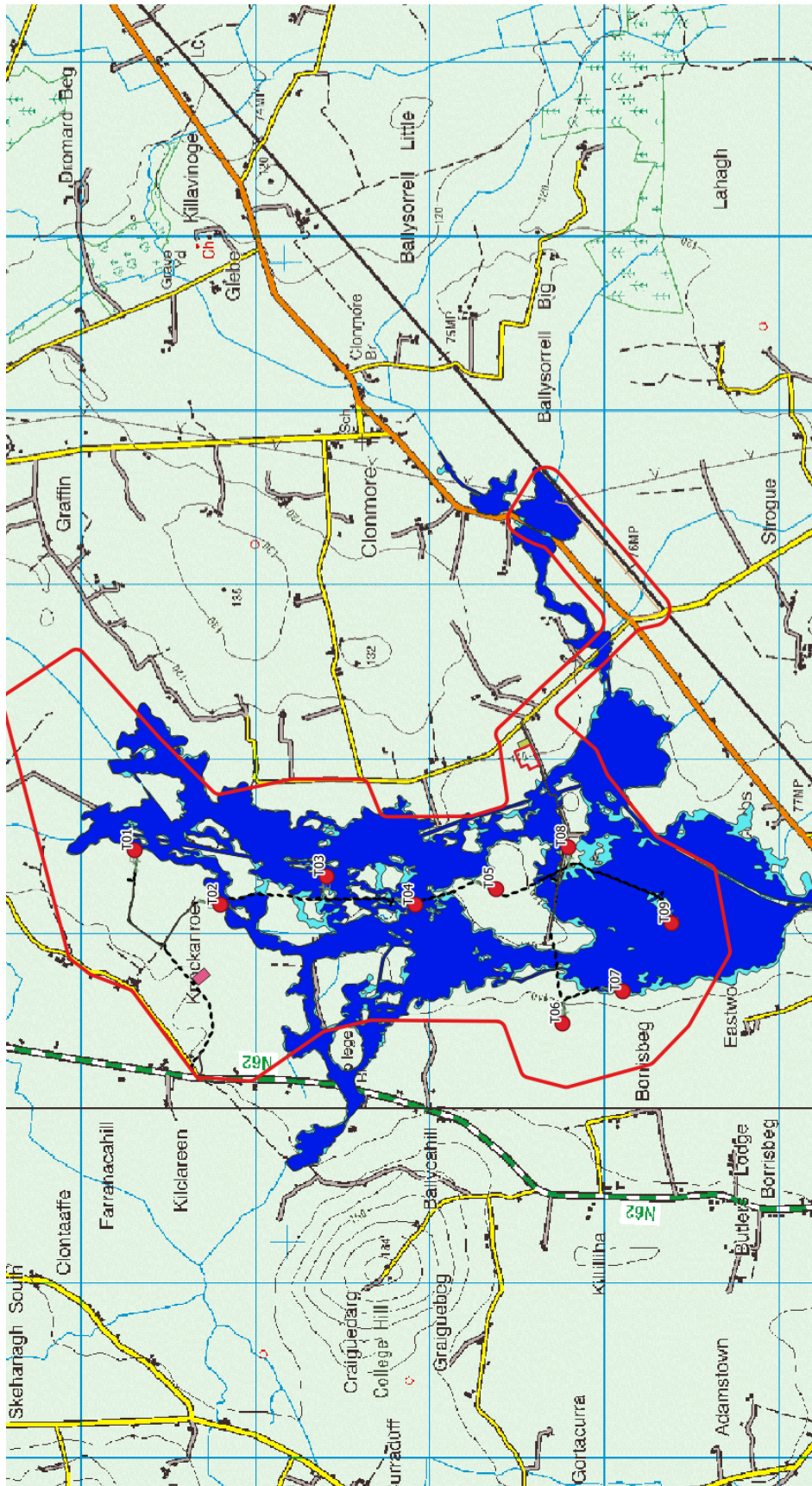


Figure 4.2. Indicative Flood Maps (floodinfo.ie)



## 4.3 SOURCES OF FLOODING

### 4.3.1 Fluvial flooding

Fluvial flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted and excess water spills out from the channel onto the floodplain.

According to the OPW historical flood maps (Figure 4.1) and indicative flood maps (Figure 4.2) there are clear indications that the site is located in both flood zones A and B. For OPW historical flood maps (Figure 4.1), only T09 is affected, while indicative flood maps (Figure 4.2) suggest that turbines T03, T04, T07 and T09 are affected.

It is concluded that any flooding risk from the River Suir on the east and the River Eastwood on the west has to be addressed with mitigation measures.

#### 4.3.1.1 CFRAM and NIF Maps

Although the CFRAM Fluvial Mapping does not show the site being vulnerable to fluvial flooding, this is most probably because the site area was not included in CFRAM detailed maps at the time of writing of this report. The site is only partially included in CFRAM Fluvial mapping as per Figure 4.3 below. However, the National Indicative Fluvial (NIF) mapping (Figure 4.4) shows that the site is within 1% and 0.1% AEP flood zones.

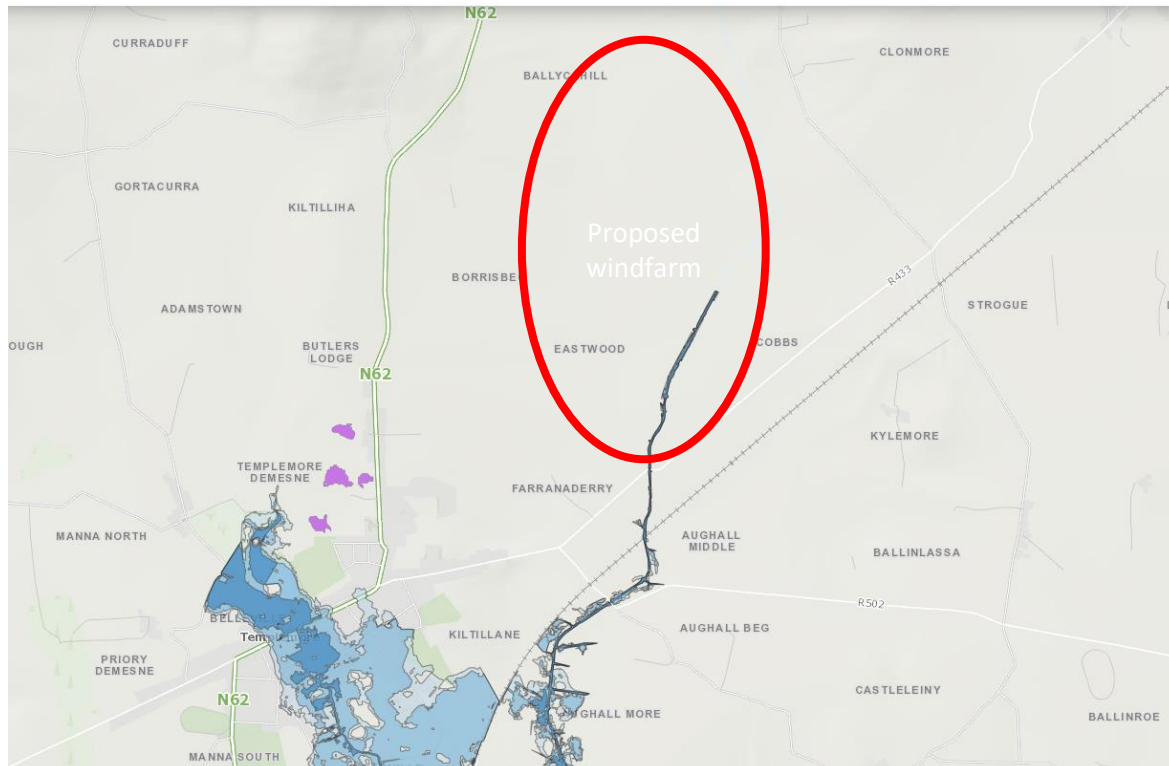


Figure 4.3. CFRAM Fluvial flood extent for 1% and 0.1% AEP (source: [www.floodinfo.ie](http://www.floodinfo.ie)).

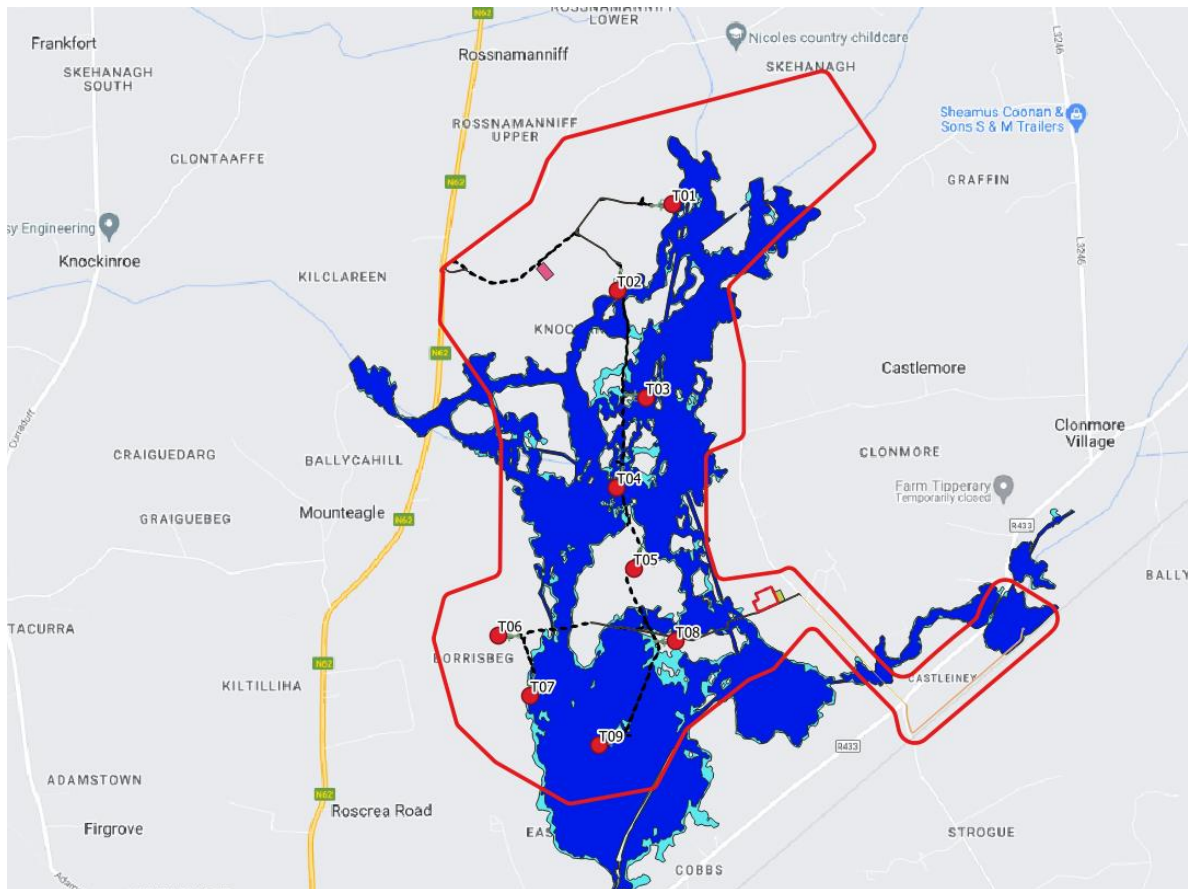


Figure 4.4. NIF Fluvial flood extent for 1% and 0.1% AEP (source: [www.floodinfo.ie](http://www.floodinfo.ie)).

#### 4.3.1.2 County Development Plan

Apart from zoning within the Renewable Energy Strategy of Tipperary County Development Plan [11], the site is not within zoning of County Development Plan, see Annex F and Annex G.

#### 4.3.2 Coastal flooding

Coastal flooding which is caused by higher sea levels than normal, largely as a result of storm surges combined with high tides resulting in the sea inundating the land. Coastal flooding is influenced by the following three factors, which often work in combination: High tide levels i.e. Highest Astronomical Tide (HAT) combined with storm surges caused by low barometric pressure exacerbated by high winds and wave action which is dependent on wind speed and direction, local topography and exposure.

River(s) are not tidal around the subject site and the site is not prone to wave action due to its geographical location.

The ground levels within the site varies between 107.0mOD and 113.0mOD. **The site at no risk of coastal flooding.**

### 4.3.3 Pluvial flooding

Pluvial flood risk has been assessed using CFRAM PFRA maps (floodinfo.ie) and findings from the site visit. According to PFRA maps the subject site is not vulnerable to pluvial flooding.

The drainage of surrounding lands was noted at the time of the site visit. The site is predominately covered with grass and has a gentle slope towards the drainage channels that ensure drainage of fields into the Rivers Suir and Eastwood.

It should be noted that all proposed developments must limit the surface runoff to the greenfield rate (pre-development rate) so as not to increase the flood risk downstream of the site. The site visit in April 2022 confirmed some pluvial flooding (water ponding) at the south end of the site between the rivers Suir and Eastwood. The water table is very high and a large portion of land is marshy with no depressions.

The Winter 2015/2016 Surface Water Flooding map from GSI Groundwater Flooding Data Viewer data show fluvial (rivers) and pluvial (rain) floods in Ireland during the 2015/2016 flood event and indicate possible Pluvial / overland flooding at the site (Figure 4.5). This flooding is predominately evident at the south end of the site between the two rivers (Eastwood and Suir) where the Eastwood river meets the Suir. This ponding and very wet soil conditions were evident during the site visit. The depth of water is very low (<0.1m) and this would not cause flooding of the extended wind farm road network or turbine hard stands. This ponding influences soil conditions and makes foundation condition for turbine hardstands more challenging for design rather than posing a flood concern.

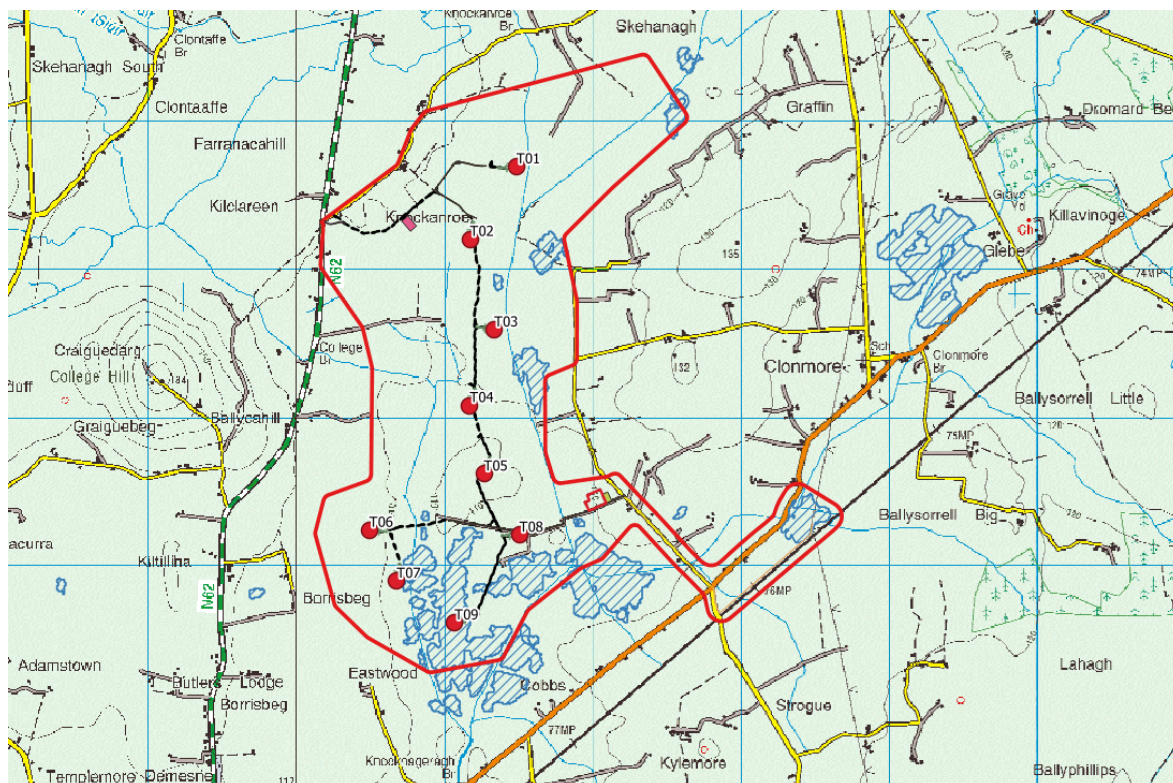


Figure 4.5. The GSI Winter 2015/2016 Surface Water Flooding map.

#### 4.3.4 Overland flooding

Overland flooding occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows and low-lying areas or behind obstructions.

Drainage channels of the surrounding fields are in operation to intercept overland flooding. Overland flooding, e.g. surface water is associated with pluvial flooding, see section above.

#### 4.3.5 Groundwater flooding

Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded.

The terrain configuration at the site is flat and with a low slope in north to south direction (see Figure 5.6 and Figure 6.1). The subsoil at the site has lower permeability as it is underlain with Limestone till (Carboniferous) (TLs) and Cutover peat (Cut) with some more permeable Alluvium undifferentiated (A), see Figure 3.1. There are no notable ponds, depressions or karst features at the site (Figure 3.2).

GSI Groundwater flooding probability maps (Green hatch in Figure 4.1) show no risk to groundwater flooding at the site.

#### 4.3.6 Flooding from artificial drainage systems

Flooding from artificial drainage systems results when flow entering a system, such as an urban storm water drainage system, exceeds its discharge capacity, the system becomes blocked, and/or cannot discharge due to a high water level in the receiving watercourse.

There several surface drainage channels within the proposed development site. The drainage channels have crossings that could be blocked or backwater could occur due to fluvial flooding of the rivers Suir and Eastwood. Therefore, the risk from drainage channel systems is linked to the fluvial flooding risk. The site falls within OPW Maintenance of Arterial Drainage Scheme. The risk of flooding from artificial drainage systems is low and is subject to maintenance under OPW jurisdiction (Figure 4.6). The Local Authority is charged with responsibility to maintain Drainage Districts. The measures prescribed by the OPW to mitigate flood risk are as follows:

- Sustainable Planning and Development Management
- Sustainable Urban Drainage Systems (SUDS)
- Adaptation Planning
- Land Use Management and Natural Flood Risk Management
- Maintenance of Channels not part of a Scheme
- Flood Forecasting and Warning
- Emergency Response Planning
- Promotion of Individual and Community Resilience
- Individual Property Protection
- Flood-Related Data Collection
- Voluntary Home Relocation

This measures are elaborated in Annex F. The local authorities have a statutory duty to maintain the Drainage Districts, and this Plan does not amend these responsibilities to provide additional flood relief.

Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at [www.flooding.ie](http://www.flooding.ie).

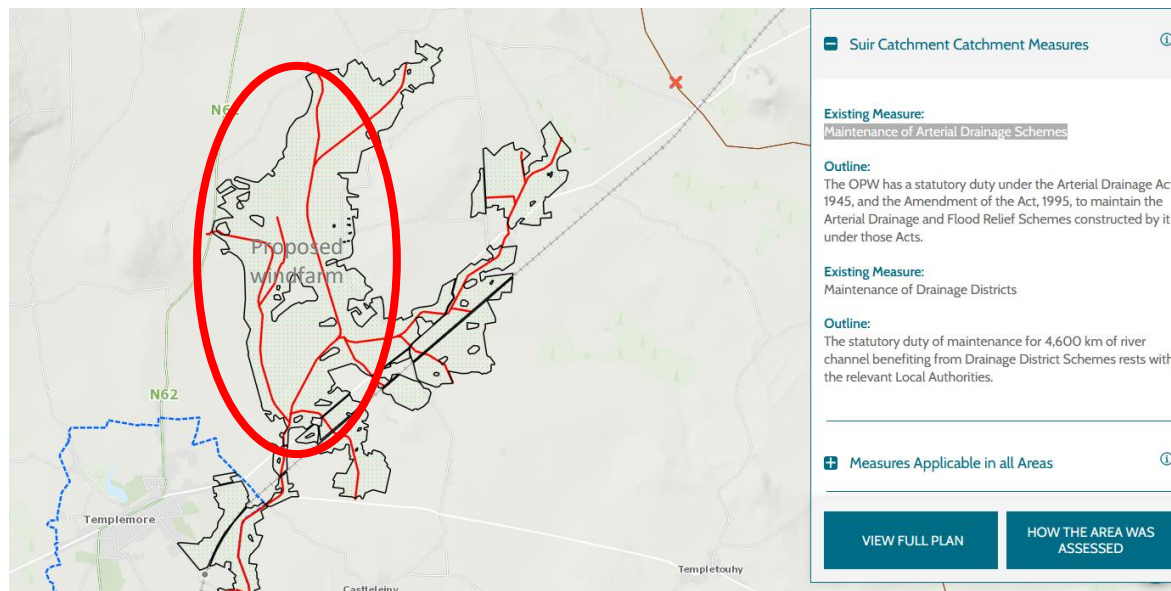


Figure 4.6. OPW Maintenance of Arterial Drainage Scheme ([www.floodinfo.ie](http://www.floodinfo.ie)).

### 4.3.7 Flooding arising from the failure of infrastructure

Flooding arising from the failure of infrastructure designed to store or carry water is a less frequent form of flooding. This type of flooding could occur due to e.g. a dam breach, a leaking canal, or a breach of flood protection measures (e.g. breach of a flood defence, failure of a non-return valve, pumping station or the blockage of a pipe or culvert).

There are no flood protection measures, e.g. dams or canals located at or near the proposed development site. A small levee is constructed along the right bank of the Eastwood stream (west side of the site – see Figure 3.3) and a very short levee at the left bank of the Suir at the south end of the site. The levee at the Eastwood stream is very low so there is low risk of failure and the levee at the Suir is wide, but short and acts more like high ground than a levee when flooding occurs. The presence of trees indicates relative stability of the river bank. Flooding arising from the failure of infrastructure is assessed to be low.

## 4.4 OTHER SOURCES

### 4.4.1 Flow gauge information

There are no gauging stations within the subject site. Station gauge No 16004 - Thurles on the River Suir has 49 years of recorded data from 1954 to 2006. The flood flows based on the Annual Maxima series were analysed in section 5.2.3.1.

#### 4.4.2 Local embankments

See section 4.3.7.

### 4.5 SOURCE-PATHWAY-RECEPTOR MODEL AND DEVELOPMENT CLASSIFICATION

A Source-Pathway-Receptor (SPR) model, see Table 4.1 summarizes the possible sources of floodwater, the receptors that maybe affected by potential flooding and the pathways by which flood water may reach the receptors. These sources, pathways and receptors will be assessed further in the Stage 2- Initial flood risk assessment

**Table 4.1: Source-Pathway-Receptor Analysis**

Source	Pathway	Receptor	Flood Risk?
<b>Tidal/Coastal</b>	Flood defence (Banks)	Proposed site	No
<b>Fluvial</b>	River Suir, River Eastwood and drainage canals	Proposed site	Yes
<b>Pluvial</b>	Increased runoff from developed site increasing flood levels	Proposed site	No
<b>Groundwater (GW) flooding</b>	Rising GW level on the site	Proposed site	No

The major flood risk at the site is from Fluvial flooding.

#### 4.5.1 Mitigation measures

Proposed turbine hard stands should be constructed with finished ground level at such a height greater or equal than:

$$H_{1000} \text{ (0.1\% AEP water levels) } + 0.5\text{m (freeboard)}$$

Planned road networks within the wind farm should include only widening of existing farm tracks and new access road routes should be constructed to finish surface levels of the existing adjacent floodplain in order to exclude the possibility of water backup due to blockage of existing flood flow paths within the floodplains. Crossings of the River Suir and River Eastwood should be subject to OPW Section 50 approval.

## 5 Stage 2 - Initial flood risk assessment

### 5.1 INTRODUCTION

The purpose of the initial scoping flood risk assessment is to ensure that the relevant flood risk issues are identified so that they can be addressed appropriately in the Flood Risk Assessment (FRA). The scoping phase included:

- Confirmation of sources of flooding that may affect a plan area
- An appraisal of the availability and adequacy of existing information
- Scope of possible mitigation measures

The previously conducted screening process implies that a development proposal is at risk from fluvial (river) flooding. It was concluded that the development site is at low risk of flooding from artificial drainage systems and groundwater flooding, and therefore these flood mechanisms were excluded from further investigation.

#### 5.1.1 Methodology

In order to assess the existing flooding risks associated with the development proposal, an unsteady 1D/2D computer based hydrological/hydraulic model study was carried out. The 2D model component covers an area of 10km<sup>2</sup>. The 1D model covers river reaches of c.16km, defined by 564 cross-sections and 25 bridges/culverts (the Existing River System model contains 22 bridges). The assessment also involves a hydrological analysis to determine a design flood flow.

The detailed assessment involved the following:

1. A hydrological analysis to determine the magnitude of the mean annual flood  $Q_m$ , 100-year and the 1000-year at defined HEP points.
2. Site visits to determine the extent of the river reach to be modelled based on detailed river and flood plain survey data.
3. Collection of additional survey data to develop DEM of selected river reach.
4. Computer model simulation to determine existing flood levels at the site for the design flow for the existing river and floodplain.

## 5.2 HYDROLOGY

The river flood risk is assessed on the basis of a 100-year (1% AEP) and 1000-year (0.1% AEP) flood flow hydrographs. The calculation of the design flow involved the use of the Office of Public Works Flood Studies Update (FSU) Programme<sup>2</sup> [15-18]. The FSU calculation reports are shown in Annex J. Median annual maximum flood  $Q_m$  at ungauged sites is estimated from seven catchment descriptors:

AREA, S1085, BFISOIL, SAAR, FARL, DRAIN, ARTDRAIN2.

In accordance with the OPW guidelines on hydrology, appropriate hydrological methods were used in the determination of the design peak flow which reflected the size of the catchment and the availability of river flow data in the vicinity of the wind farm site. The generation of a design flood hydrograph was necessary since we are investigating hydrological system storage effects caused by the infrastructure of the windfarm.

The following hydrological methods used for calculation of design flow rates are as follows:

- Flood Frequency Analysis from observed data
- Flood Studies Update – FSU [15].

### 5.2.1 Catchment Area

The calculation of the total catchment area at the downstream end of the model is 95.963km<sup>2</sup>, see Figure 5.1. The effective contributing catchment area is calculated as:

Catchment area,  $A$ , = 95.963km<sup>2</sup>.

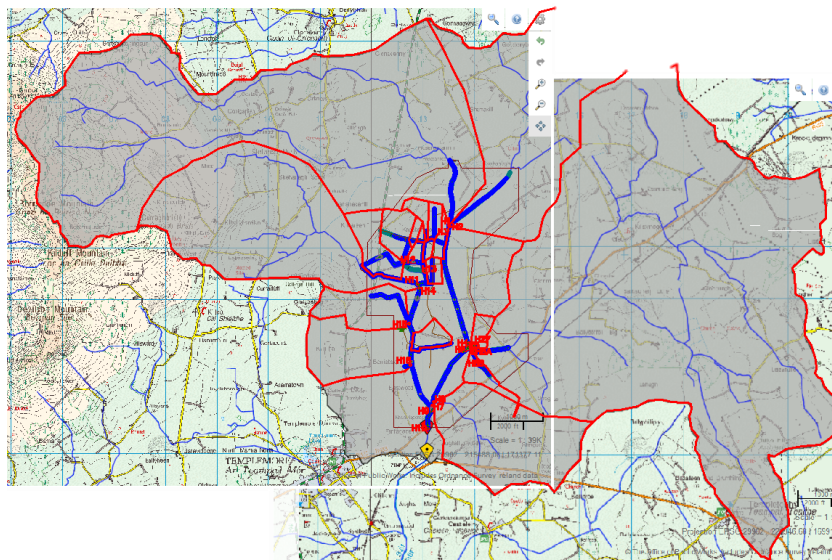


Figure 5.1. Catchment area delineation for all HEPs.

<sup>2</sup> Office of Public Works, Flood Studies Update, Technical Research Report, Volumes I-IV, 2014.



## 5.2.2 Hydrological Estimation Points - HEPs

As stated in the Section above, the FRA requires a high resolution hydrological analysis due to the fact that the OPW Indicative flood maps show flooding. The hydrological model for the wind farm site therefore is complex involving the combination of a number of tributaries and drainage channels.

Each of the tributaries is hydrologically assessed separately and the runoff is calculated for a set of Hydrological Estimation Points (HEPs). The locations of the HEPs are shown in Figure 5.2 below. The breakdown of the contributing catchment areas for each HEP is given in the Table 5.1 below.

**Table 5.1. Contributing catchment area for each HEP**

Catchment area [km <sup>2</sup> ]							
H1	H2	H3	H4	H5A	H5B	H6	H7
22.243	11.911	34.877	37.089	35.253	0.332	72.495	77.438
H8	H9	H10	H11	H12	H13	H14	H15
3.987	95.450	95.619	8.439	1.318	2.588	11.230	1.219
H16	H17	H18	H19	H20	H21	H22	H23
2.005	0.288	0.141	0.157	0.170	0.179	0.035	0
H24	H25	H26	H27				
0.591	0.383	0.026	0.212				

Selected: 'Existing'

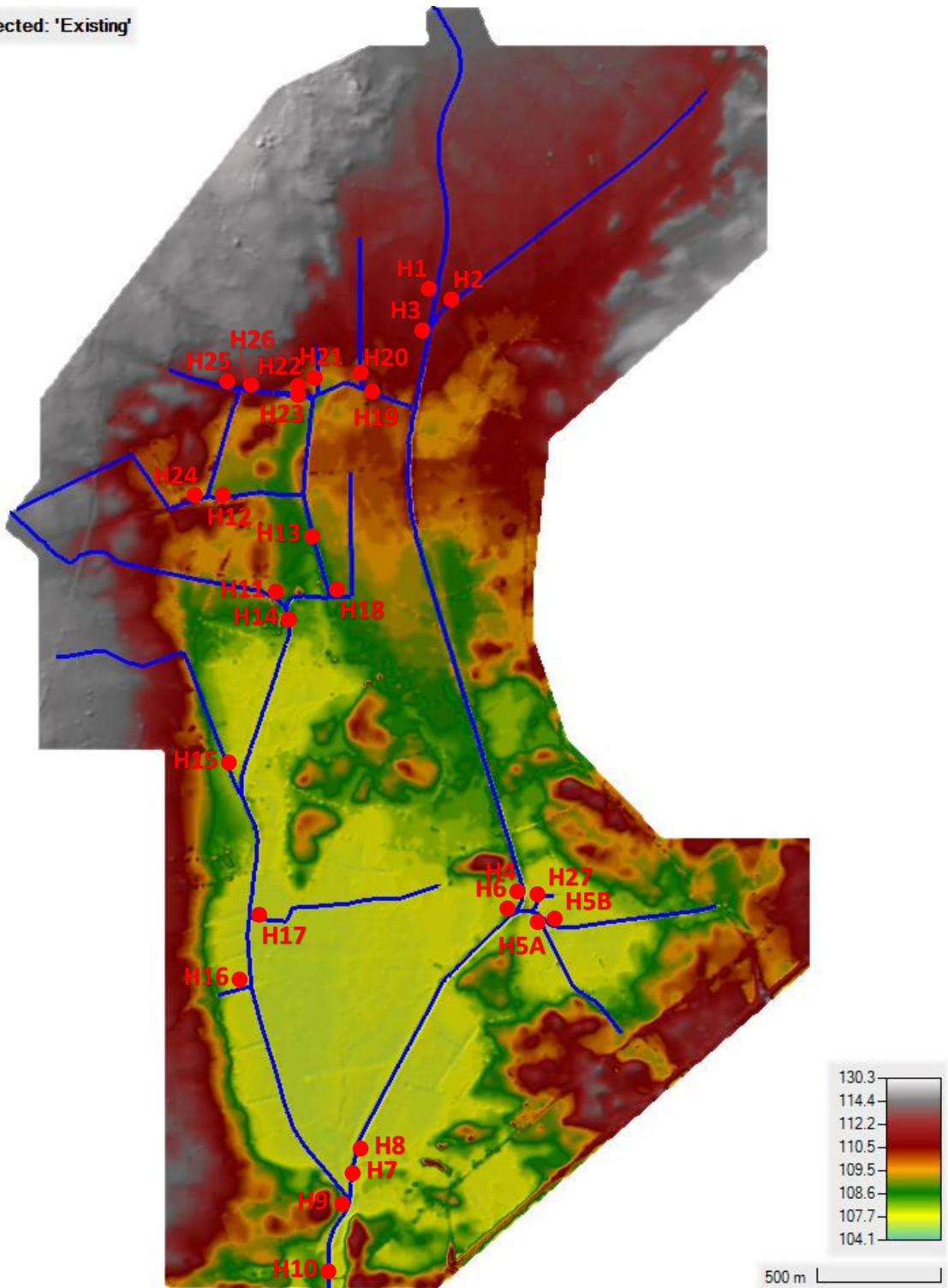


Figure 5.2. Location of HEPs.

## 5.2.3 Design Flow Rates

### 5.2.3.1 Flood Frequency Analysis from observed data

#### 5.2.3.1.1 Input data for gauge No 16004 - Thurles

The relevant gauging station for the River Suir is located just upstream of Thurles. The gauge is owned, monitored and maintained by OPW. The gauge has provided water level and flow rate records since 1954 (49 years of Amax series flow records was available for the analysis). The gauging point has a catchment area of 228.74km<sup>2</sup>. The catchment characteristics are shown in Table 5.2. The Amax Series from 1954 to 2002 is shown below.

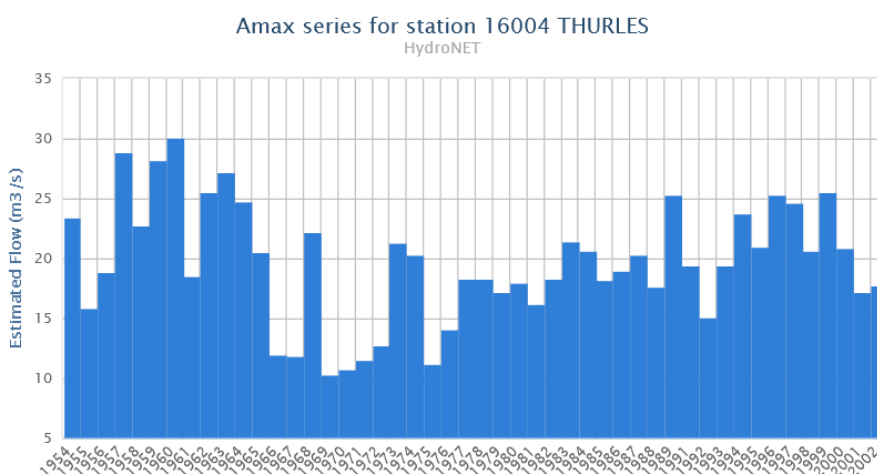


Figure 5.3. Amax series for OPW gauge No 16004 – Thurles on Suir.

Table 5.2. Catchment characteristics for gauge 16004 on Suir, Thurles.

Contributing Catchment Area	228.7432 km <sup>2</sup>
BFISOIL	0.5786
SAAR	941.36 mm
FARL	1
DRAIND	0.915 km/km <sup>2</sup>
S1085	1.7914 m/km
ARTDRAIN2	0
URBEXT	0.0109
Centroid distance	7.6626 km
Hydrological similarity	0.7169
QMED <sub>rural</sub> values and confidence	
Pivotal gauged	19.43m <sup>3</sup> /s
Pivotal PCD rural	27.5153m <sup>3</sup> /s
Pivotal PCD urban	27.9609m <sup>3</sup> /s
Subject PCD estimate	16.6089m <sup>3</sup> /s
68% upper bound	22.7542m <sup>3</sup> /s
68% lower bound	12.1233m <sup>3</sup> /s
95% upper bound	31.1733m <sup>3</sup> /s
95% lower bound	8.8491m <sup>3</sup> /s

### 5.2.3.1.2 CFRAMS design flows for gauge No 16004 - Thurles

OPW CFRAMS study data are available. (The OPW conducted a Flood Frequency Analysis for Thurles station and their results gave a similar value of  $Q_{100} = 35.64\text{m}^3/\text{s}$ ). The design flows from CFRAMS are shown in Table 3 below.

**Table 5.3. Flood Frequency analysis for Station 16004 – Thurles.**

AEP	16004
50%	20.72
20%	25.28
10%	27.97
5%	30.46
2%	33.36
1%	35.64
0.50%	37.71
0.10%	42.48

In addition to CFRAMS analysis [15], an independent statistical analysis of Amax series was conducted as part of this report. This is elaborated in the following section.

### 5.2.3.1.3 Flood frequency analysis from Amax series at gauge 16004 – Thurles

A Flood Frequency Analysis was conducted at station 16004 – Thurles for 49 years flood record (Figure 5.3) using four theoretical distributions: Gauss, Gumbel, Pearson III, Log Pearson III and Galton. Theoretical distributions were compared to the empirical distributions (Chegodajev and Hazen).

Log Pearson III distribution showed the best fit (see Figure 5.4) and was selected for the flow rate analysis for the site.

Table 5.4. Flow frequency for gauge No 16004 Thurles.

Flow rates Q [m <sup>3</sup> /s]						
Return Period [Years]	AEP [%]	Gauss	Gumbel	Pearson III	Log Pearson III	Galton
1000	0.10%	34.8	43.8	34.7	<b>35.5</b>	43.7
100	1.00%	31.0	35.0	31.0	<b>31.8</b>	35.6
50	2.00%	29.7	32.3	29.7	<b>30.4</b>	33.1
30	3.33%	28.6	30.4	28.6	<b>29.2</b>	31.2
25	4.00%	28.2	29.6	28.2	<b>28.8</b>	30.5
20	5.00%	27.7	28.8	27.7	<b>28.2</b>	29.6
10	10.00%	25.9	26.0	25.9	<b>26.3</b>	26.8
5	20.00%	23.8	23.2	23.8	<b>23.9</b>	23.8
2	50.00%	19.7	18.9	19.7	<b>19.5</b>	19.0
1.5	66.67%	17.6	17.1	17.6	<b>17.3</b>	16.9
1.25	80.00%	15.5	15.6	15.5	<b>15.3</b>	15.1

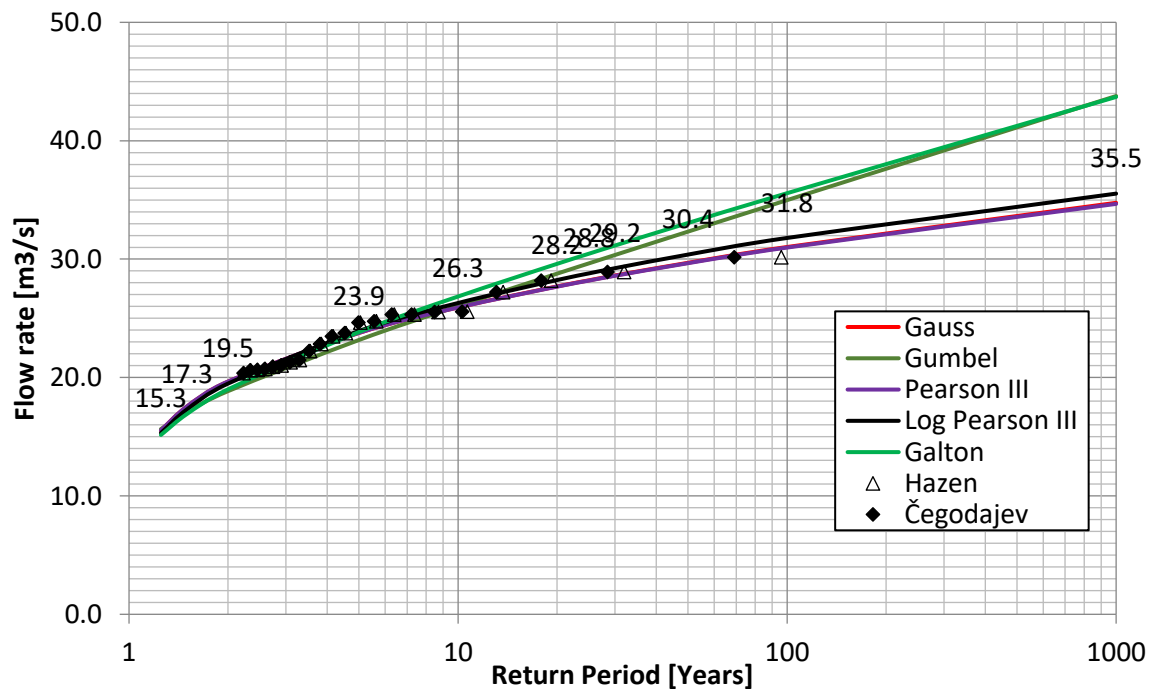


Figure 5.4. Flood Frequency analysis for the EPA [3] gauge No 16004 Thurles.

### 5.2.3.1.4 Adjusting 100-year flood for the proposed site

The flood frequency analysis showed the best fit for the Log Pearson III distribution (see Figure 9). The flood flows obtained for Log Pearson III distribution will be factorised to fit the location of the proposed bridge PC1 based on the catchment area.

The EPA gauge in Thurles has a catchment area of 228.7432km<sup>2</sup> and the bridge location for the site HEP east of Templemore has a contributing catchment area of 95.963km<sup>2</sup>. This means that all flows from the above flood frequency analysis should be factored with the following catchment area downscaling factor:

$$C_{\text{AREA}} = 95.963 / 228.7432 = \mathbf{0.419522854}.$$

**Table 5.5. Adjustment of flow rates for the proposed bridge location (factor 0.419522854 used).**

Flow rates Q [m <sup>3</sup> /s]			
Return Period [Years]	AEP [%]	Gauge No 16004 Location	Proposed Bridge Location
1000	0.10%	35.53	14.91
100	1.00%	31.79	13.34
50	2.00%	30.39	12.75
30	3.33%	29.23	12.26
25	4.00%	28.80	12.08
20	5.00%	28.23	11.85
10	10.00%	26.29	11.03
5	20.00%	23.93	10.04
2	50.00%	19.49	8.18
1.5	66.67%	17.31	7.26
1.25	80.00%	15.32	6.43

After the Climate Change Factor of 1.2 is applied;

**the frequency analysis gained 1% AEP flow of  $Q_{100cc} = 16.01\text{m}^3/\text{s}$ .**

The design  $Q_{100cc}$  flows for all HEPs is shown in table below. Using similar downscaling factors the HEPs' flow rates were calculated as given in the table below.

**Table 5.6. Flood Frequency Analysis flows for HEPs –  $Q_{100cc}$ .**

Factorised Flow rates [m <sup>3</sup> /s]							
H1	H2	H3	H4	H5A	H5B	H6	H7
3.71	1.99	5.82	6.19	5.88	0.06	12.09	12.91
H8	H9	H10	H11	H12	H13	H14	H15
0.66	15.92	15.95	1.41	0.22	0.43	1.87	0.20
H16	H17	H18	H19	H20	H21	H22	H23
0.33	0.05	0.02	0.03	0.03	0.03	0.01	0.00
H24	H25	H26	H27				
0.10	0.06	0.00	0.04				

### 5.2.3.2 Flood Study Update

The catchment of the selected subject site has an area of more than 95km<sup>2</sup> which is above the FSU minimum threshold and is ideally suited for this catchment.

The FSU Catchment characteristic approach was used to determine Q<sub>med</sub> values. The OPW online tool was used to determine BFISOIL, SAAR, FARL, DRAIN, ARTDRAIN2 and URBEXT, see table below and [Annex K](#).

There site area is rural. Q<sub>med</sub> = 11.45 (2-year flood flow) was calculated based using equation below. A Climate Change factor of 1.20 is applied to the Q<sub>med</sub>.

$$Q_{med} = 1.237 \times 10^{-5} AREA^{0.937} BFISOil^{-0.922} SAAR^{1.306} FARL^{2.217} DRAIN^{0.341} S1085^{0.185} (1+ARTDRAIN2)^{0.408} \quad (2.2)$$

$$Q_{med,urb} = Q_{med} \times (1+URBEXT)^{1.4825} \quad (2.3)$$

**Table 5.7. FSU Input parameters**

Contributing Catchment Area	<i>see Table 1</i>	km <sup>2</sup>
BFISOIL	0.5536	
SAAR	935.05	mm
FARL	1	
DRAIN	0.951	km/km <sup>2</sup>
S <sub>1085</sub>	7.4615	m/km
ARTDRAIN2	0.00	
URBEXT	0.0036	
<b>Q<sub>MED</sub> values</b>		
Q <sub>med</sub> (without factors)	16.61	m <sup>3</sup> /s

The Pivotal site adjustment factor was not used as the flows without adjustment are more conservative. The EV1 distribution yielded the Growth factors as shown in Table 5.8 below.

**Table 5.8. Growth factors from FSU analysis.**

Return Period [years]	Growth factors [1]
2	1
5	1.33
10	1.52
50	1.93
100	2.09
200	2.26
1000	2.64

The FSU Method was applied to the HEPs as shown in Table 5.9 below:

Table 5.9. FSU design flows.

			Q <sub>med</sub>	Q <sub>med,urb</sub>	t=2	t=5	t=10	t=50	t=100	t=200	MRFS t=100 + 20% CC	t=1000	MRFS t=1000 + 20% CC
Growth Factors			1.00	1.00	1.00	1.33	1.52	1.93	2.09	2.26	2.508	2.64	3.17
F.S.E.			-	-	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37
HEP	HEC- RAS	Area [km <sup>2</sup> ]	Flow rates [m <sup>3</sup> /s]										
H1	17	22.243	3.10	3.12	4.27	5.68	6.49	8.24	8.92	9.65	10.70	11.27	13.52
H2	16	11.911	1.73	1.74	2.38	3.16	3.61	4.59	4.97	5.37	5.96	6.28	7.54
H3	18	34.877	4.72	4.75	6.51	8.65	9.89	12.56	13.60	14.70	16.32	17.17	20.60
H4	-	37.089	5.00	5.03	6.89	9.17	10.47	13.30	14.40	15.57	17.28	18.19	21.83
H5a	3	35.253	4.77	4.80	6.57	8.74	9.99	12.68	13.73	14.85	16.48	17.35	20.82
H5b	6	0.332	0.06	0.06	0.08	0.11	0.13	0.16	0.17	0.19	0.21	0.22	0.26
H6	19	72.495	9.38	9.43	12.91	17.17	19.63	24.92	26.99	29.18	32.38	34.09	40.91
H7	-	77.438	9.97	10.03	13.74	18.27	20.88	26.51	28.71	31.04	34.45	36.26	43.51
H8	20	3.987	0.62	0.62	0.85	1.13	1.30	1.65	1.78	1.93	2.14	2.25	2.70
H9	-	95.450	12.13	12.20	16.71	22.22	25.40	32.25	34.92	37.76	41.91	44.11	52.93
H10	-	95.619	12.15	12.22	16.74	22.26	25.44	32.30	34.98	37.82	41.98	44.18	53.02
H11	7	8.439	1.25	1.26	1.72	2.29	2.62	3.32	3.60	3.89	4.32	4.54	5.45
H12	14	1.318	0.22	0.22	0.30	0.40	0.46	0.58	0.63	0.68	0.76	0.80	0.96
H13	-	2.588	0.41	0.42	0.57	0.76	0.87	1.10	1.20	1.29	1.43	1.51	1.81
H14	-	11.230	1.63	1.65	2.26	3.01	3.44	4.37	4.73	5.11	5.67	5.97	7.16
H15	1	1.219	0.20	0.21	0.28	0.38	0.43	0.55	0.59	0.64	0.71	0.75	0.90
H16	2	2.005	0.33	0.33	0.45	0.60	0.68	0.87	0.94	1.02	1.13	1.19	1.43
H17	4	0.288	0.05	0.05	0.07	0.10	0.11	0.14	0.15	0.17	0.18	0.19	0.23
H18	5	0.141	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.12
H19	8	0.157	0.03	0.03	0.04	0.06	0.06	0.08	0.09	0.09	0.10	0.11	0.13
H20	9	0.170	0.03	0.03	0.04	0.06	0.07	0.09	0.09	0.10	0.11	0.12	0.14
H21	10	0.179	0.03	0.03	0.05	0.06	0.07	0.09	0.10	0.11	0.12	0.12	0.14
H22	11	0.035	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04
H23	12	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H24	13	0.591	0.10	0.10	0.14	0.19	0.22	0.28	0.30	0.32	0.36	0.38	0.46
H25	14	0.383	0.07	0.07	0.10	0.13	0.15	0.18	0.20	0.22	0.24	0.25	0.30
H26	15	0.026	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
H27	22	0.212	0.04	0.04	0.05	0.07	0.08	0.11	0.11	0.12	0.14	0.14	0.17

These flows were further processed for suitable form for hydraulic model input (see Table 5.12).



### 5.2.3.3 Hydrology – Summary

The catchment area was calculated to be 95km<sup>2</sup>.

The River Suir has a recording gauge at Thurles (EPA gauge 16004 - Thurles). A detailed Flood Frequency Analysis was conducted based on the 49 years of records. Based on the catchment area, the flow obtained from Flood Frequency Analysis was applied to the wind farm site.

In addition, FSU approach was used to determine  $Q_{med}$ ,  $Q_{100}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  flood flows.

The Flood frequency analysis of the observed data at Thurles station No 16004 is suggesting >50% lower flood flows when compared to FSU approach at the location of wind farm. To remain conservative, FSU approach was used. The design flows are shown in Table 5.11.

It should be noted that some of the sub-catchments have catchment area less than 25km<sup>2</sup>, thus input flow hydrographs are set to peak at the same time. This adds additional safety factor and implies that input flood flows flood maps are conservative.

**Table 5.10. Summary table comparing design  $Q_{100cc}$  flows.**

HEP	HEC-RAS node	Area [km <sup>2</sup> ]	FFA (observations) [m <sup>3</sup> /s]	FSU [m <sup>3</sup> /s]	HEP	HEC-RAS node	Area [km <sup>2</sup> ]	FFA (observations) [m <sup>3</sup> /s]	FSU [m <sup>3</sup> /s]
H1	17	22.243	3.71	10.70	H14	-	11.230	1.87	5.67
H2	16	11.911	1.99	5.96	H15	1	1.219	0.20	0.71
H3	18	34.877	5.82	16.32	H16	2	2.005	0.33	1.13
H4	-	37.089	6.19	17.28	H17	4	0.288	0.05	0.18
H5a	3	35.253	5.88	16.48	H18	5	0.141	0.02	0.09
H5b	6	0.332	0.06	0.21	H19	8	0.157	0.03	0.10
H6	19	72.495	12.09	32.38	H20	9	0.170	0.03	0.11
H7	-	77.438	12.91	34.45	H21	10	0.179	0.03	0.12
H8	20	3.987	0.66	2.14	H22	11	0.035	0.01	0.03
H9	-	95.450	15.92	41.91	H23	12	0.000	0.00	0.00
H10	-	95.619	15.95	41.98	H24	13	0.591	0.10	0.36
H11	7	8.439	1.41	4.32	H25	14	0.383	0.06	0.24
H12	14	1.318	0.22	0.76	H26	15	0.026	0.00	0.02
H13	-	2.588	0.43	1.43	H27	22	0.212	0.04	0.14

**Table 5.11. Summary table comparing design  $Q_{100cc}$  and  $Q_{1000cc}$  flow rates for MRFS.**

HEP	HEC-RAS node	Area [km <sup>2</sup> ]	$Q_{100cc}$ 1% AEP [m <sup>3</sup> /s]	$Q_{1000cc}$ 0.1% AEP [m <sup>3</sup> /s]	HEP	HEC-RAS node	Area [km <sup>2</sup> ]	$Q_{100cc}$ 1% AEP [m <sup>3</sup> /s]	$Q_{1000cc}$ 0.1% AEP [m <sup>3</sup> /s]
H1	17	22.243	10.70	13.52	H14	-	11.230	5.67	7.16
H2	16	11.911	5.96	7.54	H15	1	1.219	0.71	0.90
H3	18	34.877	16.32	20.60	H16	2	2.005	1.13	1.43
H4	-	37.089	17.28	21.83	H17	4	0.288	0.18	0.23
H5a	3	35.253	16.48	20.82	H18	5	0.141	0.09	0.12
H5b	6	0.332	0.21	0.26	H19	8	0.157	0.10	0.13
H6	19	72.495	32.38	40.91	H20	9	0.170	0.11	0.14
H7	-	77.438	34.45	43.51	H21	10	0.179	0.12	0.14
H8	20	3.987	2.14	2.70	H22	11	0.035	0.03	0.04
H9	-	95.450	41.91	52.93	H23	12	0.000	0.00	0.00
H10	-	95.619	41.98	53.02	H24	13	0.591	0.36	0.46
H11	7	8.439	4.32	5.45	H25	14	0.383	0.24	0.30
H12	14	1.318	0.76	0.96	H26	15	0.026	0.02	0.02
H13	-	2.588	1.43	1.81	H27	22	0.212	0.14	0.17

## 5.3 HYDRAULIC MODEL FOR EXISTING RIVER SYSTEM

### 5.3.1 Methodology

The methodology described in Section above requires the development of a 1-D 2-D HEC-RAS computer model for varying flood flows to provide:

1. Hydrological/hydraulic simulations for the existing pre-development on the River Suir and flood plain site which give a benchmark for post-development impacts.
2. Hydrological/hydraulic simulations to determine if there are any hydrological/hydraulic impacts adjacent to or downstream of the site.
3. Hydrological/Hydraulic simulations of the initial proposed windfarm layout and iterations leading to the final design (chapter 6).
4. Hydrological/hydraulic simulations of the final windfarm layout to obtain all relevant data relating to the wind farm design and planning application.

### 5.3.2 Model description

The computer model is based on detailed river and tributary cross-sections which form the 1-D component of the model and detailed topographical maps of the surrounding flood plains which provide the 2-D component of the integrated 1D-2d HEC-RAS computer model. In addition to this, estimates of the river channel and flood plain roughness (Manning's-n values) are required as input parameters and these were determined during a site inspection.

Models were developed for two River Systems:

- Existing River System which uses the geometry of the natural river channel and flood plains.
- Design River System that includes the final geometry of the proposed windfarm.

In addition to the assessment of flood risks for the development, adjacent lands and downstream reaches, the simulations provided the following additional information:

- Identification of locations where new or upgraded culverts would be required.
- Identification of existing culverts and the role they play in providing storage in the hydrological system.

The 2D model covers an area of 10km<sup>2</sup>. The 1D model covers a reach of c. 16km, defined by 564 cross sections and a 25 bridges/culverts (the Existing River System model contains 22 bridges). The layout of the HEC-RAS cross-section locations and DTM are shown in Figure 10.

The model did not include any detail on the end masts. The impact of the masts was assessed during the site visit and it was concluded that the small footprint of the masts would not change the floodplain flow or storage in any significant way. The finished level of the roads covering the underground cable should be the same as the existing ground levels of the area in order to avoid disturbance of natural(existing) flow paths.

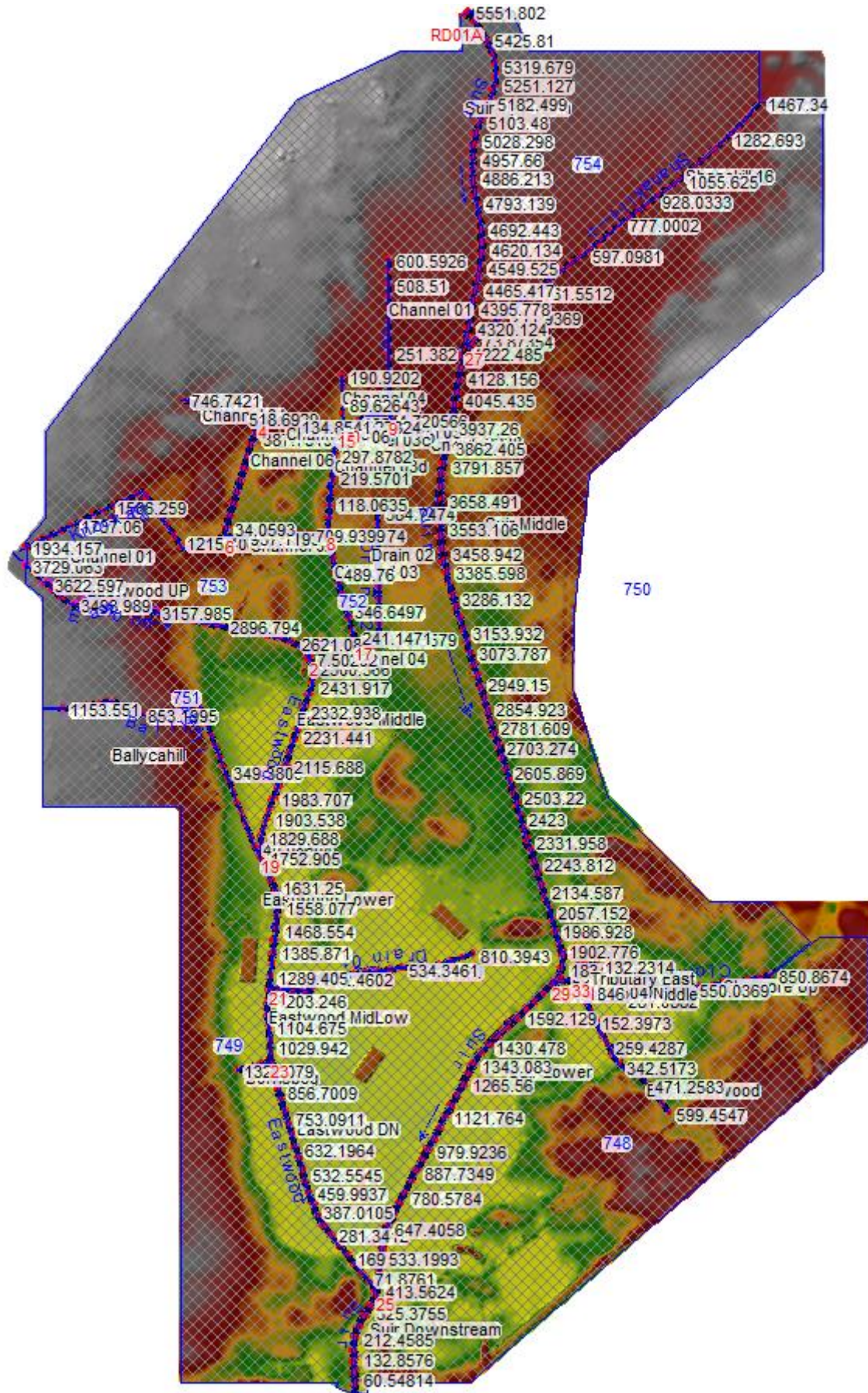


Figure 10. Layout of HEC-RAS model.

### 5.3.3 Model Input data

#### 5.3.3.1 Geometry - Survey of river bed and flood plains

A survey of the river channel, banks and flood plains were carried out between 24<sup>th</sup> March 2022 to 1<sup>st</sup> April 2022 by KU217 Ltd. The survey included river banks, river channel and flood plains, (see Figure 5.5). The extensive area of the flood plains was surveyed using a LIDAR/RGB Drone surveying which was conducted by Maydon Ltd. The survey covered an area of approximately 1040ha and included a river length of more than 16km. The survey data were processed using a GIS toolset and a Digital Terrain Model (DTM) was created; two DTM's were created. The first DTM describes the Existing River System and flood plains (Figure 5.6) and second one describes the Design River System with added wind turbine hardstands elevated above flood water levels, a road network which follows the existing terrain and includes additional bridges and culverts (Figure 6.1).



Figure 5.5. Overlay of the Survey points and satellite images.

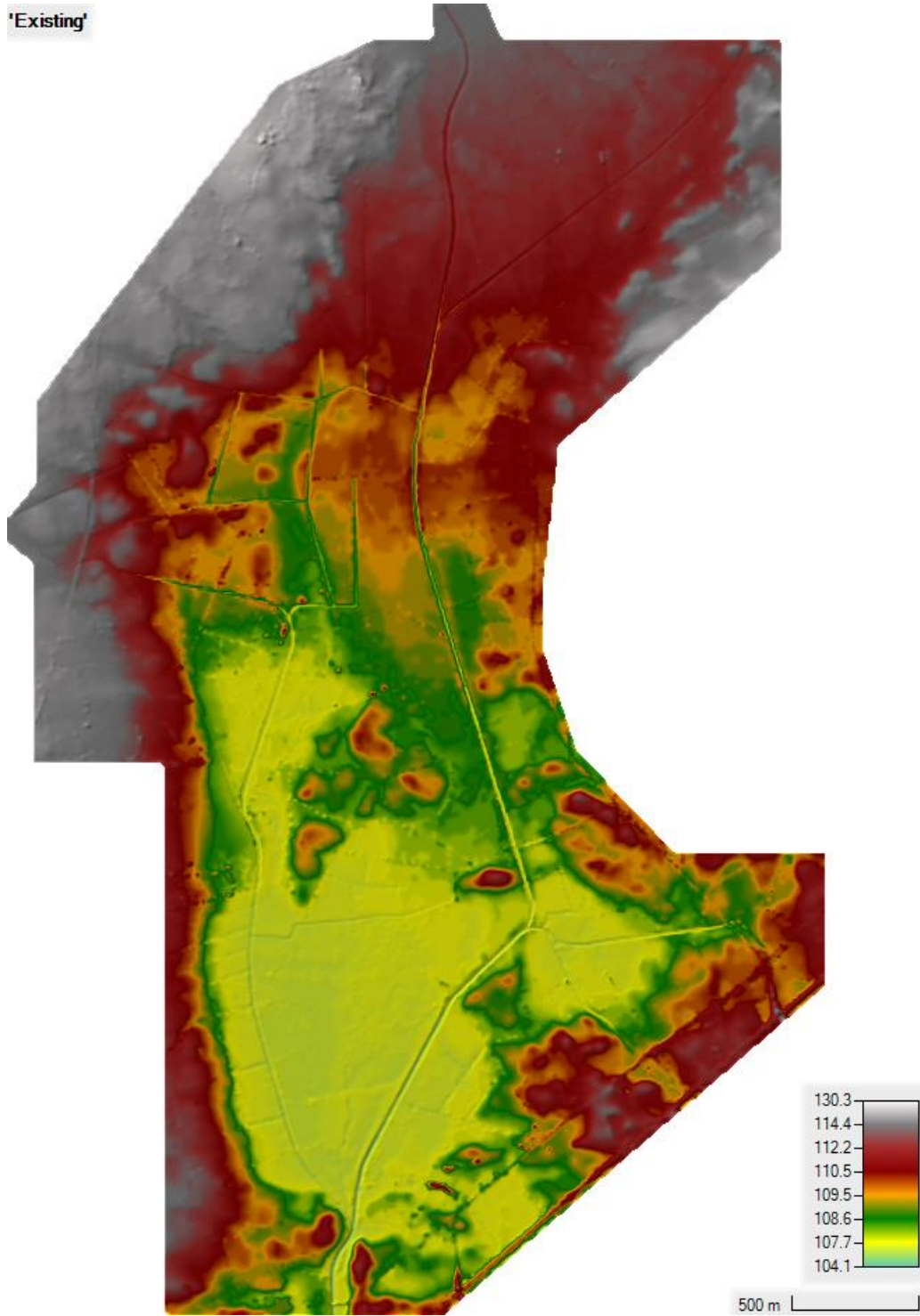


Figure 5.6. Digital Terrain Model of the existing model area.

### 5.3.3.2 Upstream Boundary condition

The upstream boundary condition is defined with a 7-hour hydrographs with a 3.4-hour rising stages (see Figure 5.7). A total of 21 upstream boundary conditions were defined and are listed in Table 5.12.

Table 5.12. Input design flows for the hydraulic model.

HEPs	HEC-RAS				Peak Flow [m <sup>3</sup> /s]	
	No	River	Reach	Station [m]	Q <sub>med</sub>	Q <sub>100cc</sub>
H15	1	Ballycahill	Ballycahill	1153.5151	0.21	0.71
H16	2	Borrisbeg	Borrisbeg	132.5079	0.33	1.13
H5a	3	Clonmore	Clonmore Up	850.8674	4.80	16.48
H17	4	Drain 01	Drain 01	810.3943	0.05	0.18
H18	5	Drain 02	Drain 02	584.7474	0.03	0.09
H5b	6	East Eastwood	East Eastwood	599.4547	0.06	0.21
H11	7	Eastwood	Eastwood UP	3729.063	1.26	4.32
H19	8	Farranacahill	Channel 02	825.2238	0.03	0.10
H20	9	FarranacahillTr01	Channel 01	600.5926	0.03	0.11
H21	10	FarranacahillTr01	Channel 04	190.9202	0.03	0.12
H22	11	FarranacahillTr01	Channel 05	155.8376	0.01	0.03
H23	12	FarranacahillTr01	Channel 06	153.9854	0.00	0.00
H24	13	Knockanroe	Channel 01	1934.157	0.10	0.36
H25	14	KnockanroeTrib1	Channel 04	746.7421	0.07	0.24
H26	15	KnockanroeTrib2	Channel 05	134.8541	0.01	0.02
H2	16	Shanakill	Shanakill 16	1467.34	1.74	5.96
H1	17	Suir	Suir Upstream	5551.802	3.12	10.70
H3	18	Suir	Lateral - Suir Middle	4187.293	0.18	0.62
H6	19	Suir	Lateral-Suir Lower	1731.846	4.55	15.62
H8	20	Suir	Suir Lower	887.7349	0.62	2.14
H27	22	East Tributary	East Tributary	132.2314	0.04	0.14

\*Note that for model stability higher peak flow than 0.3m<sup>3</sup>/s was used

Unit hydrographs were multiplied with peak flows from Table 5.12 to obtain the final shapes of the input hydrographs. All input hydrographs for Q<sub>med</sub> and Q<sub>100cc</sub> are shown in Figure 5.8 and Figure 5.9 respectively.

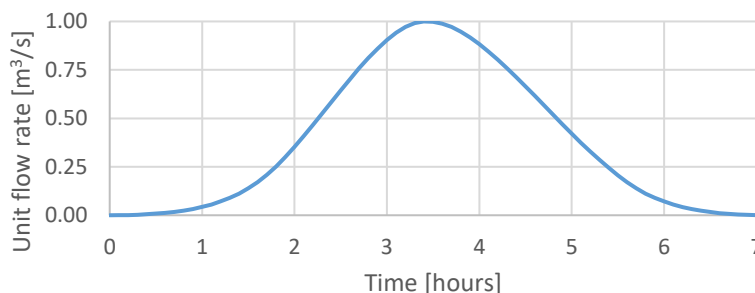


Figure 5.7. Unit hydrograph.

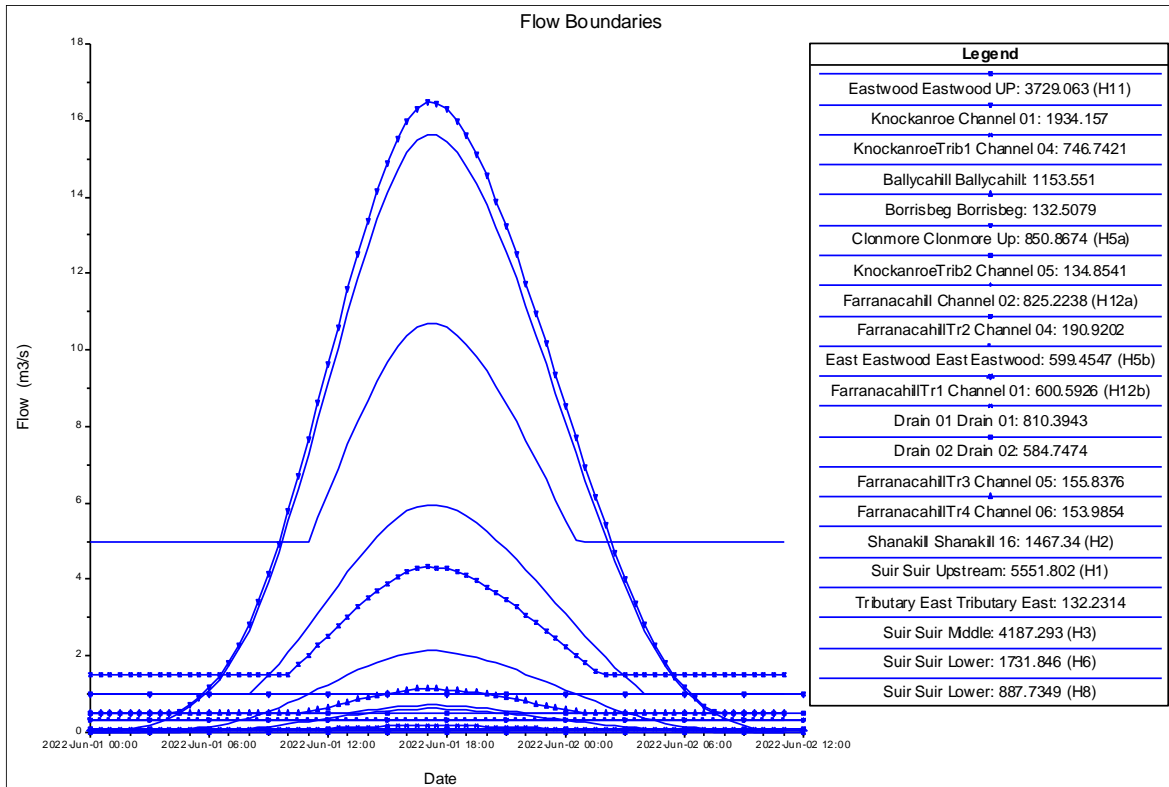


Figure 5.8. Resulting hydrographs for Q<sub>100cc</sub>.

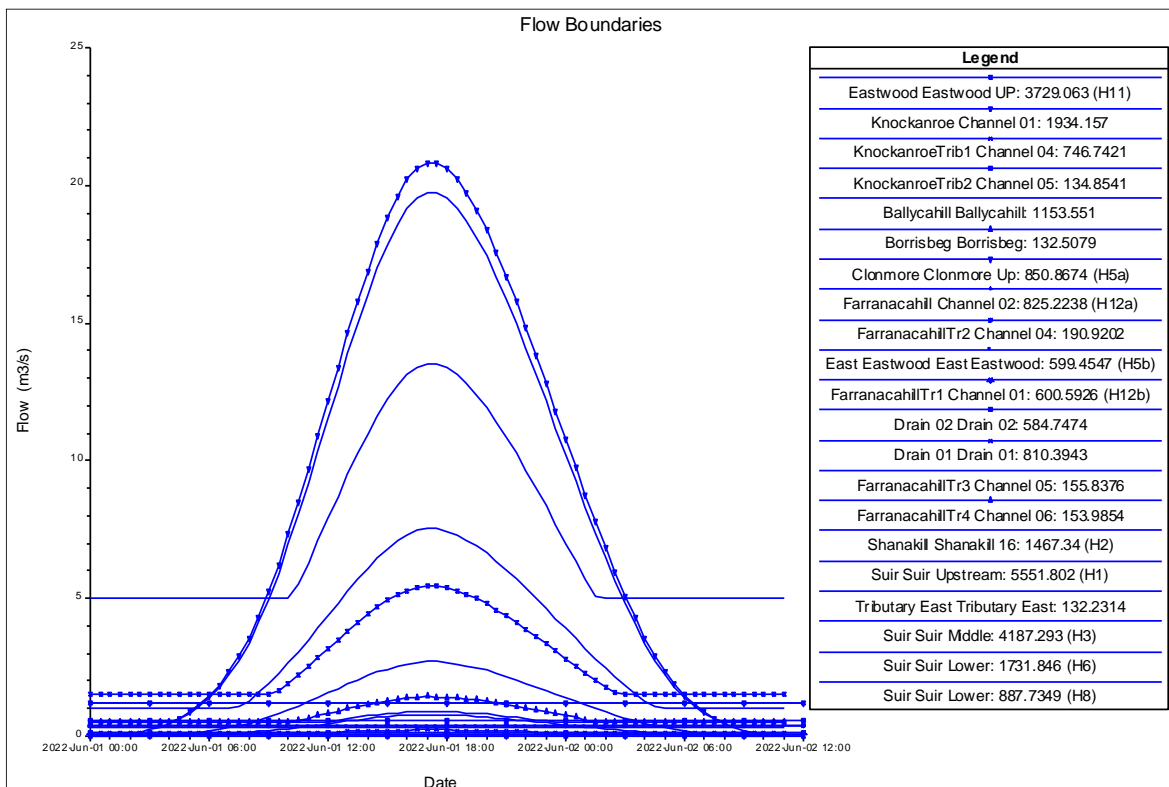


Figure 5.9. Resulting hydrographs for Q<sub>100cc</sub>.



### 5.3.3.3 Downstream Boundary condition

The downstream boundary conditions are defined as the normal depth,  $d_n$ , with a defined energy slope of 0.008m/m.

### 5.3.3.4 Calibration results

According to inspected site conditions, **roughness values for river channel have a Manning coefficient of  $n=0.045 - 0.050$  s/m<sup>1/3</sup>. Roughness factor of  $n=0.060$  s/m<sup>1/3</sup> was used for the flood plains.** Recommended values of Manning roughness values for channels and flood plains are shown in *Annex E - Table E4.3*.

## 5.3.4 Design events in flood risk scoping

Using the HEC-RAS computer model, computer simulations were carried out for unsteady flow conditions using a flood flow value corresponding to the peak of the flood hydrograph. In summary the flood risk at development site was analysed for two hydrologically extreme existing scenarios, as shown in Table 5.13.

**Table 5.13. Design Events used in flood risk scoping**

Design event	Flow Rate [m <sup>3</sup> /s] / return period	Downstream boundary condition – Normal depth	Description
1	$Q_{100cc}$ (20% climate change)	0.008m/m.	<b>Flood zone A - <math>Q_{100cc}</math>-Exist</b>
2	$Q_{1000cc}$ (20% climate change)	0.008m/m.	<b>Flood zone B - <math>Q_{1000cc}</math>- Exist</b>

## 5.3.5 Computer model results for existing river system

The results are shown for Existing River System for  $Q_{100cc}$  and  $Q_{1000cc}$  year flow rates with included 20% increase of flows due to climate change (MRFS) as follows:

- $Q_{100cc}$  and  $Q_{1000cc}$  Longitudinal profiles for River Suir main channel showing water levels for Existing river system (Figure 5.10).
- $Q_{100cc}$  and  $Q_{1000cc}$  Longitudinal profiles for Eastwood tributary showing water levels for Existing river system (Figure 5.11).
- $Q_{100cc}$  and  $Q_{1000cc}$  Flow velocity map for the River Suir main channel for Existing River System (Figure 5.12).
- $Q_{100cc}$  and  $Q_{1000cc}$  Flow velocity map for the Eastwood tributary channel for Existing River System (Figure 5.13).
- $Q_{100cc}$  Flow velocity maps for Existing river system (Figure 8.1).
- $Q_{1000cc}$  Flow velocity maps for Existing river system (Figure 8.2).
- $Q_{100cc}$  Flood Maps for Existing river system (Figure 8.3).
- $Q_{1000cc}$  Flood Maps for Existing river system (Figure 8.4).

Table output model results for  $Q_{100cc}$  (MRFS) and  $Q_{1000cc}$  (HEFS) is shown in Annex H.

5.3.5.1 Longitudinal profiles

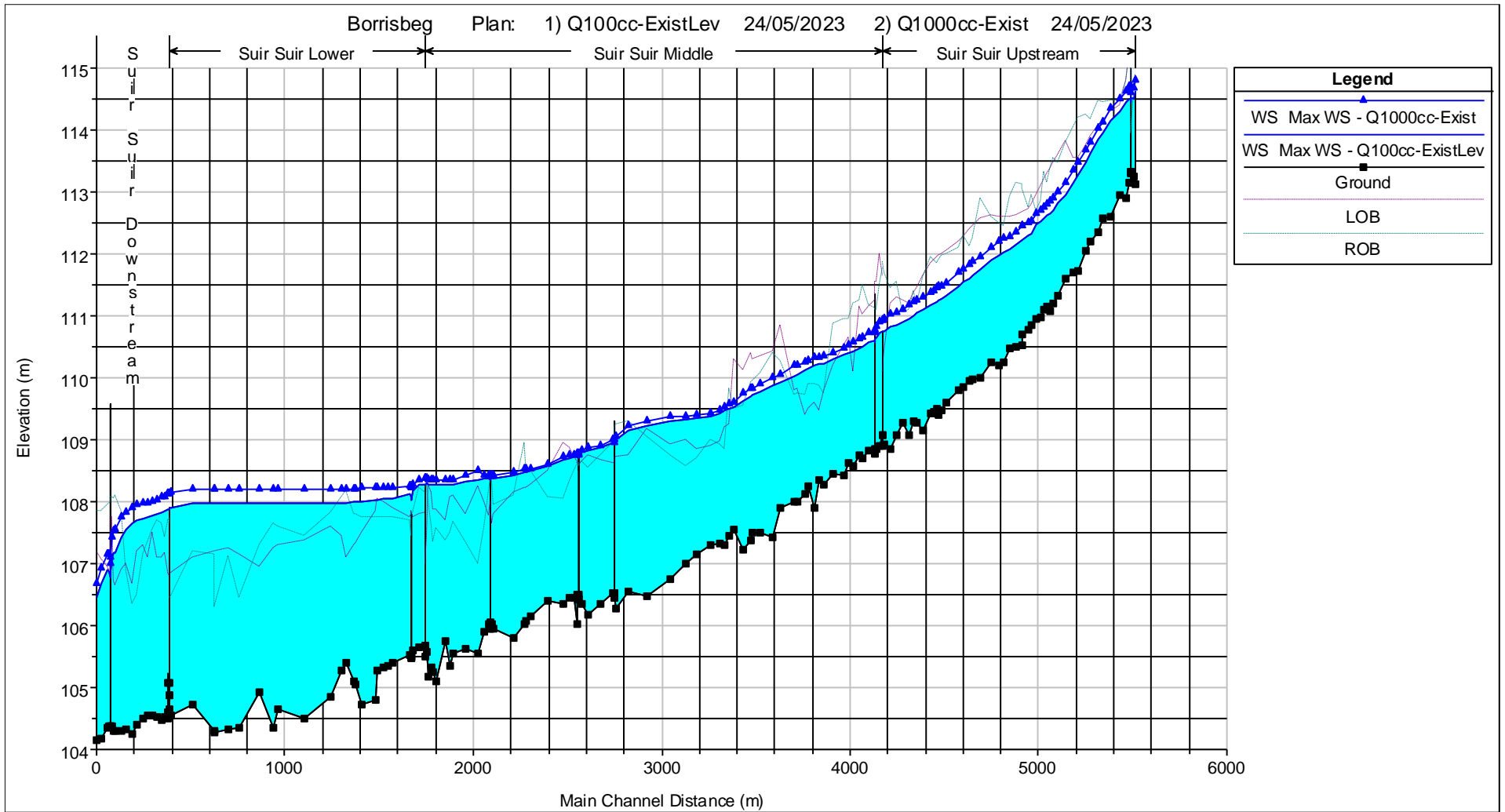


Figure 5.10. Suir Longitudinal profile showing water levels in the river channel for Existing River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

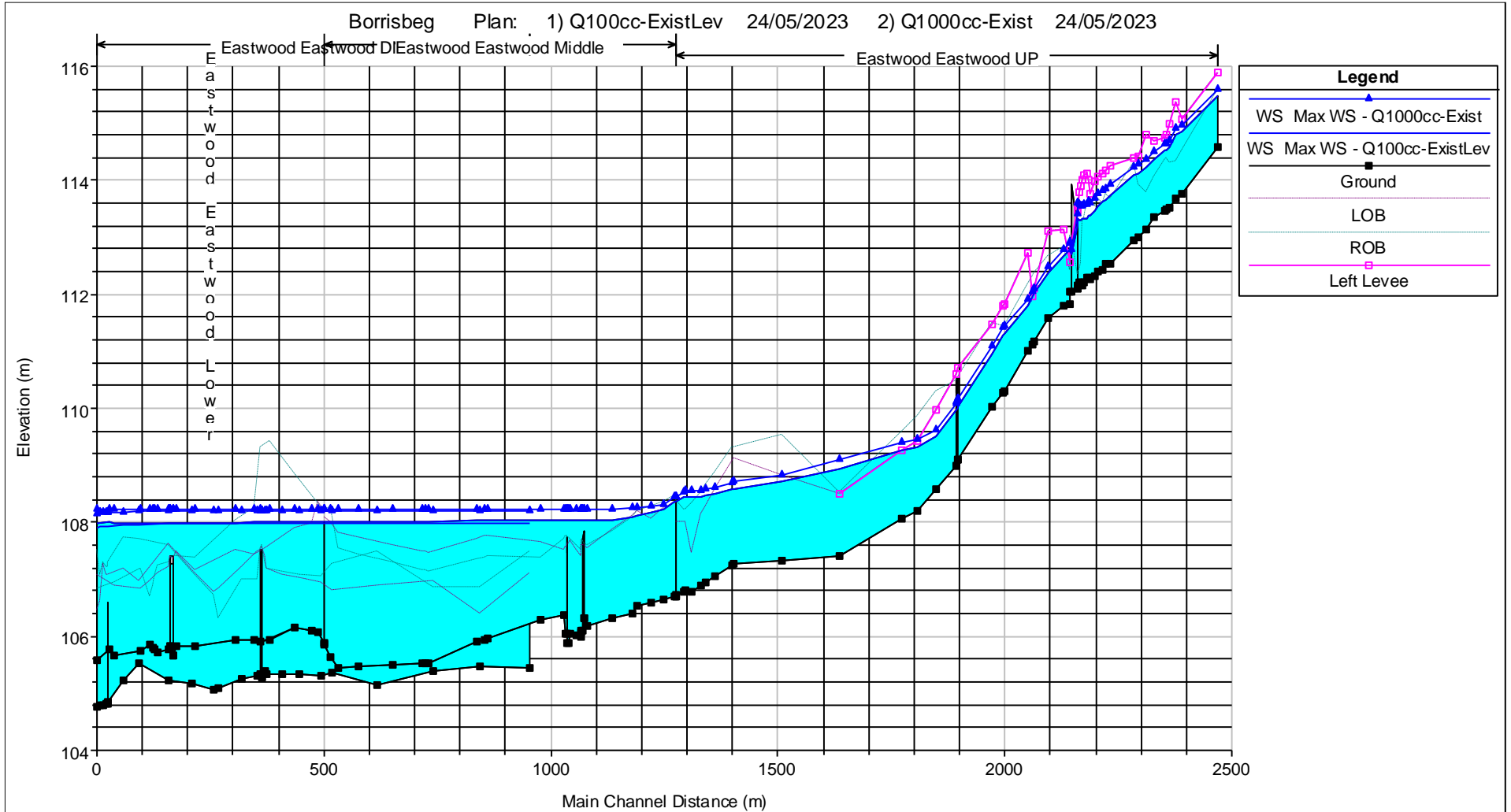


Figure 5.11. Eastwood Longitudinal profile showing water levels in the river channel for Existing River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

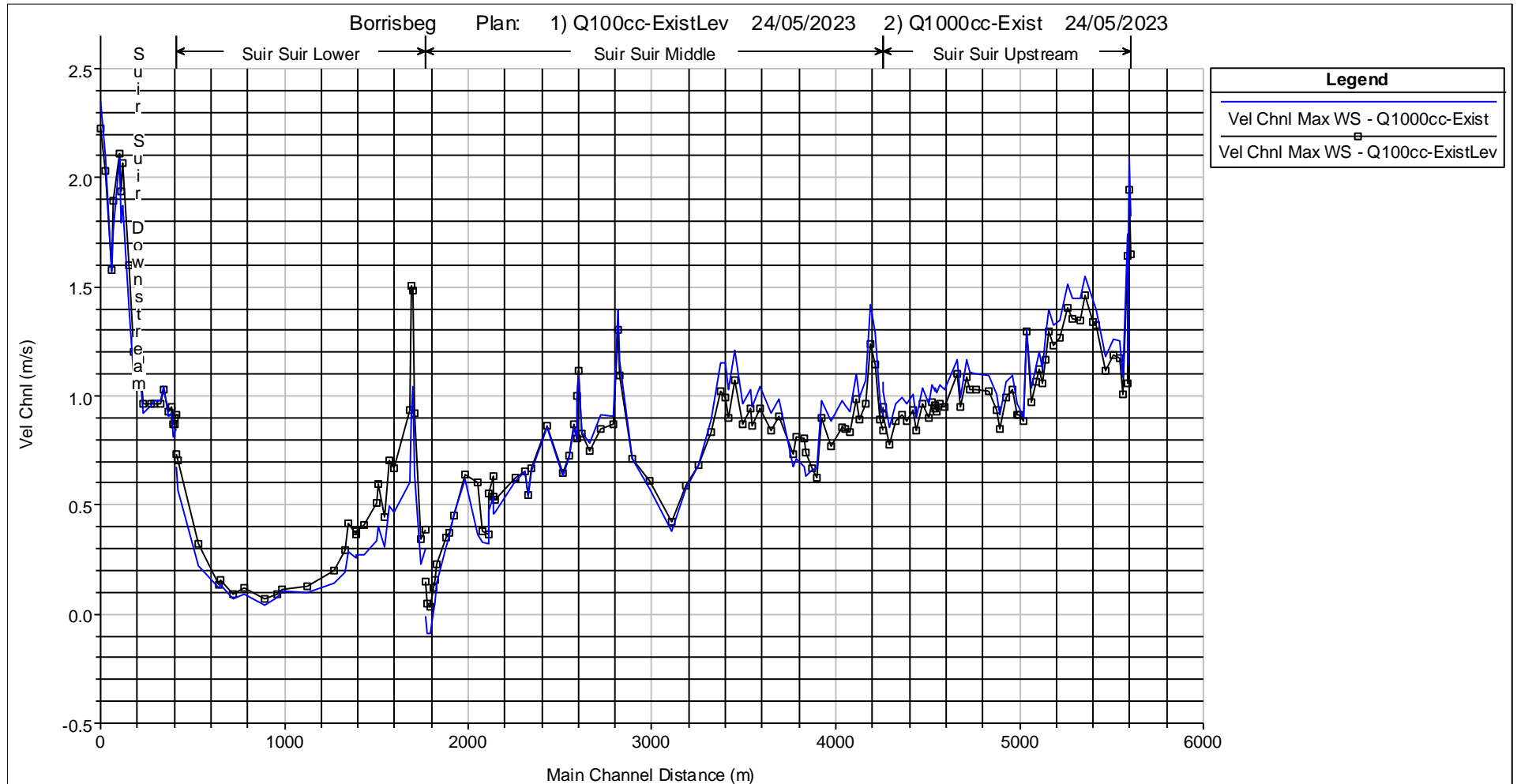


Figure 5.12. Suir Longitudinal profile showing flow velocity in the river channel for Existing River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

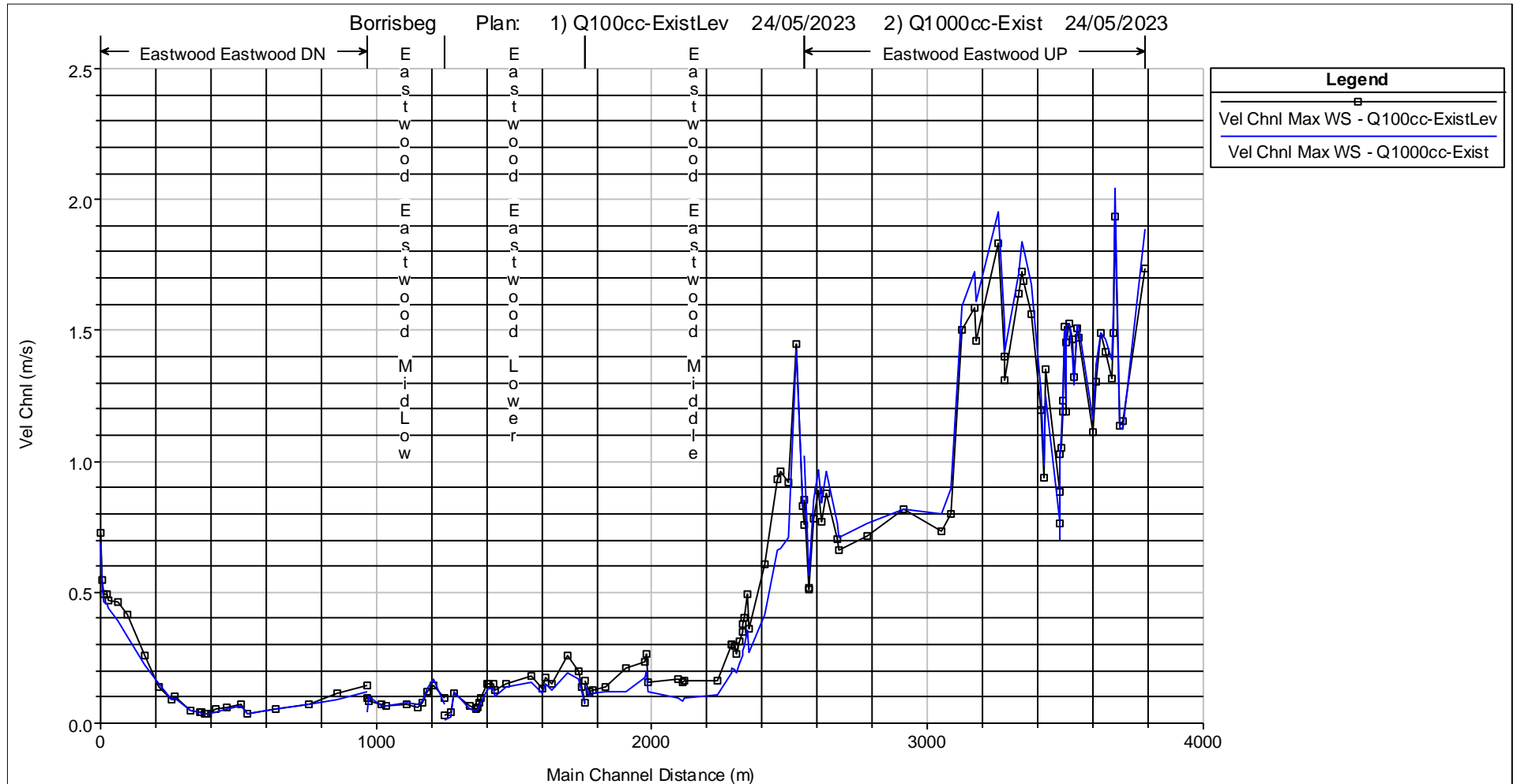


Figure 5.13. Eastwood Longitudinal profile showing flow velocity in the river channel for Existing River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

## 5.4 FLOOD RISK MANAGEMENT MEASURES

### 5.4.1 Fluvial and coastal flood risk

#### **Finished Floor/Hardstand Levels**

In order to mitigate tidal and fluvial flood risk, the proposed properties, e.g. wind turbine hard stands and substation should be constructed with their finished floor/ground levels at a height greater than:

$$(1000\text{-year flood flow including climate change}) + c. 0.5\text{m}$$

Design Finished Floor Levels are shown in Table 6.3.

#### **Site roads**

The finished level of site roads should be the same as the existing ground levels of the of the site in order to avoid disturbance of natural(existing) flood flow paths.

#### **Bridges and Culverts**

Proposed bridges and culverts or culvert upgrades should be constructed in compliance with OPW Section 50.

### 5.4.2 Coastal flooding

Excluded from further investigation. See section 4.3.2.

### 5.4.3 Pluvial flooding

Some ponding evident, but affects soil conditions rather than causing flooding. Excluded from further investigation. See section 4.3.3.

### 5.4.4 Overland flooding

Excluded from further investigation. See section 4.3.4.

### 5.4.5 Groundwater flooding

Excluded from further investigation. See section 4.3.5.

### 5.4.6 Drainage systems

Excluded from further investigation and attributed to fluvial flooding. See section 4.3.6.

## 6 Stage 3 – Detailed flood risk assessment

### 6.1 INTRODUCTION

This detailed risk assessment assesses the combined effects of the two rivers, the Suir and the Eastwood and a network of field drainage channels at the development site. Residual risks that remain after all risk avoidance, substitution and mitigation measures have been applied, have also been considered. An iterative process of the assessment of flood risk and impacts has been performed, to give detailed design parameters which are recommended for the wind farm development.

The hydrology of the system is calculated and elaborated on in Chapter 5 and section 5.2.3. Two flow rate scenarios combining climate change (20% flow increase) were analysed in order to obtain flood Zones A and B, in accordance with Table 5.13 and Table 6.1.

In order to examine the extreme hydrological occurrence of ‘worst case scenario’ the approach of combining all flow hydrographs peaks simultaneously is used and is considered conservative.

#### 6.1.1 Risk of fluvial flooding

The Stage 1 assessment concluded that the development proposal is at risk from river, e.g. fluvial flooding, and that the proposed development site falls in flood Zone A and Zone B.

In the scoping process, additional detail surveys have been conducted and subsequently computer model simulations were performed for the existing river system. An assessment of proposed mitigation measures for river flood risk involved computer simulations to determine flood levels at the site for the river channel and modified floodplain.

#### 6.1.2 Risk of coastal flooding

The Stage 1 assessment concluded that the development proposal is not at risk of coastal flooding (see 4.3.2).

#### 6.1.3 Risk of pluvial flooding

The Stage 1 assessment concluded that the development proposal is not at risk of pluvial flooding (see 4.3.3).

#### 6.1.4 Risk of artificial drainage system and groundwater flooding

It was concluded that the development site is at low risk of flooding from artificial drainage systems and groundwater flooding, and therefore these flood mechanisms were excluded from risk assessment. See section 4.3.4. and section 4.3.5.

#### 6.1.5 Surface water drainage risk

The study also examines the effect of the proposed development on the storm runoff from the site area and assesses if this will have any significant impact on flood levels in the rivers. Since extreme flood levels are dominated by extreme river levels the contribution from surface runoff from a relatively small site will be insignificant. Therefore, it is excluded from further investigation.

#### 6.1.6 Risk of flooding due to culvert blockage

A tree investigation was conducted on site in order to determine if there is a risk of blockage at the culverts due to fallen trees (Table 3.1). There is some risk for four culverts to be blocked (due to small pipe diameter of 600mm). Culvert 16 is already partially blocked due to partial collapse of its stone opening. Culverts 12, 14 and 15 are under of risk of blockage due to their small size (600mm).



## 6.2 HYDRAULIC MODEL FOR DESIGN RIVER SYSTEM

### 6.2.1 Model Input data

The Design Model input data is a combination of Existing River System model data, (see section 5.3.3 for input Digital Terrain Model data), and the additional geometry of nine turbine hardstands and three bridges which are required for windfarm access road (Figure 6.1).

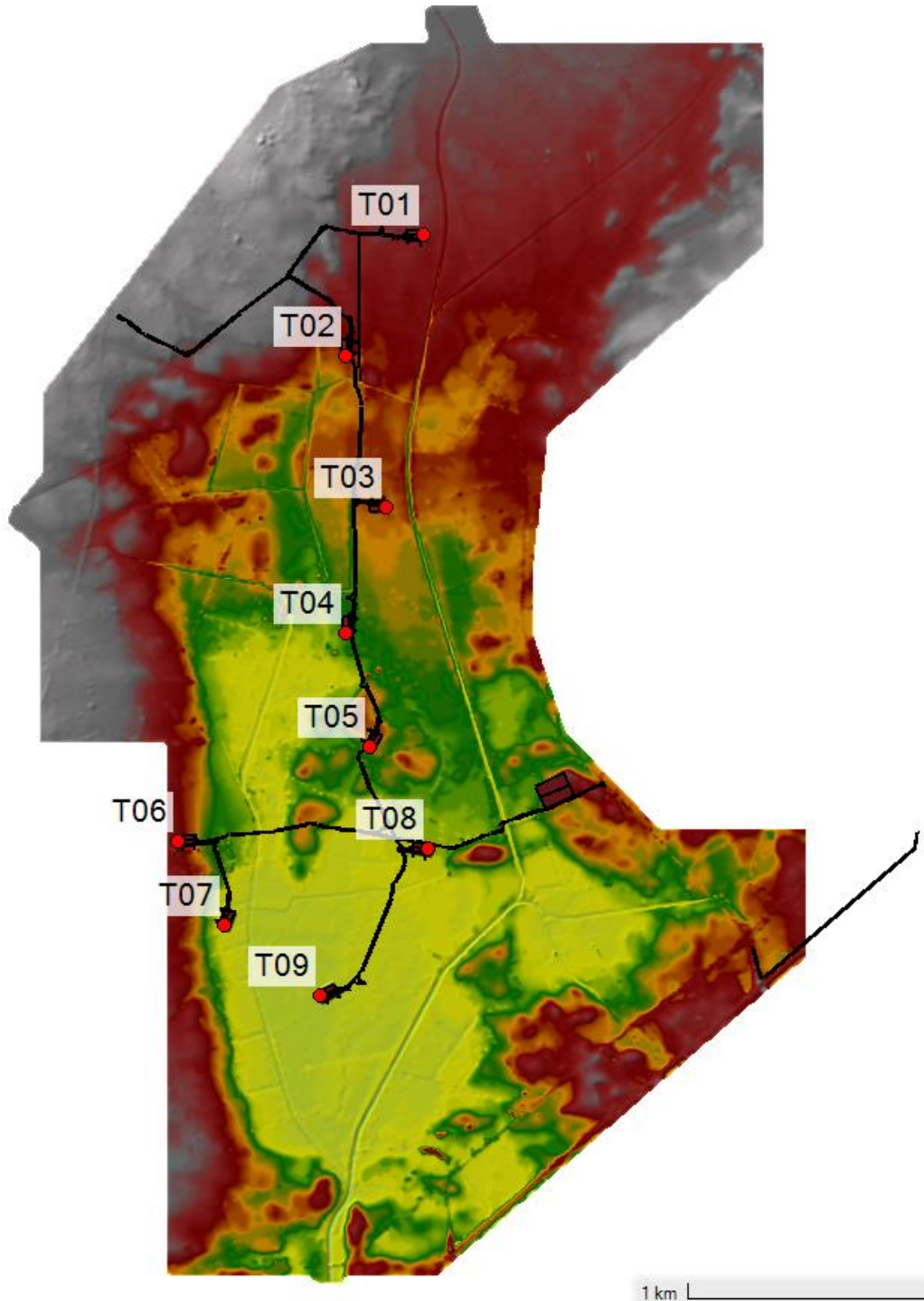


Figure 6.1. Digital Terrain Model of the design model area.

## 6.2.2 Design events in flood risk scoping

Using the HEC-RAS computer model, computer simulations were carried out for unsteady flow conditions using a flood flow value corresponding to the peak of the flood hydrograph. In summary the flood risk at development site was analysed for two hydrologically extreme design scenarios, as shown in Table 6.1.

**Table 6.1. Design Events used in flood risk scoping**

Design event	Flow Rate [ $\text{m}^3/\text{s}$ ] / return period	Downstream boundary condition – Normal depth	Description
1	$Q_{100\text{cc}}$ (20% climate change)	0.008m/m.	<b>Flood zone A - <math>Q_{100\text{cc}}</math>-Design</b>
2	$Q_{1000\text{cc}}$ (20% climate change)	0.008m/m.	<b>Flood zone B - <math>Q_{1000\text{cc}}</math>-Design</b>

## 6.2.3 Computer model results for design river system

The results are shown for Existing River System for  $Q_{100\text{cc}}$  and  $Q_{1000\text{cc}}$  year flow as follows:

- $Q_{100\text{cc}}$  and  $Q_{1000\text{cc}}$  Longitudinal profiles for River Suir main channel showing water levels for Design river system (Figure 6.2).
- $Q_{100\text{cc}}$  Longitudinal profiles for River Suir main channel showing water levels for Existing and Design river system (Figure 6.3).
- $Q_{1000\text{cc}}$  Longitudinal profiles for River Suir main channel showing water levels for Existing and Design river system (Figure 6.4).
- $Q_{100\text{cc}}$  and  $Q_{1000\text{cc}}$  Longitudinal profiles for Eastwood tributary showing water levels for Design river system (Figure 6.5).
- $Q_{100\text{cc}}$  Longitudinal profiles for Eastwood tributary showing water levels for Existing and Design river system (Figure 6.6).
- $Q_{1000\text{cc}}$  Longitudinal profiles for Eastwood tributary showing water levels for Existing and Design river system (Figure 6.7).
- $Q_{100\text{cc}}$  and  $Q_{1000\text{cc}}$  Flow velocity profile for the River Suir main channel for Existing and Design River Systems (Figure 6.8).
- $Q_{100\text{cc}}$  and  $Q_{1000\text{cc}}$  Flow velocity profile for the Eastwood tributary channel for Existing and Design River Systems (Figure 6.9).
- $Q_{100\text{cc}}$  Flow velocity distribution maps for Design river system (Figure 8.5).
- $Q_{1000\text{cc}}$  Flow velocity distribution maps for Design river system (Figure 8.6).
- $Q_{100\text{cc}}$  Flow depth maps for Design river system (Figure 8.7).
- $Q_{1000\text{cc}}$  Flow depth maps for Design river system (Figure 8.8).
- Flood zone A Existing and Design river system comparison (Figure 8.9).
- Flood zone B Existing and Design river system comparison (Figure 8.10).
- Flood zone A Comparison of Water Levels for Existing and Design river system (Figure 8.9).
- Flood zone B Comparison of Water Levels for Existing and Design river system (Figure 8.10).
- Hydrographs for Existing and design river systems to ascertain if there has been any change in the downstream flow as a result of the wind farm development (Figure 6.17).

Table output model results for  $Q_{100\text{cc}}$  (MRFS) and  $Q_{1000\text{cc}}$  (HEFS) is shown in Annex H.

## 6.2.4 Longitudinal profiles

There are two main river channels within the zone of influence of the wind farm. The main River Suir channel and the Eastwood tributary channel. Figure 6.2 below, for the main River Suir channel, gives the longitudinal profiles for the  $Q_{100cc}$  and  $Q_{1000cc}$  flows for Final Design River System - one superimposed on the other.

Comparison of water levels between Existing and Design river systems - one superimposed on the other is shown in Figure 6.3 and Figure 6.4 for the main River Suir channel for  $Q_{100cc}$  and  $Q_{1000cc}$  respectively. It is clear that the two water surface profiles are co-incident which confirms that the construction of the wind farm involving access roads and turbine hardstands has no impact on the water levels for the extreme  $Q_{100cc}$  and  $Q_{1000cc}$  flood events.

Figure 6.6 and Figure 6.7 show water level longitudinal profiles for  $Q_{100cc}$  and  $Q_{1000cc}$  respectively for the Eastwood channel and again the surface profiles are co-incident for the existing and Design River Systems confirming no water level change due to the windfarm construction.

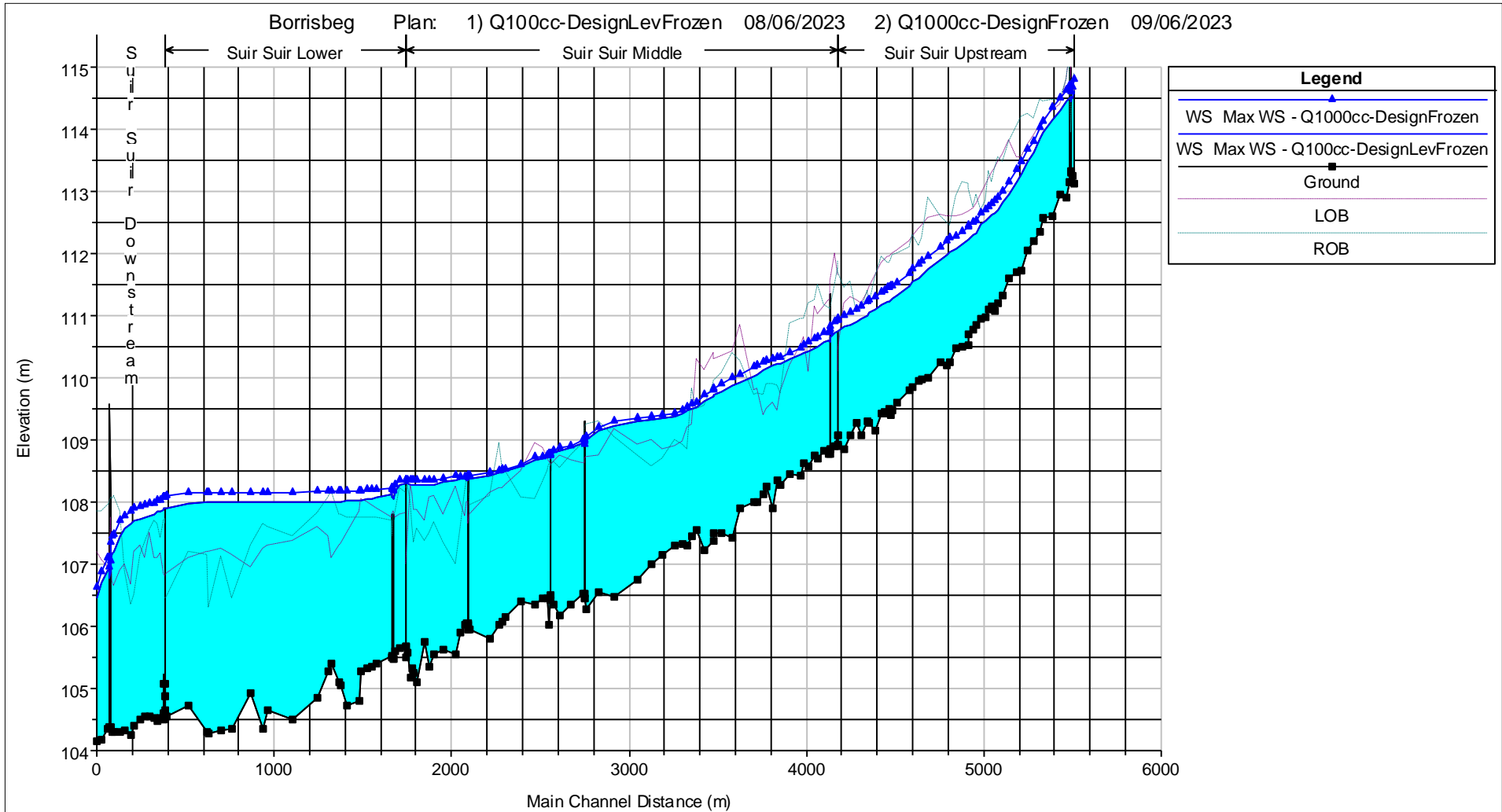


Figure 6.2. Suir Longitudinal profile showing water levels in the river channel for Design River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

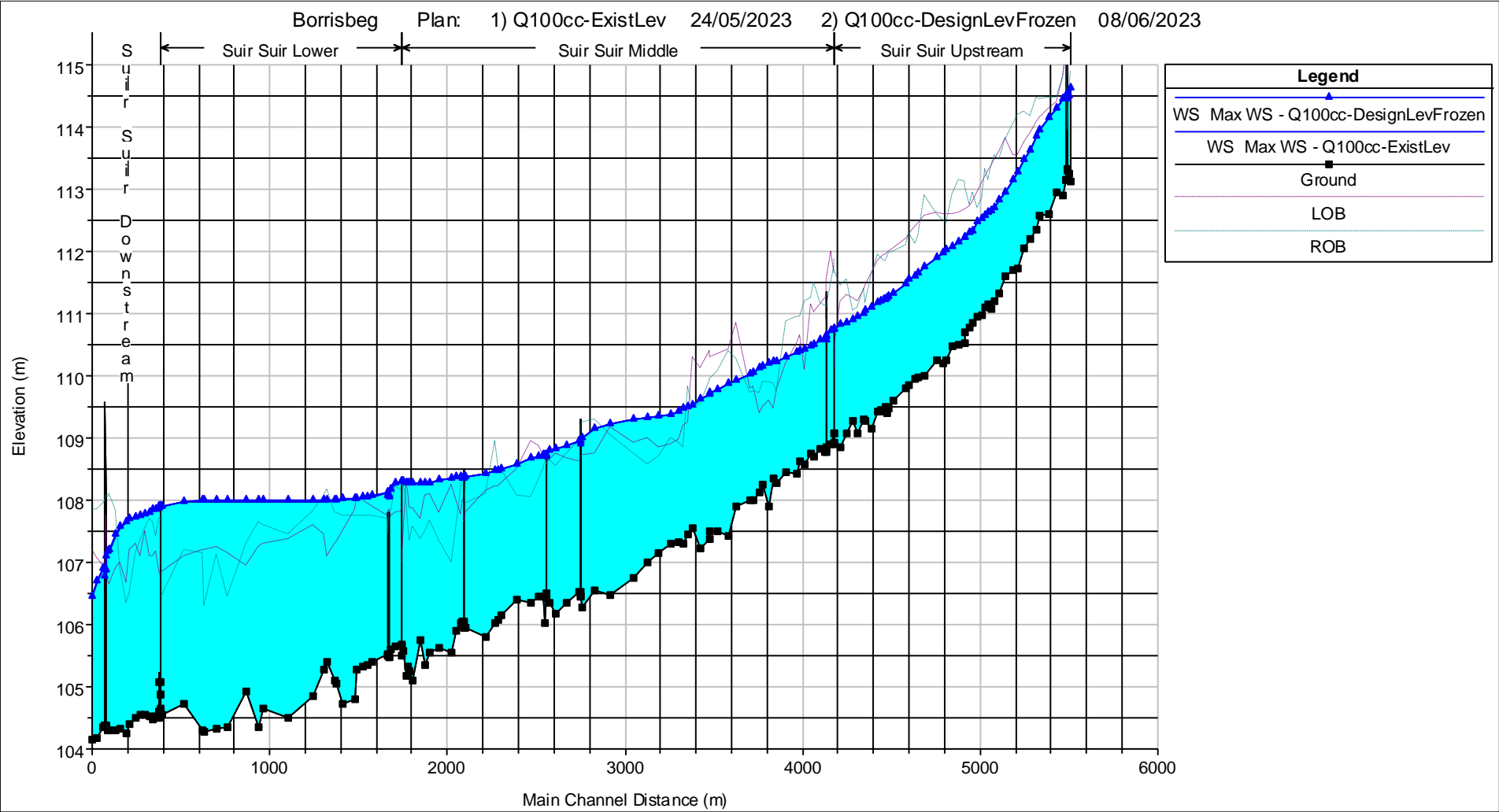


Figure 6.3. Suir Longitudinal profile comparing water levels in the river channel for Existing and Design River System for Q<sub>100cc</sub>.

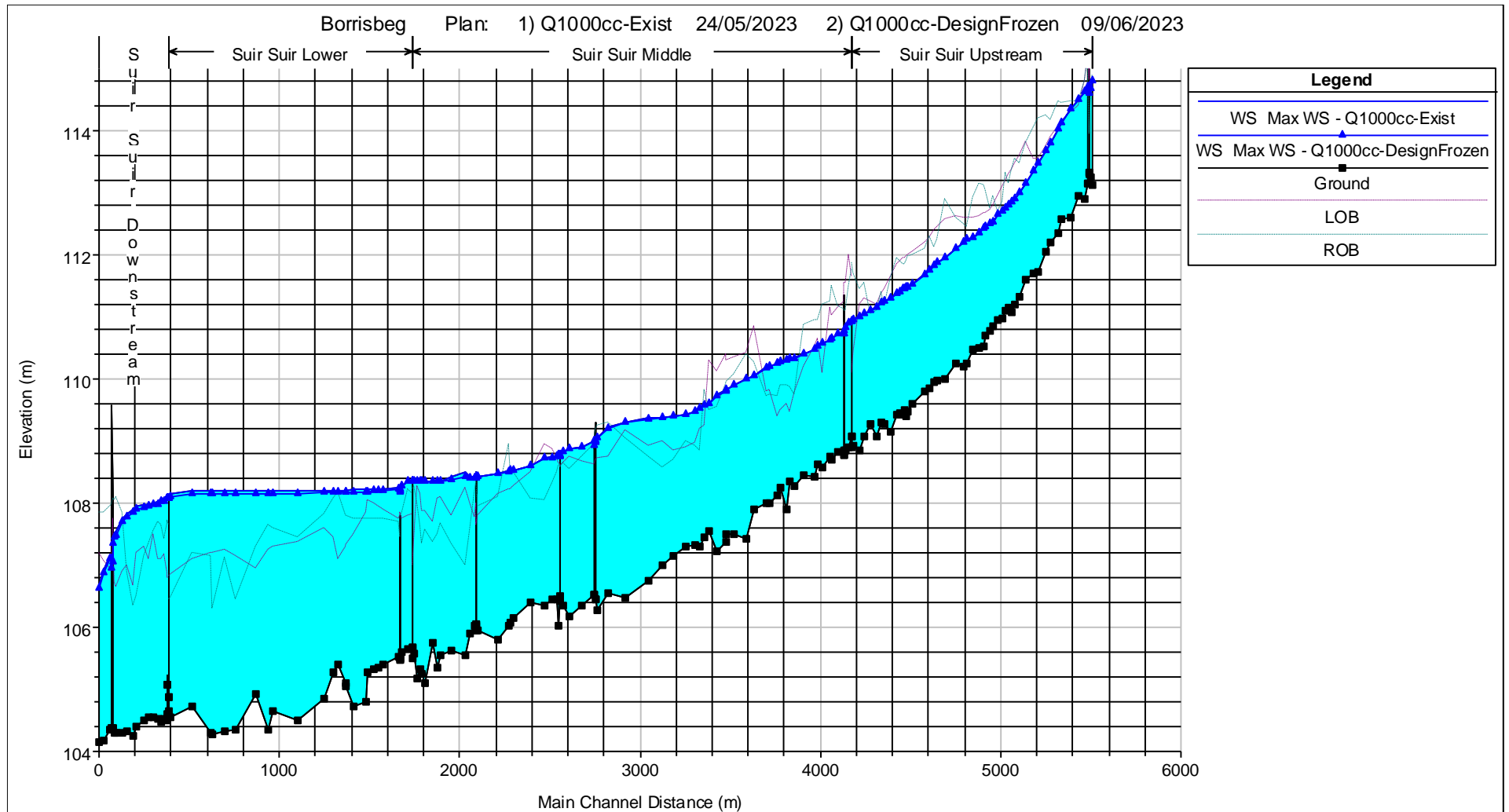


Figure 6.4. Suir Longitudinal profile comparing water levels in the river channel for Existing and Design River System for Q<sub>1000cc</sub>.

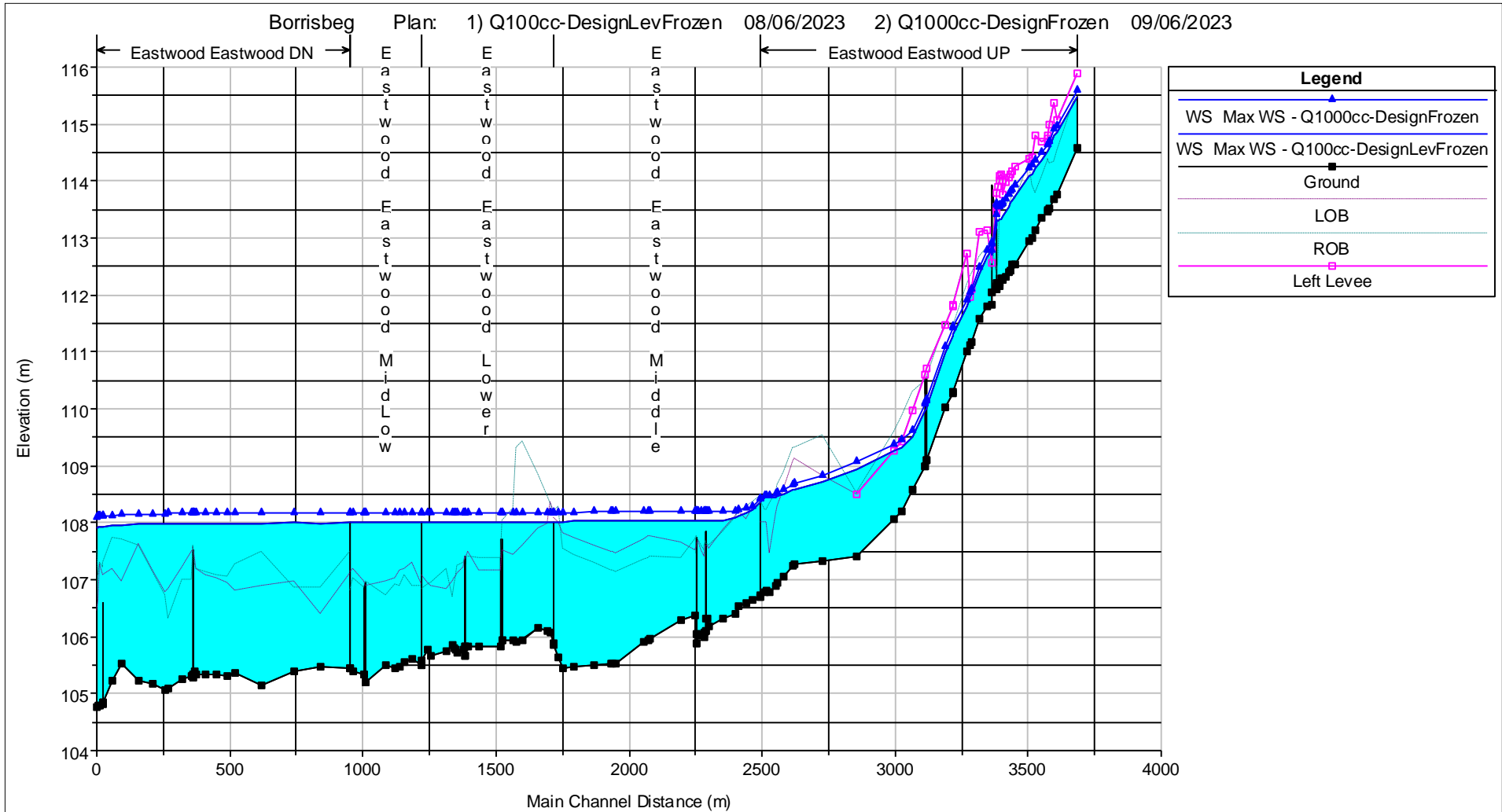


Figure 6.5. Eastwood Longitudinal profile showing water levels in the river channel for Design River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

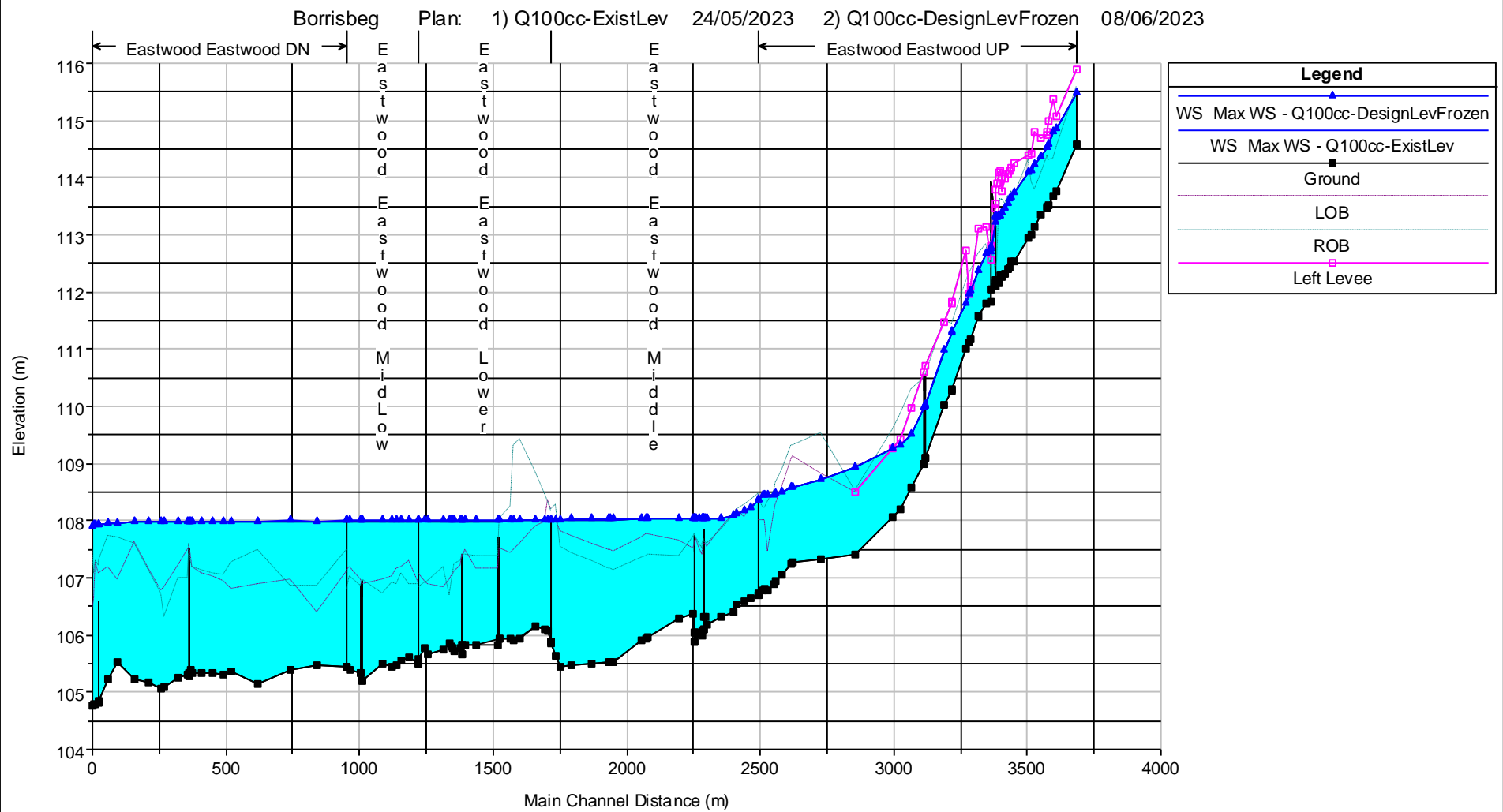


Figure 6.6. Eastwood Longitudinal profile comparing water levels in the river channel for Existing and Design River System for Q<sub>100cc</sub>.



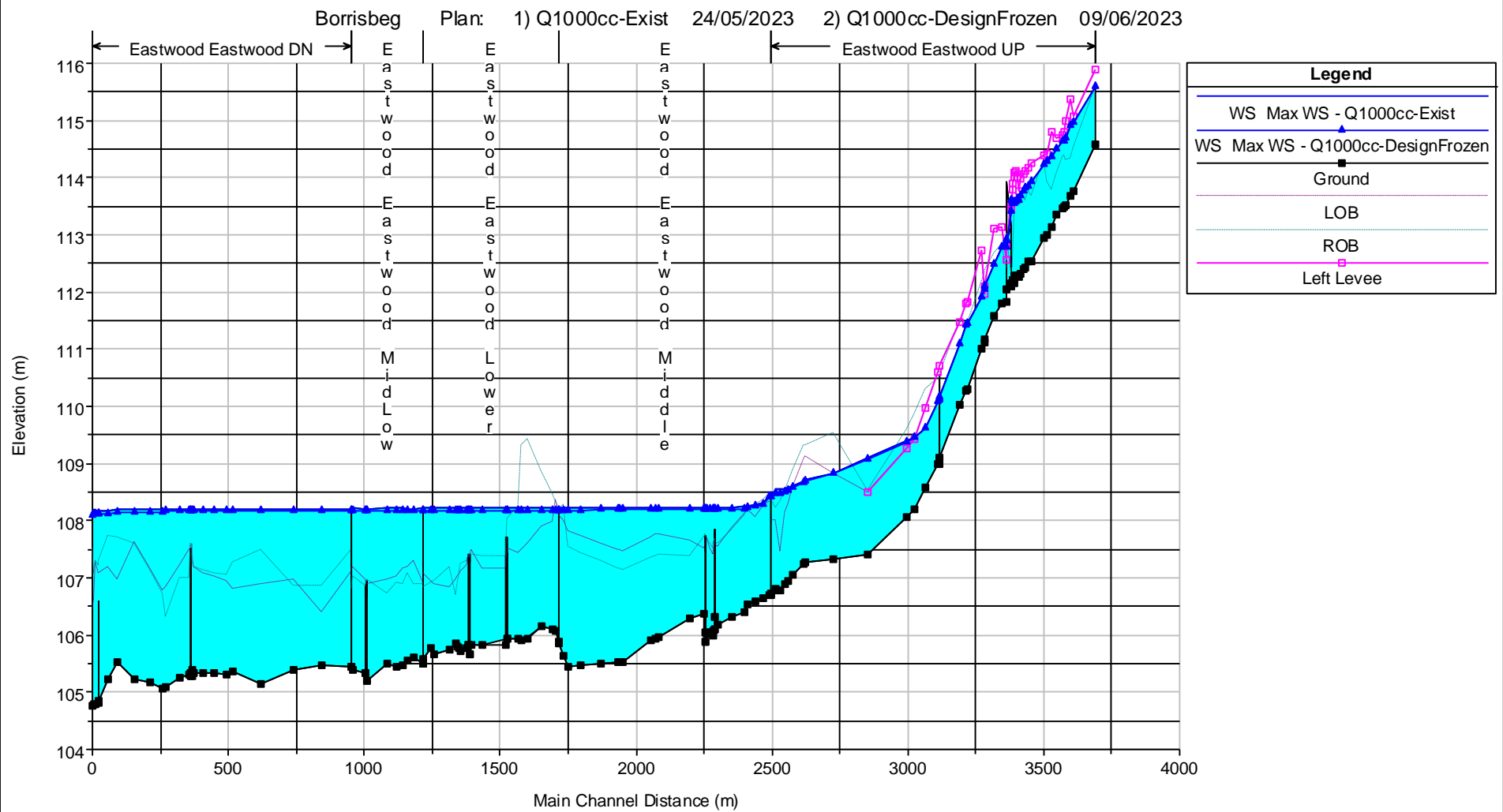


Figure 6.7. Eastwood Longitudinal profile comparing water levels in the river channel for Existing and Design River System for Q<sub>1000cc</sub>.

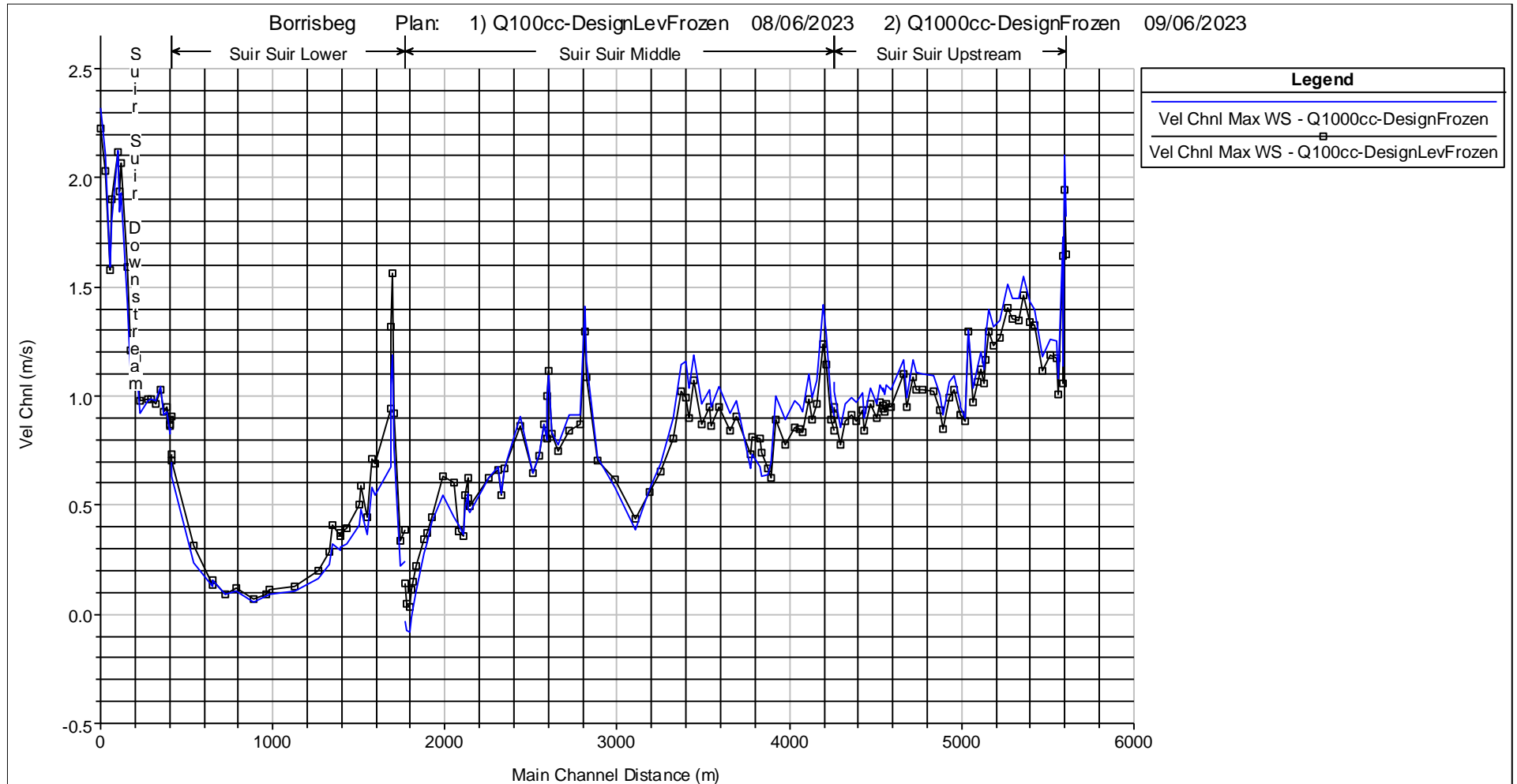


Figure 6.8. Suir Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

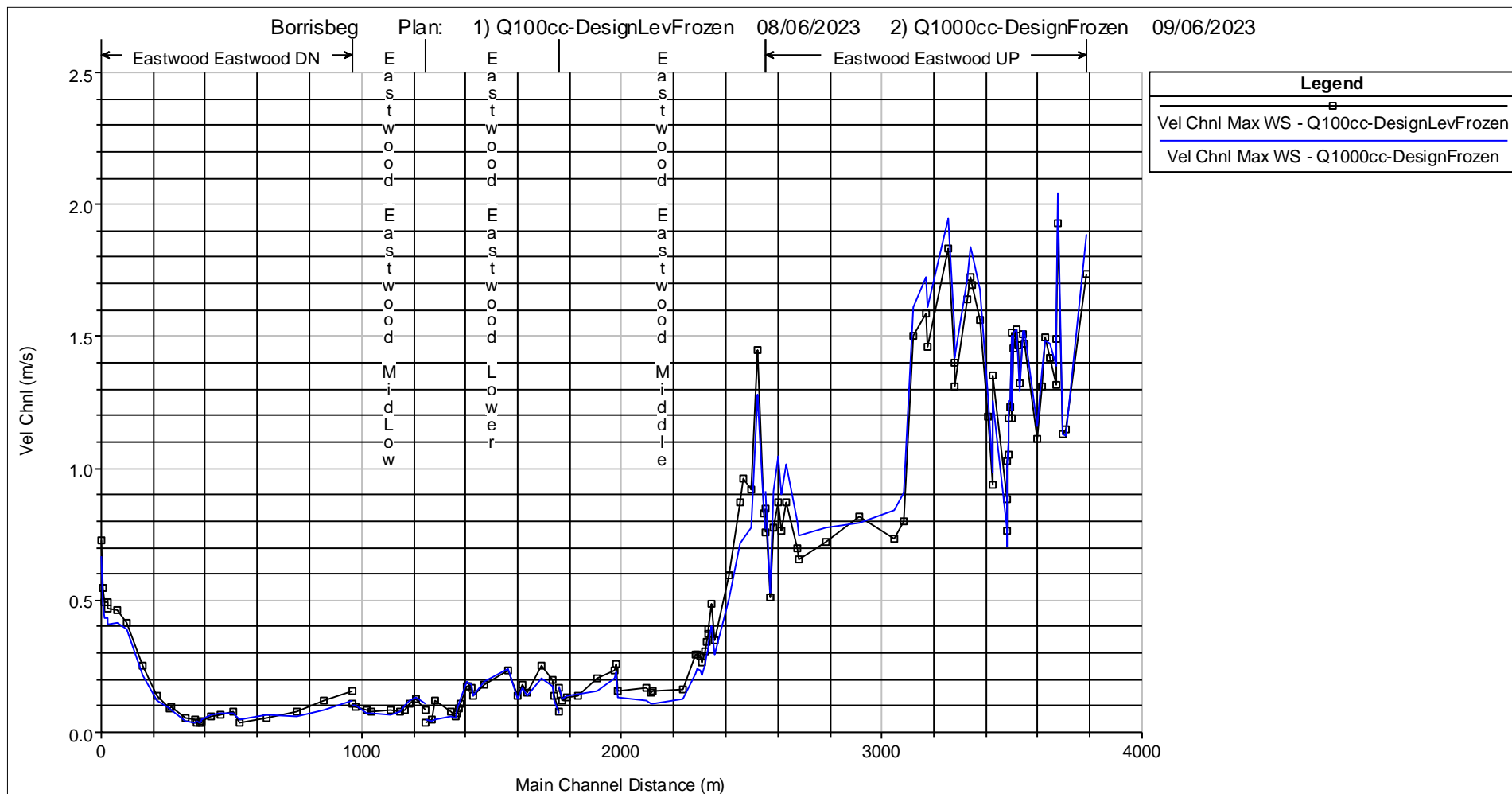


Figure 6.9. Eastwood Longitudinal profile showing flow velocity in the river channel for Design River System for Q<sub>100cc</sub> and Q<sub>1000cc</sub>.

## 6.2.5 Velocity distribution

A comparison of Figure 5.12 with Figure 6.8 data gives the impact on mean velocity along the River Suir a channel for the existing and design river systems. It is apparent that there is no perceptible change in the velocities. The velocities are relatively low and range between 1m/s and 2m/s along the river reach. These velocity values for such an extreme flood event should give no cause for concern for the development but as a precaution rock armouring of the hardstands, designed to withstand velocities in excess of 1.5m/s, should be provided at the appropriate locations.

A comparison of Figure 5.13 with Figure 6.9 gives the velocity distribution impact for the Eastwood channel and again the velocity pattern is similar; with velocities ranging from 0.5m/s to 2m/s.

**Note:**

**Figures which give velocity distributions and flood maps are in Appendices B & C and have the identifier label in the main text of Figure 8.1-Figure 8.2 and Figure 8.5-Figure 8.6.**

Figure 8.5 and Figure 8.6 (in Appendix B) give maps of the velocity distribution throughout the site for  $Q_{100cc}$  and  $Q_{1000cc}$ . It is clear that, in general, velocities are at an acceptable level and slightly higher velocities occur downstream of the wind farm.

## 6.2.6 Flood Maps for design System

Figure 8.7 (Appendix C) gives the flood map for the extreme 100-year flood with Climate Change factored in ( $Q_{100cc}$ ). The main access roads affected are in the vicinity of turbines T7, T8 and T9 where there is significant flooding with relatively high water depths (0.1 to 0.7m). It is important that the turbine hardstands at these locations should be elevated with ground levels higher than the extreme flood level. The access roads to these elevated hardstands should be ramped at a suitable gradient for heavy vehicle access. The Design model used in the hydrological/hydraulic simulations has accounted for elevated hardstands and ramped approach roads

Figure 8.8 (Appendix C) gives the flood map for the extreme 1000-year flood with Climate Change factored in ( $Q_{1000cc}$ ). The main access roads affected are in the vicinity of turbines T03, T04, T7, T8 and T9 where there is significant flooding with relatively high water depths (circa 0.4 to 1.4m). It is important that the turbine hardstands at these locations should be elevated constructions with ground levels c. 0.5m higher than the extreme flood level. The access roads to these elevated hardstands should be ramped at a suitable gradient. The Design model used in the hydrological/hydraulic simulations has accounted for elevated hardstands and ramped approach roads.

A comparison of the flood extent for Zone A and Zone B for Existing and Design river system is shown in Appendix C in Figure 8.9 and Figure 8.10 respectively. The impact of the wind turbine hardstands and roads on the flood extent for both flood zones A and B is minimal and is further discussed in section 6.4.3.

Figure 8.11 and Figure 8.12 in Appendix C show the difference between Design and Existing water levels for  $Q_{100cc}$  and  $Q_{1000cc}$  flood flows respectively. Only a minor water level rise of +0.01m is evident along the site for  $Q_{100cc}$  (Zone A) flows. This rise is associated with wind turbine hardstands which have been raised above extreme flood levels. For the  $Q_{1000cc}$  flows very little changes of water levels are noted when compared Design with Existing river system.

## 6.2.7 On site impact assessment

The proposed flood protection works for the development involve the construction of a flood terrace, to form the hardstands to a levels that are shown in Table 6.3 for turbines T03, T04, T07-T09.

A comparison of water levels and flow velocities in the channel, between existing and design river system imply that there would be no significant change in water levels and in flow velocities. **This means that all normal river flows remain unaffected by the proposed flood protection works.**

Some minor increase of flood extents (see section 6.4.3) due to the extraction of effective storage volume, (see 6.4.5) due to hardstands is noted, however this increase is localised and not significant.

An assessment of flow velocities for extreme flood flows shows that there will be no increase in the potential for erosion within main river channels. Furthermore, there will be no increase of flooding risk, since water levels are not increased by the development.

## 6.2.8 Flood Mitigation for design river system

### 6.2.8.1 Existing Culverts

The existing river system of main channels, tributaries and drainage channels has a number of existing culverts which influence the hydrological characteristics of the catchment. These culverts have been modelled accurately within the HEC-RAS model. The overall effect of these existing culverts is to increase the storage within the catchment thus attenuating flood flows. The development should not interfere with the existing storage and therefore the hydraulic characteristics of existing culverts should not be changed if possible.

### 6.2.8.2 New Culverts / Bridges

One new bridge (C1) and two new culverts (C1 and C3) will be required at points where the proposed access roads cross waterways. Figure 6.10 identifies the locations where new culverts are required. Proposed bridges and culverts with their location and description are listed in Table 6.2 below.

**Table 6.2. Proposed new bridges and culverts with description and location.**

No	Crossing ID	Type	X [m]	Y [m]	Shape: Dimensions (W, D, H, L)	Notes
1	C1	Culvert	613151.25	676139.94	Pipe: D =1.20m L = 5.5m	River Suir
2	C2	Bridge	612754.11	674311.31	Box: W=3m H=1.5m L = 6m	Eastwood
3	C3	Culvert	613300.03	674080.89	Pipe: D =0.90m L = 6.0m	Drain 01

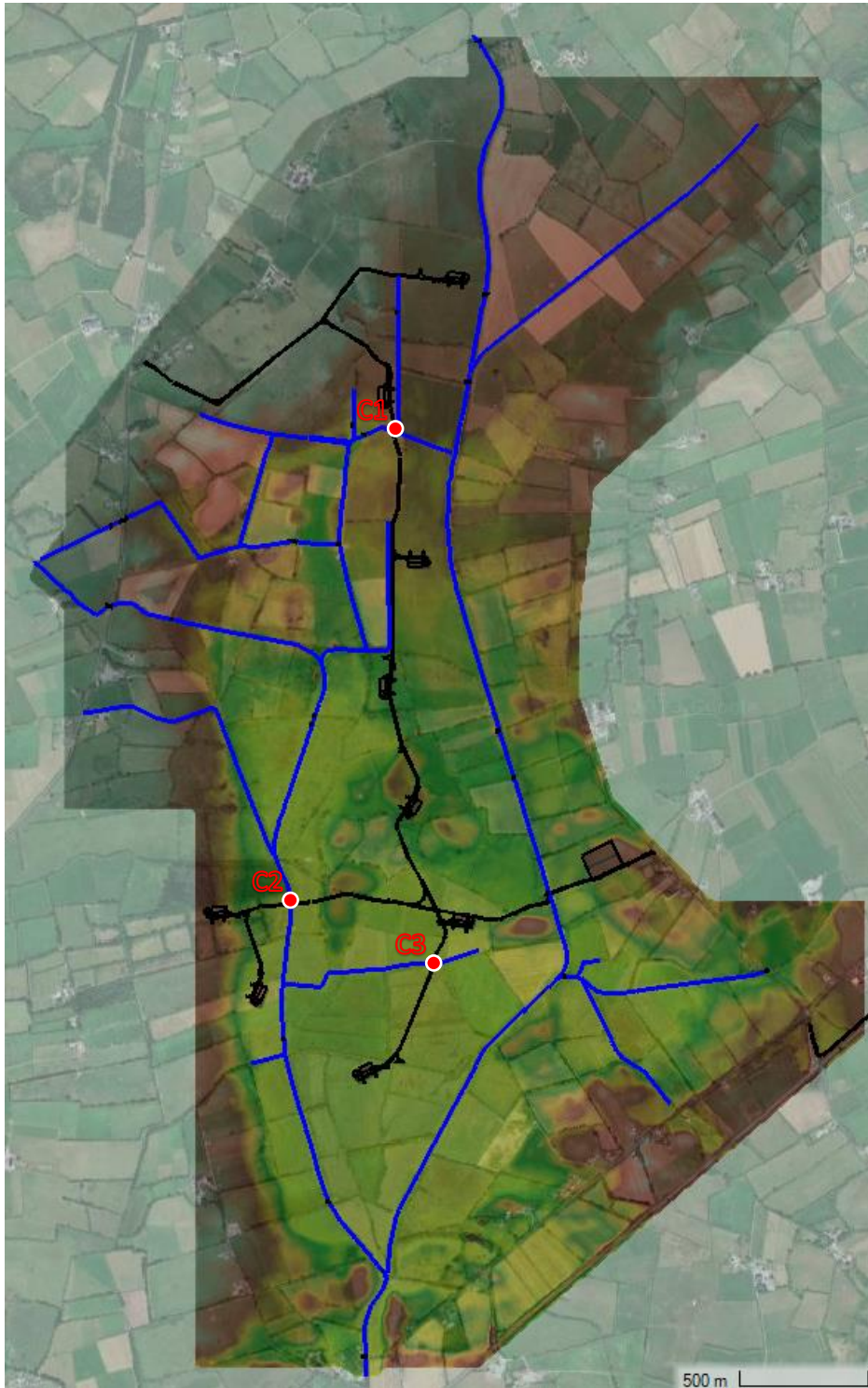


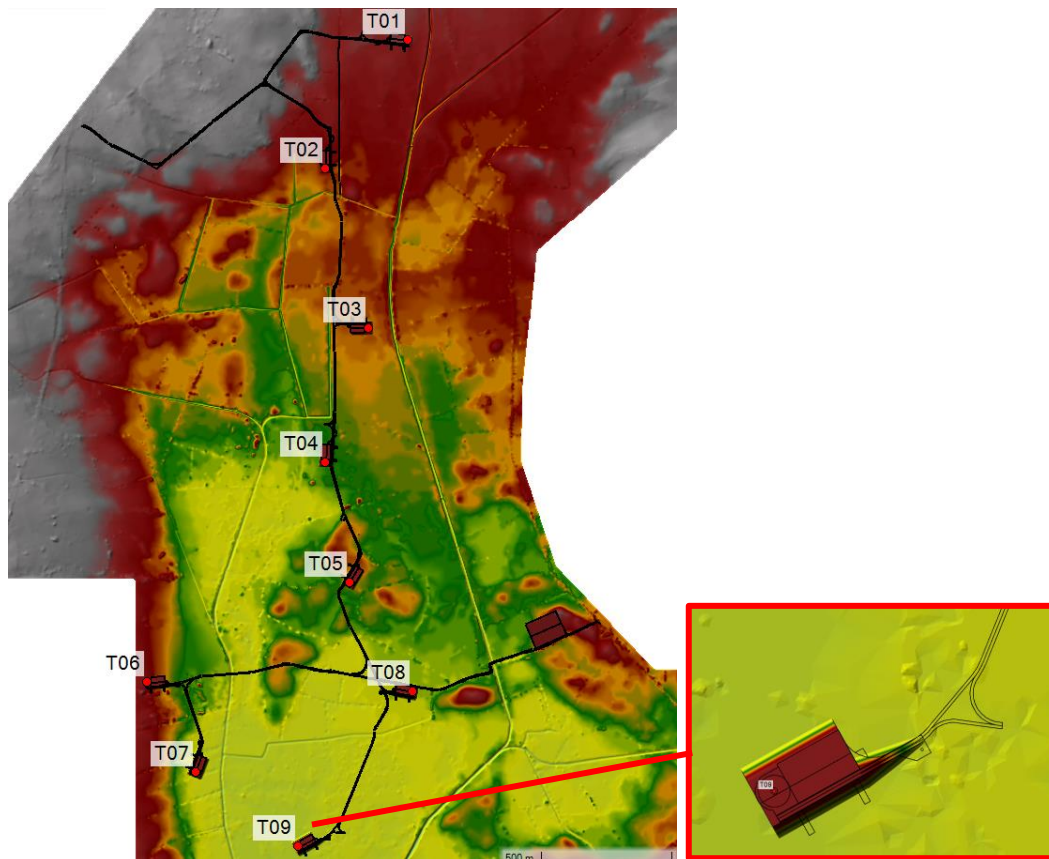
Figure 6.10. New culvert locations.

### 6.2.8.3 Wind turbine hardstands

Hardstands are required at each of the nine turbines and have been modelled in detail in the Design system HEC-RAS model. The hardstands required for turbines T03, T04, T07, T08 and T09 should have finished ground levels with freeboard of c. 0.5m above  $Q_{100cc}$  design flood levels, in accordance with table below.

**Table 6.3. Wind turbine hardstands Finished Ground levels.**

No	Turbine ID	Finished ground Levels FFL [mOD]	Q100cc		Q1000	
			WL [mOD]	Max Depth [m]	WL [mOD]	Max Depth [m]
1	T03	110.6	110.01	0.01	110.07	0.07
2	T04	109.3	108.76	0.05	108.82	0.10
3	T07	108.7	108.00	1.25	108.17	1.42
4	T08	108.7	108.13	0.52	108.21	0.60
5	T09	108.7	107.99	1.24	108.16	1.41



**Figure 6.11. Wind turbine Hardstands location and typical close-up layout.**

#### 6.2.8.4 Wind farm sub-station

Windfarm sub-station is placed of Flood zones A and B.

## 6.3 ASSESSMENT OF SURFACE WATER DRAINAGE RISK

### 6.3.1 Calculations showing the pre- and post-development peak run-off flow rate for the critical rainfall event

The OPW River Basin Management measures at the location of the site suggest to 'ensure that all new developments incorporate sustainable drainage systems (SuDS)' and 'provide adequate storm water infrastructure in order to accommodate the planned levels of growth expected in the County'. The drainage from the site, e.g. from turbine hardstands and widened road network will be taken to the Suir and Eastwood rivers Notwithstanding the above, runoff calculations associated with the development are presented in this report for completeness.

The increased runoff from the site was calculated using the Modified Rationale Formula. Based on an increase in impermeable surface area for ten turbine hardstands<sup>3</sup> (runoff coefficient = 0.9) from 0m<sup>2</sup> (existing - runoff coefficient = 0.5) to 61981m<sup>2</sup> (hardstands 3,143x9= 28,287m<sup>2</sup> and new proposed roads 33,694m<sup>2</sup>) the increase in runoff was determined for the 100-year rainstorm event. The rainfall intensity taken for this calculation was 106.2mm/hr obtained Met Eirann DDF tables (Annex I) for a duration of 10mins.

The calculation gave a total increase in flow to the river which peaks at a value of  $Q_{\text{increased}} = 0.73\text{m}^3/\text{s}$  ( $Q_{\text{design}} = 1.645\text{m}^3/\text{s} - Q_{\text{exist}} = 0.914\text{m}^3/\text{s}$ ). This is relatively low flow increase (1.8% of  $Q_{100\text{cc}}$  flow) and it is not expected to have effect on water levels in the river. Sustainable Drainage Systems is designed for the rain duration of 1hour for each turbine hardstand (Area of single hard stand is 3,143m<sup>2</sup>) and new design roads (33,694m<sup>2</sup>). The calculated volume of excess water in 1 hour per single hardstand is 334m<sup>3</sup> and for roads is 3358 m<sup>3</sup>. One option for SuDS:

- Design of open collection/attenuation ponds. The attenuation pond should be 1.0m deep with an area of 350m<sup>2</sup> per hardstand and 3600 m<sup>2</sup> for all roads. The attenuation ponds should be distributed at appropriate locations throughout the wind farm site taking advantage of natural depressions and existing drainage channels. (The attenuation ponds could tie in with silt management systems using silt traps which would normally be employed during construction).

<sup>3</sup> Total area single turbine hardstand is 3143m<sup>2</sup>

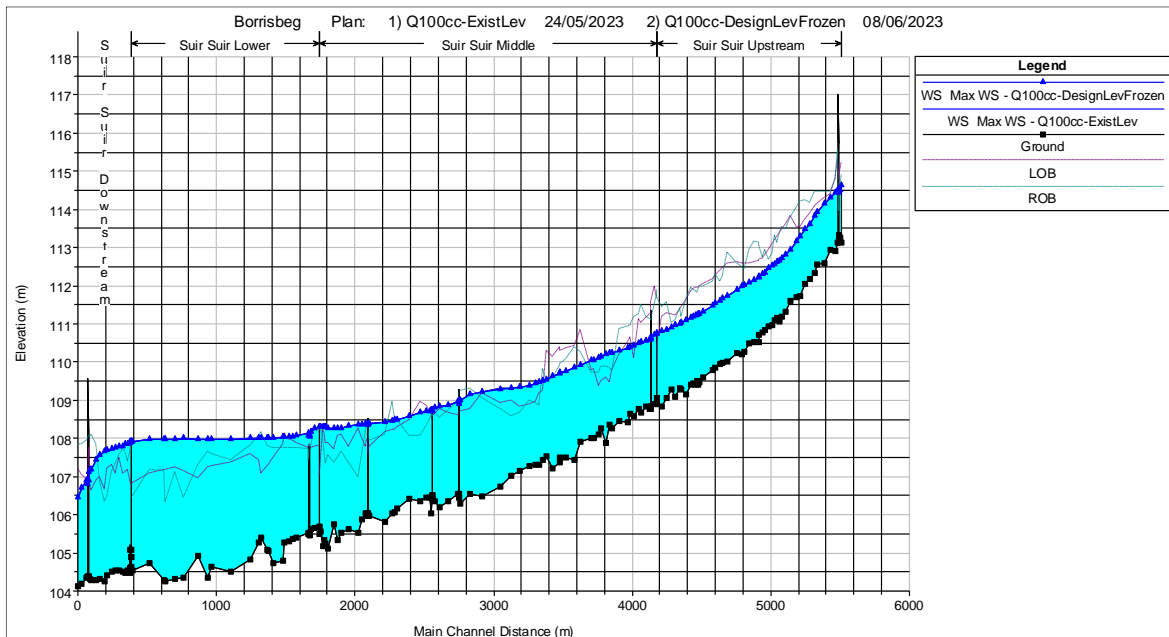


## 6.4 POTENTIAL IMPACT OF DEVELOPMENT ON FLOODING ELSEWHERE

Proposals at the site must not worsen flood risk at other developments, be they upstream, downstream or adjacent to the site. The off-site impacts associated with the development are identified in sections below.

### 6.4.1 Water level comparisons

There are two main river channels within the zone of influence of the wind farm. The main River Suir channel and the Eastwood tributary channel. Figure 6.12 below, for the main River Suir channel, gives the longitudinal profiles for the Existing River System and the Final Design River System - one superimposed on the other. It is clear that the two water surface profiles are co-incident which confirms that the construction of the wind farm involving access roads and turbine hardstands has no impact on the water levels for the extreme  $Q_{100cc}$  flood event. Figure 6.13 gives the  $Q_{100cc}$  longitudinal profiles for the Eastwood channel and again the surface profiles are co-incident for the existing and Design River Systems confirming no water level change due to the windfarm construction.



**Figure 6.12. Suir Longitudinal profile showing water levels in the river channel for Existing and Design River System for  $Q_{100cc}$ .**

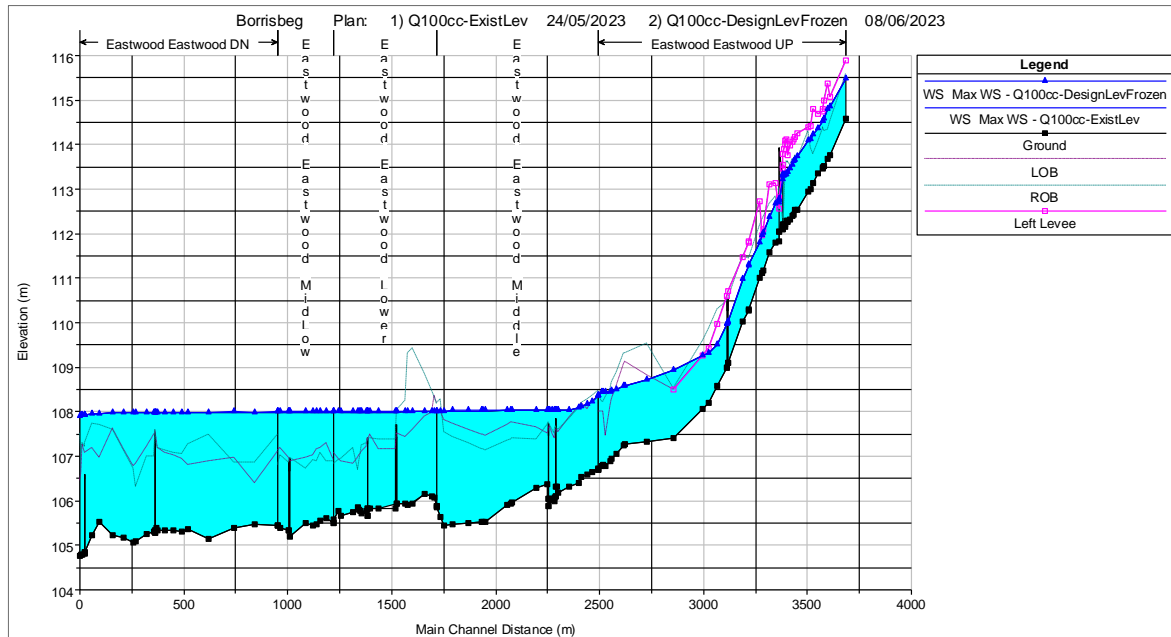


Figure 6.13. Eastwood Longitudinal profile showing water levels in the river channel for Existing and Design River System for  $Q_{100cc}$ .

### 6.4.2 $Q_{100cc}$ MRFS Velocity distributions

Figure 6.14 below gives the mean velocity along the River Suir channel for the existing and design river systems. It is apparent that there is no perceptible change in the velocities. The velocities range between 1m/s and 2m/s along the river reach. These velocity values for such an extreme flood event should give no cause for concern for the development but as a precaution, rock armouring of the hardstands, designed to withstand velocities of 2m/s should be provided at the appropriate locations.

Figure 6.15 gives the velocity distributions for the Eastwood channel and again the velocity pattern is similar; with velocities ranging from 0.5m/s to 2m/s.

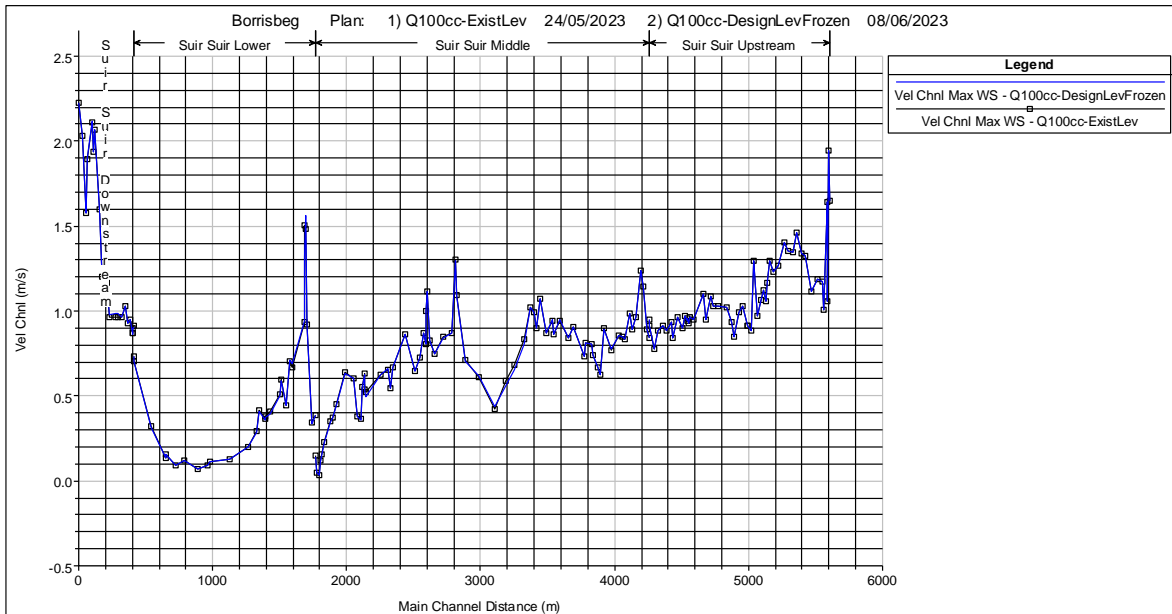


Figure 6.14. Suir Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for  $Q_{100cc}$ .

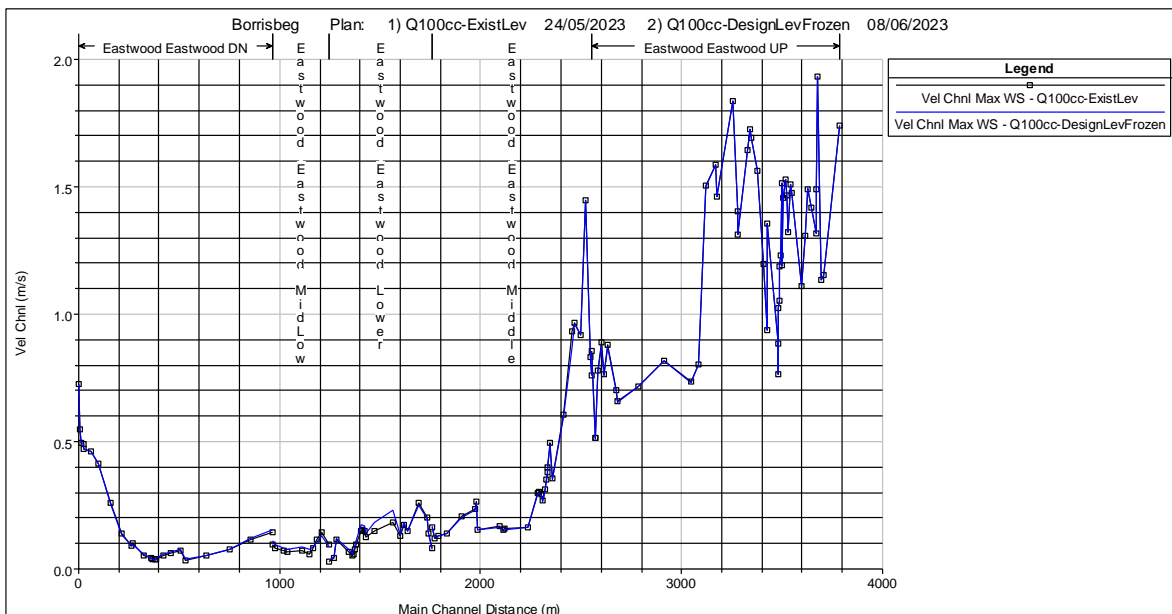
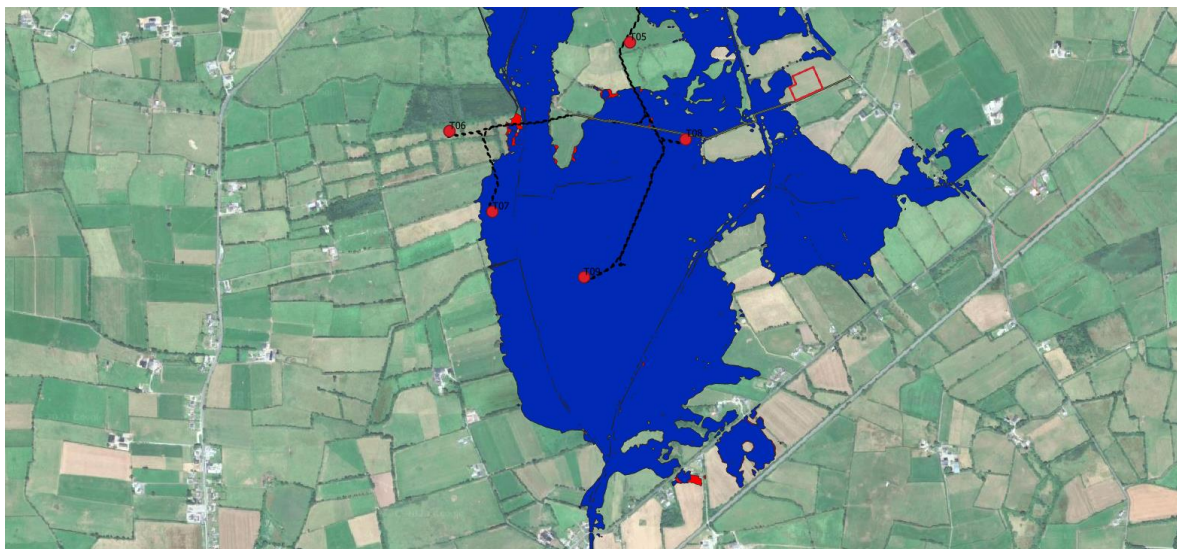
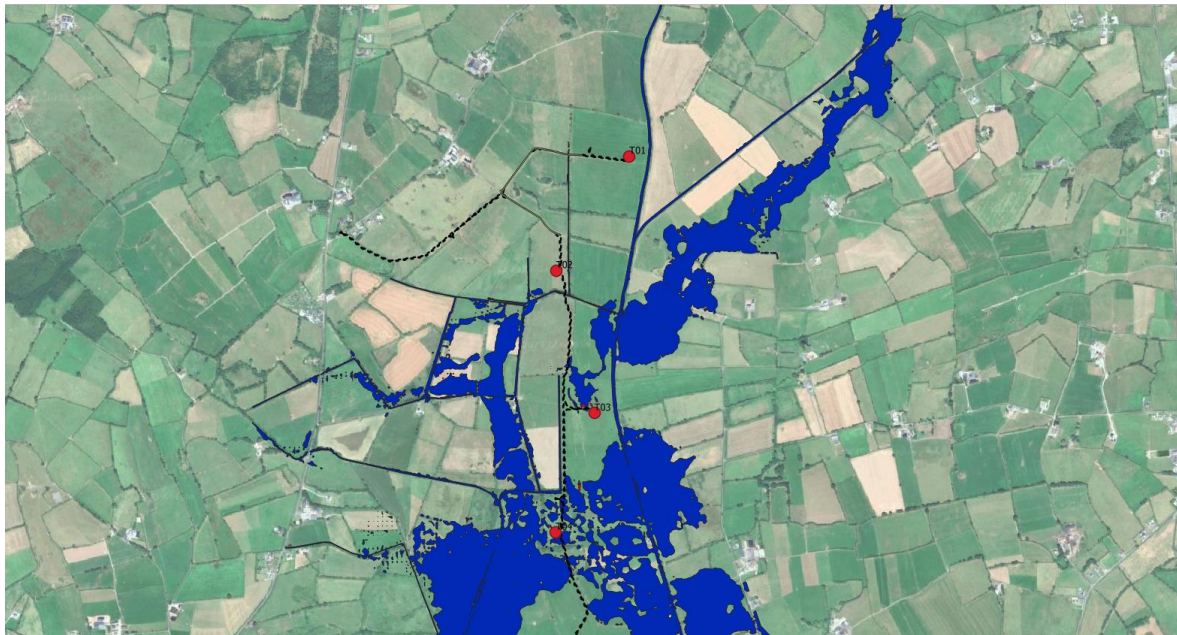


Figure 6.15. Eastwood Longitudinal profile showing flow velocity in the river channel for Existing and Design River System for  $Q_{100cc}$ .

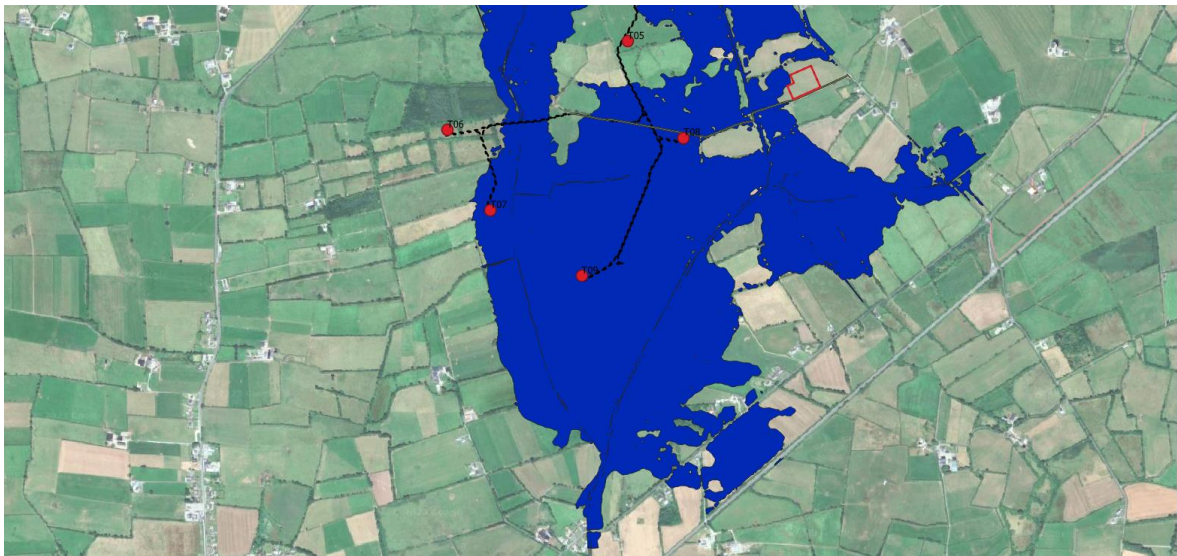
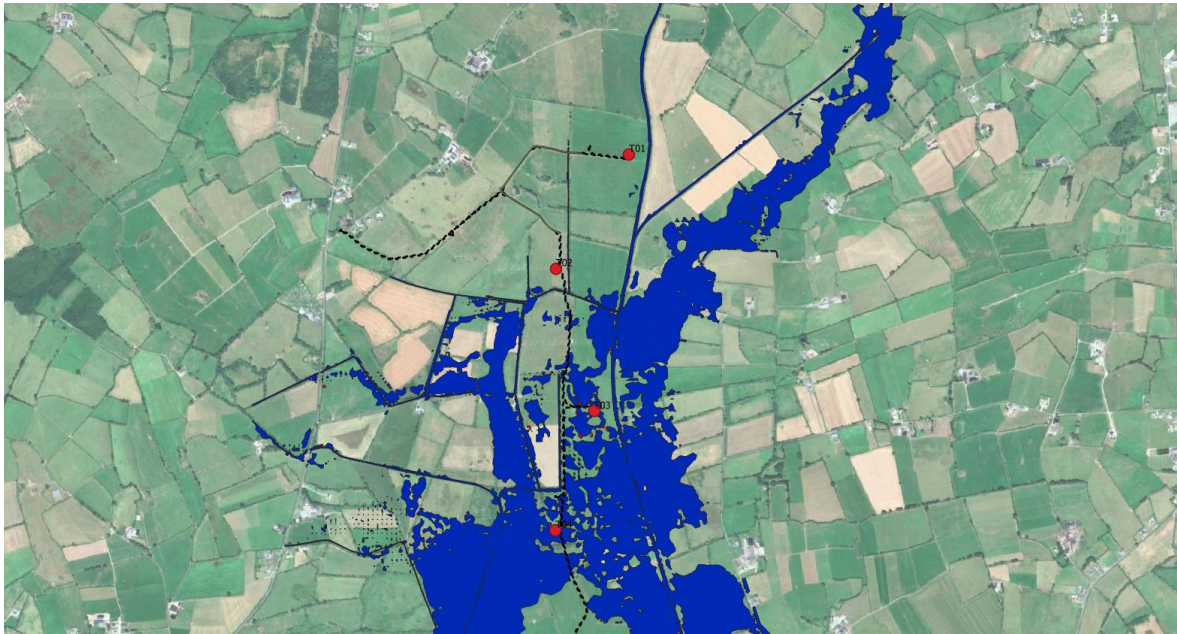
### 6.4.3 Flood Extent comparisons

Flood extent for both Zone A and B note small increase (almost imperceptible red hatch shown in figures below) of flood extent around the proposed site area (middle of the model) for the design river system. This increase in flood extent is associated with construction of turbine hardstands. Differences are more notable for flood Zone A –  $Q_{100cc}$ , than in flood Zone B –  $Q_{1000cc}$ .

#### 6.4.3.1 Flood Zone A



### 6.4.3.2 Flood Zone B



#### 6.4.4 Hydrograph comparisons for $Q_{100cc}$

The hydrographs for the existing river system was compared to the hydrograph for the design River system at a number of locations as shown in Figure 6.16 below.

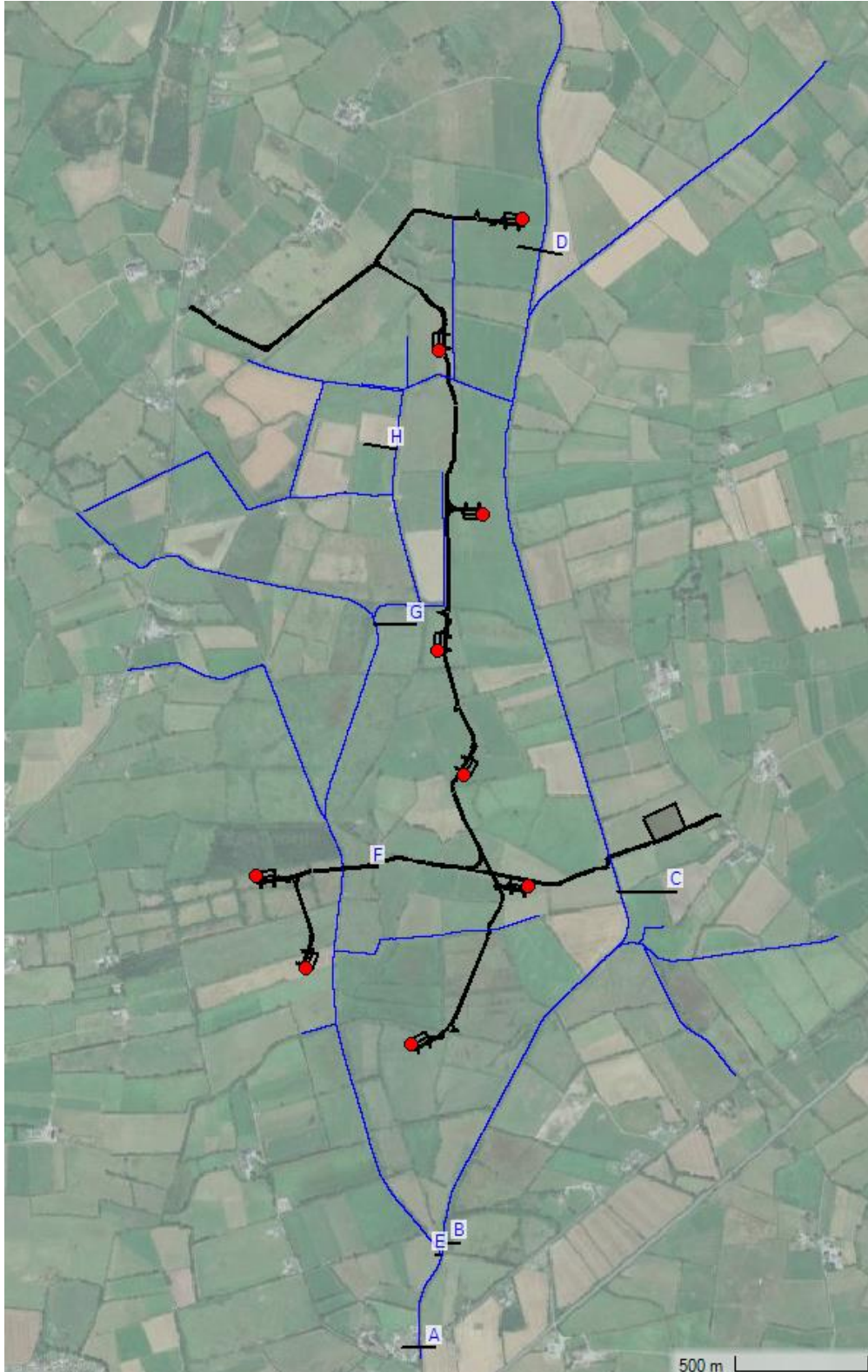
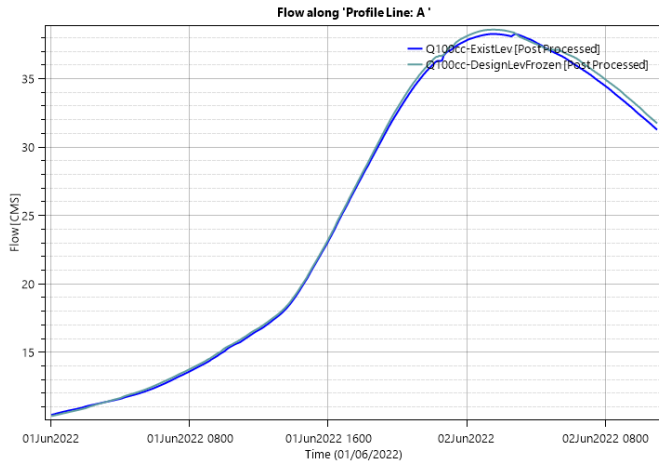


Figure 6.16. Hydrograph comparison locations for  $Q_{100cc}$  design flow.

Figure 6.17(a),(b),(c),(d),(e),(f) & (g) gives the comparisons and it is clear that there is only minor changes in the sub-catchment flood flow values at the downstream points (in some cases there is a flow reduction).

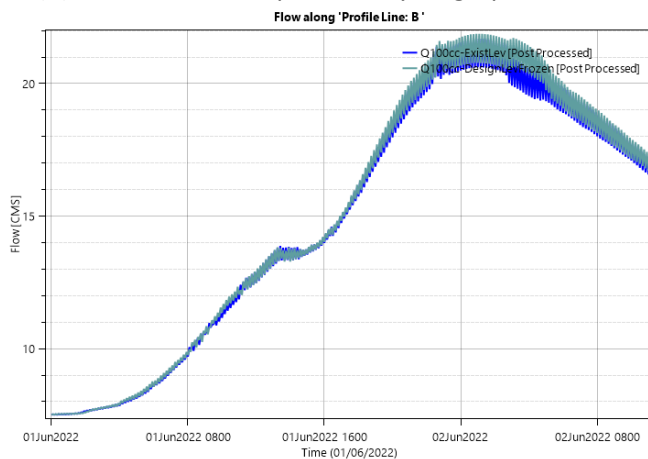
**Figure 6.17. Hydrograph comparisons at the above locations for Q<sub>100cc</sub> design flow.**

(a) Location A - Output flow hydrographs for Q<sub>100cc</sub>



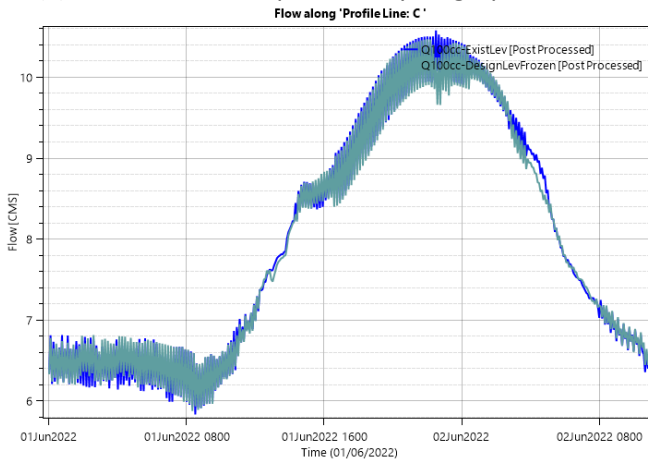
Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
38.28	38.60	+0.32	+0.83%

(b) Location B - Output flow hydrographs for Q<sub>100cc</sub>



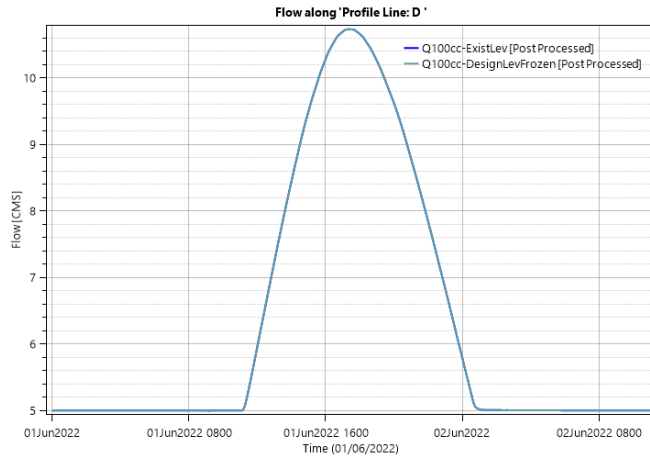
Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
21.70	21.88	+0.18	+0.83%

(c) Location C - Output flow hydrographs for Q<sub>100cc</sub>



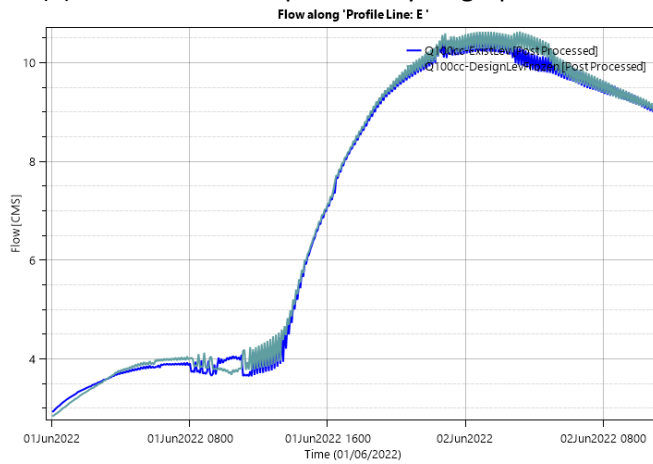
Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
10.58	10.47	-0.11	-1.02%

(d) Location D - Output flow hydrographs for Q<sub>100cc</sub>



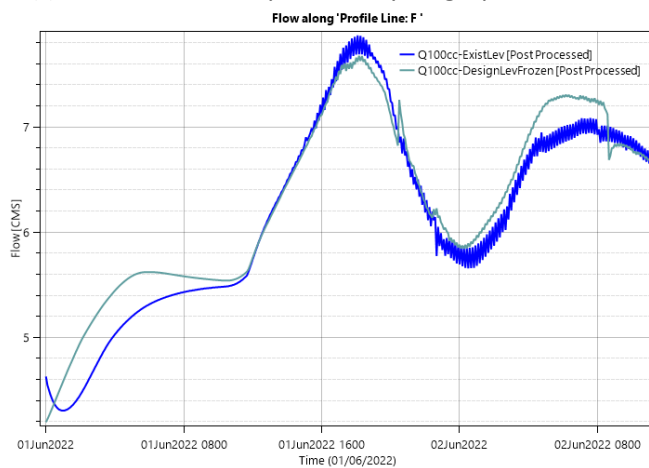
Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
10.73	10.73	0.00	0.00%

(e) Location E - Output flow hydrographs for Q<sub>100cc</sub>



Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
7.87	7.67	-0.19	-2.48%

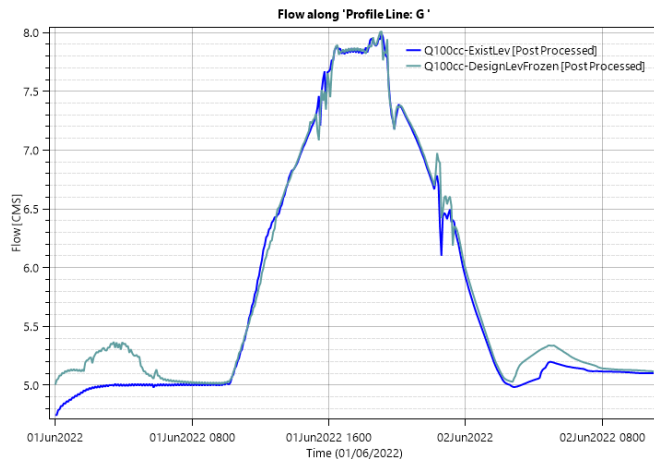
(f) Location F - Output flow hydrographs for Q<sub>100cc</sub>



Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
7.67	7.65	-0.01	-0.18%



(g) Location G - Output flow hydrographs for Q<sub>100cc</sub>



Q <sub>100cc</sub> Exist [m <sup>3</sup> /s]	Q <sub>100cc</sub> Design [m <sup>3</sup> /s]	ΔQ [m <sup>3</sup> /s]	ΔQ [%]
7.99	8.01	+0.02	+0.23%

### 6.4.5 Loss of storage

Approximate loss of storage for Q<sub>100cc</sub> flood event is around **storage loss of  $V_{loss}^{net} = -8,014.65m^3$  on the floodplain at the proposed site**. The figure  $V_{loss}^{net}$  [m<sup>3</sup>] was calculated for a total of three hardstands with an area of 3143m<sup>2</sup> for each hardstand for turbines T07, T08 and T09 with average water depth of 0.75m, 0.40m and 1.40m respectively (conservative approximation).

### 6.4.6 Increased run-off

The increase of run-off due to construction of hardstands is mitigated by incorporating a SuDS system of runoff management. The potential increase of the runoff due to construction of hardstands is estimated to be 0.73m<sup>3</sup>/s (see section 6.3.1). SuDS are therefore required. The runoff increase and proposed SuDS dimensions are given in section 6.3.1.

## 6.5 RESIDUAL RISKS

Residual flood risks include the failure of flood management infrastructure or a severe flood event that exceeds a flood design standard.

### 6.5.1 Failure scenarios and flood resilient building design

According to the OPW Guidance, assessment of flood defence breaching should be undertaken on the basis of a design event of the appropriate design standard. The flood protection system involving a raised terrace which is extremely stable, is not liable to structural failure in the same way as an embankment or levee and as such does not pose a risk due to failure.

The proposed design standard is 1% AEP for river flooding and 0.5% AEP for flooding from the sea, including an allowance for climate change. Assessment of overtopping of flood defences should be undertaken on the basis of the 0.1% AEP event, including an allowance for climate change.

In order to mitigate residual flood risk, it is proposed that the properties should be constructed with their finished floor/ground levels at such a height greater than:

(the 1000-year flood) + (an allowance for climate change) + freeboard

There is a single pronounced levee Figure 3.3 at the left bank of Eastwood Stream. The residual risk of this levee was tested by modelling of the system with and without (failure) of this levee. The analysis showed no difference in flood extent or water levels as the levee is overtopped and flooded for both  $Q_{100cc}$  and  $Q_{1000cc}$  flood flows. Therefore there is no risk associated with failure scenarios.

### 6.5.2 Access and egress

According to the flood extent maps and Figure 6.18, access and egress to and from the site is provided at two points first is on the west at N62 road and second to the East from local road L7039.

Both access and egress points are not prone to flooding.

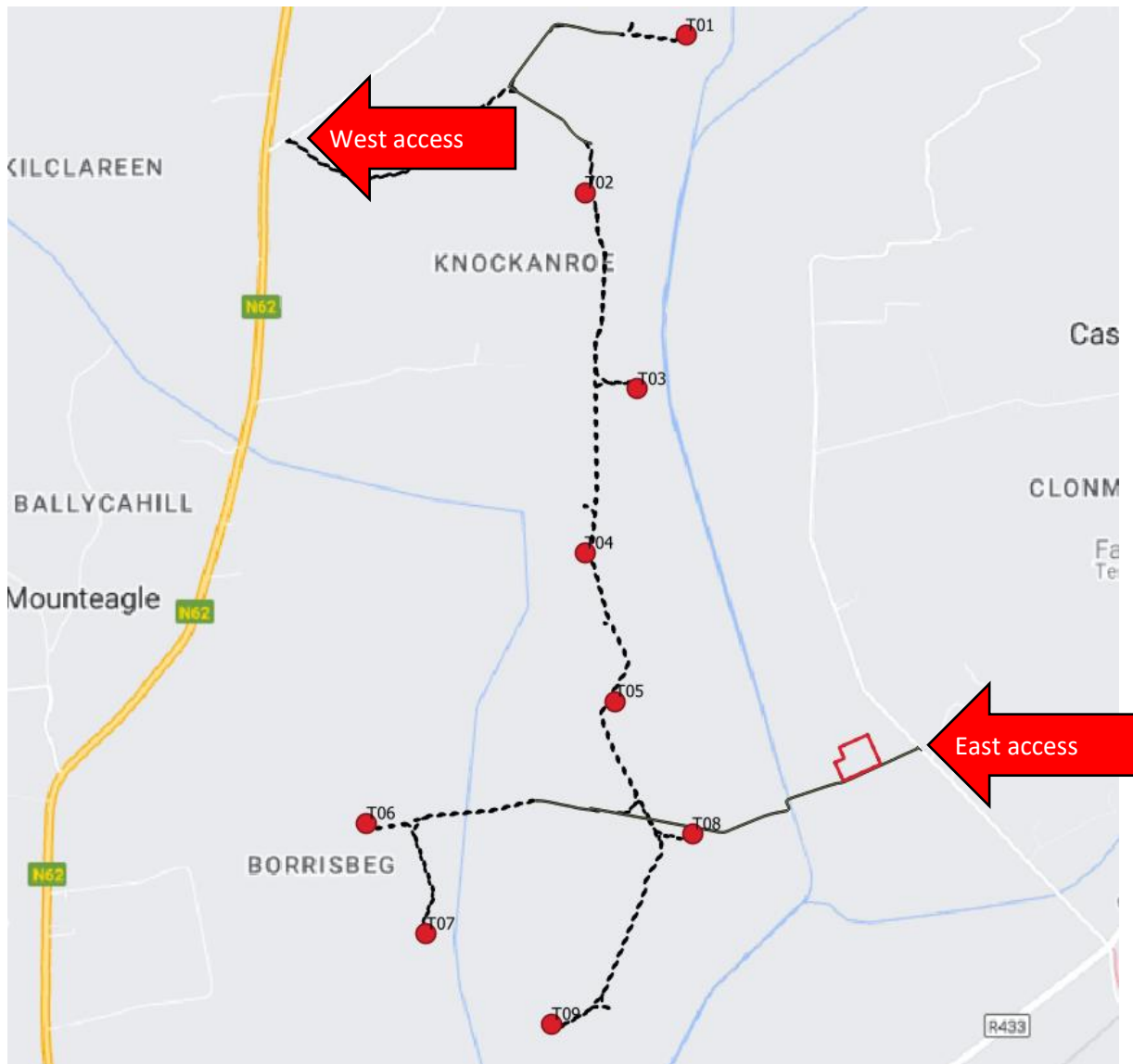


Figure 6.18. Layout of emergency access and egress road

## 6.6 JUSTIFICATION TEST

The Justification Test of the OPW Guidelines [1] has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk.

According to the requirements of the Guidelines, in the Justification Test, a sequentially-based decision-making process was applied, through Part 1 and Part 2 presented below.

The first is the Plan-making Justification Test described in chapter 4 of the Guidelines [1] and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. The second part relates to the development management.

### 6.6.1 Part 1 - Plan Making Justification Test

As the proposed development site falls within Zone A with high risk of flooding, a Justification Test needs to be undertaken to review issues of proper planning and sustainable development.

The proposed development site is located north of town Templemore in Co. Tipperary, and is at risk of fluvial flooding (Flood zone A). The site is outside of Local Area Plans as shown in Annex D. However, according to the Co. Tipperary Energy plan as part of Development Plan 2022-2028 [11] (Figure 0.1 and Figure 0.2) the site is within “Areas Open for Consideration for New Wind Energy Development”.

Therefore it can be concluded that the requirements of Justification Test Part 1 are **satisfied**.

### 6.6.2 Part 2 – Development Management Justification Test

If the requirements of Part 1 are satisfied, then the following additional detailed criterion should also be met. The development has been the subject of a sufficiently detailed Flood Risk Assessment, as appropriate to the nature and scale of the development, and the potential risk that may arise, which is demonstrated below.

This abstract from the OPW Guidelines [1] describe the Justification Test application.

”

#### Application of the Justification Test in development management

- 5.15 Where a planning authority is considering proposals for new development in areas at a high or moderate risk of flooding that include types of development that are vulnerable to flooding and that would generally be inappropriate as set out in Table 3.2, the planning authority must be satisfied that the development satisfies all of the criteria of the Justification Test as it applies to development management outlined in Box 5.1 below.

**Box 5.1 Justification Test for development management  
(to be submitted by the applicant)**

When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied:

1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines.
2. The proposal has been subject to an appropriate flood risk assessment that demonstrates:
  - (i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
  - (ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
  - (iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
  - (iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: See section 5.27 in relation to major development on zoned lands where sequential approach has not been applied in the operative development plan.

Refer to section 5.28 in relation to minor and infill developments.

1. The development lands have not been zoned by Tipperary County Council.
  - i. The LAP zoning (Annex G) shows that the development is located outside of the any, e.g. Templemore Local Area Plan Zoning.
  - ii. However, Figure 8.13. Suitability of wind farm development for Tipperary Co. Co. and Figure 8.14. Map 2 Wind Energy Policy Areas (in Annex F) suggest that the site is **within Areas open for consideration for New Wind Energy Development**
2. The proposal has been subject to an appropriate Flood Risk Assessment:
  - i. Annex H - HEC-RAS output tables and Figure 8.11-Figure 8.12 show detailed comparison in water levels between existing and design river system for  $Q_{100cc}$  and  $Q_{1000cc}$  respectively. For  $Q_{100cc}$  the increase in water levels is +0.01m on average, whilst for  $Q_{1000cc}$  even some reduction in water levels is evident. The scoping process showed that the site area does not act as an effective floodplain due to relatively low flow velocities and higher ground elevations at the site. The low flow velocities at the proposed site are confirmed in the hydraulic model. Comparison of flow velocities implies that there will be no increase in the potential for erosion, which was demonstrated by insignificant flow velocity increases. Calculations of the pre- and post-development peak run-off flow rate gave an increase in flow to the river of  $0.73m^3/s$  for the critical rainfall even, and this relatively low flow (relative to river flows of up to  $41m^3/s$ ) will have no effect on water levels. However SuDS design was proposed to mitigate increase of peak flood flows. Flood hydrograph comparison showed small increase or even reduction in peak flood runoff for  $Q_{100cc}$  and  $Q_{1000cc}$ . Therefore, on the basis of performed calculations, it can be concluded that the site development **will not increase flood risk on the site or elsewhere**.

- ii. A design measures to minimise flood risk includes design of a high level flood terrace, e.g. turbine hardstands with and a 0.5m freeboard for floor levels with ramps to the wind farm road network which is to be finished to exiting ground levels. With the proposed measures the **flood risk to people, property and the environment is minimised** as far as reasonably possible. A comparison of water levels and flow velocity in the channel, between existing and design river system for Design Event 1 comprised 100 years (1% AEP) flows with included climate change of the Suir river and Eastwood stream imply that there would be no change in water levels and in flow velocities. This means that all normal river flow remains unaffected by the proposed flood protection works, and ensures that the existing river main channel remains intact. Therefore, it can be concluded the proposed flood mitigation measures **minimise flood risk to people, property and the environment** as far as reasonably possible.
- iii. According to the flood extend maps, emergency access and egress to and from the site is provided on the east side of the development via the local road L7039 and at the west side from N62 road. Both roads, e.g. access and egress location being outside flood Zone A and B. The proposed finished floor levels of hardstands ensure that the flooding of buildings that are part of Wind Farm are not affected and with on-site road network levels that remain at levels of existing ground ensure that **residual risks to the development can be managed to an acceptable level and that flooding elsewhere is mitigated.**
- iv. The development flood alleviation measures in the form of a simple raised terrace and raised floor levels do not involve any major deviations from what would be considered good urban design.

According to the presented results, it can be concluded that the requirements of Justification Test Part 2 are **satisfied on all defined criteria.**

## 6.7 FLOOD RISK BALANCE SHEET

Flood-risk indicator	Ultra-positive ++	Positive +	Neutral	Negative	Ultra-negative
<i>Is the development within existing flood-risk area?</i>					Risk area within flood zone A
<i>What are the scale and nature of flood risks?</i>	Understood, easy to warn	Predictable			
<i>What scale of residual risk measures will be required?</i>	Measures could eliminate risk to development				
<i>How will egress and access be assured? What will be the emergency planning impact?</i>	Emergency access and egress ensures safe evacuation for 0.1% AEP flow	Hardstands are designed with FFL 1.0m above 0.1% AEP flow levels			
<i>Will there be a change in number of people at risk?</i>			No increase or increase of people at risk		
<i>Will there be a change in number of properties at risk?</i>			Neutral impact		
<i>Will there be an impact of the mitigation measures elsewhere?</i>			Neutral impact		

## 6.8 ENVIRONMENTAL ENHANCEMENT

It is proposed to restore an approximately 240m segment of the Eastwood River within the project site. The Eastwood River within the Project Site is currently in poor condition. It has been straightened and lacks good quality in-stream or riparian habitat. It is proposed to restore appropriate pattern, profile and dimension to the channel with a view to improving stability of the channel and restoring in stream habitat. It is also proposed to establish a natural wooded riparian buffer and to exclude livestock from accessing the restored channel.

The restoration reach is currently approximately 240 meters in length with no sinuosity. It is proposed to construct a new meandering channel with a length of approximately 299m. This will result in a channel sinuosity of approximately 1.32m/m. The new channel (Figure 6.19) will have an average slope of 0.0026 m/m and a bankfull width of 4m. A full assessment on impact of environmental enhancement with details of the concept stream design are provided in Fluvio R&D Ltd. Hydraulic Assessment Report [2]. The Report [2] confirms that impact on the proposed restoration works on the downstream area is zero with slight improvement of flood levels and natural flow conditions locally.



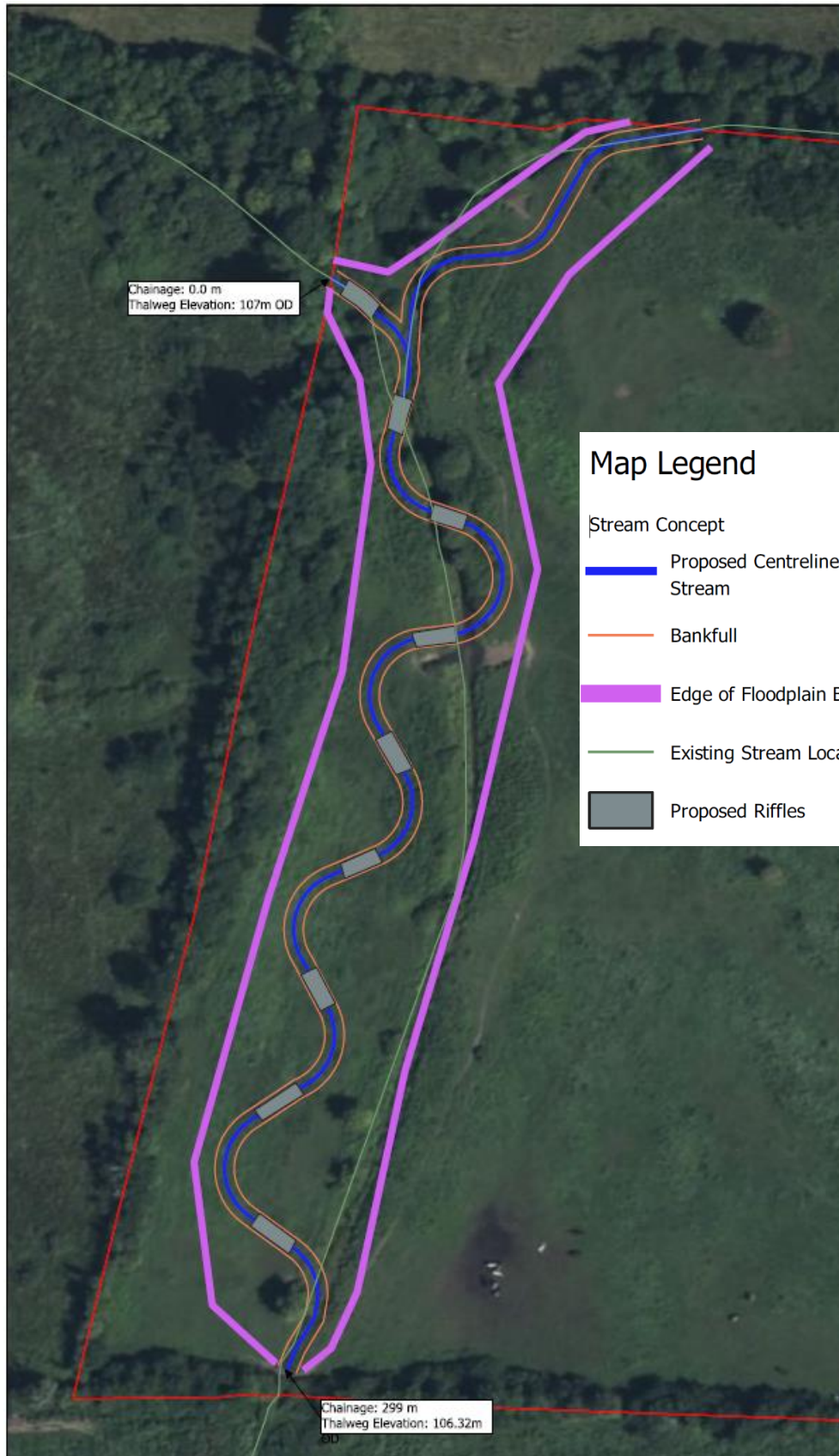


Figure 6.19. Environmental enhancement of Eastwood River reach.

## 6.9 CONCLUSIONS

1. In accordance with the OPW and the Department of the Environment, Heritage and Local Government Guidelines „The Planning System and Flood Risk Management - Guidelines for Planning Authorities“ from November 2009 [1] a flood risk assessment was carried out in three stages

**Stage 1 - Flood risk identification**

**Stage 2 - Initial flood risk assessment.**

**Stage 3 - Detailed flood risk assessment**

2. Stages 2&3 required hydrological and hydraulic analyses as follows:
3. The  $Q_{100cc}$ , and  $Q_{1000cc}$  (including a climate change factor of 1.2) flood flows were obtained from our FSU hydrological study and have the following values  $41.98\text{m}^3/\text{s}$  and  $53.02\text{m}^3/\text{s}$  respectively for total catchment area ( $95.619\text{km}^2$ ). The drainage of the windfarm site is complex involving two main river channels viz. the River Suir and Eastwood fed by a series of smaller stream and drainage channels. The hydrological model used reflects this complexity and is characterized by a network of Hydrological Estimation Points (HEPs) as described in Table 5.1.
4. A detailed river and bridge survey was carried out which were used to develop a digital elevation model of the river and floodplain. The model did not include any detail on the end masts due to the fact that their relatively small footprint is insignificant in relation to the flow and storage of the huge area of the floodplains.
5. An unsteady flow analysis was required for the FRA to assess the development impact on storage and consequently a number of hydrographs for each of the constituent rivers, stream and channels were developed. The 1D2D hydraulic model HecRas v6.2 was created for Existing and Design River System. The 1D model covers a reach of c. 16km, defined by 564 cross sections and a 28 bridges/culverts (Existing river system model contains 22 bridges). The 2D model covers an area of  $10\text{km}^2$ .
6. The following results were obtained for stages 2 & 3
  - a. The Highest predicted water levels are for +0.01m higher than existing water levels. The lowest predicted (design) water levels are for -0.07m lower than existing water levels.
  - b. The results from the simulations showed that there is no change on the longitudinal profile water levels of the  $Q_{100cc}$  and  $Q_{1000cc}$  floods.
  - c. The flow velocities throughout the site range between 0.5m/s and 2.5m/s for the extreme flood event. These velocities are not considered to be of major concern.
  - d. The impact of the development of the storage capacity of the windfarm site was assessed and was demonstrated to be minor by comparing the hydrographs for existing and design river systems at a number of locations and at the downstream end of the site as shown in Figure 6.16 and Figure 6.17.

7. The development design is influenced by the above results as follows:
  - a. Floor levels in the development should be set at a level above water levels for  $Q_{1000cc}$  (Climate Change) + 0.5m additional safety factor freeboard, see Table 6.3.
  - b. The proposed new roads should remain at the same level as existing ground levels in order to ensure natural flow paths over the floodplain and avoid backup of the water.
8. There is an increase in storm runoff from the site as a result of the increase in the impermeable. The increase in flow to the river peaks at a value of  $0.73\text{m}^3/\text{s}$  and is mitigated with the design of SuDS.
9. The question of access and egress from the public road is dealt with as follows:
  - a. Access and egress to and from the site can be provided on the west side via the N62 road or as alternative from the east side of the development via the local road L7039 at an elevation. Both access and egress sites are outside flood zone A and B.
10. Justification test
  - a. The requirements of Justification Test Part 1 - Plan making Justification Test are satisfied on all defined criteria. For the planning elaboration, see the Planning Document.
  - b. The requirements of Justification Test Part 2 - Development Management Justification Test are satisfied on all defined criteria. For the planning elaboration, see the Planning Document.
11. A number of existing culverts throughout the site are function as throttles for flood flows and have the effect of flood flow attenuation. These culverts will not be altered by the wind farm layout design.
12. A number of new culverts have been identified (Figure 6.10) and these can be hydraulically designed using the flows calculated in this study.
13. It is proposed to restore an approximately 240m segment of the Eastwood River to construct a new meandering channel with a length of approximately 299m (Figure 6.19). A full assessment on impact of environmental enhancement are provided in Fluvio R&D Ltd. Hydraulic Assessment Report [2]. The Report [2] confirms that impact on the proposed restoration works on the downstream area is zero with slight improvement of flood levels and natural flow conditions locally.

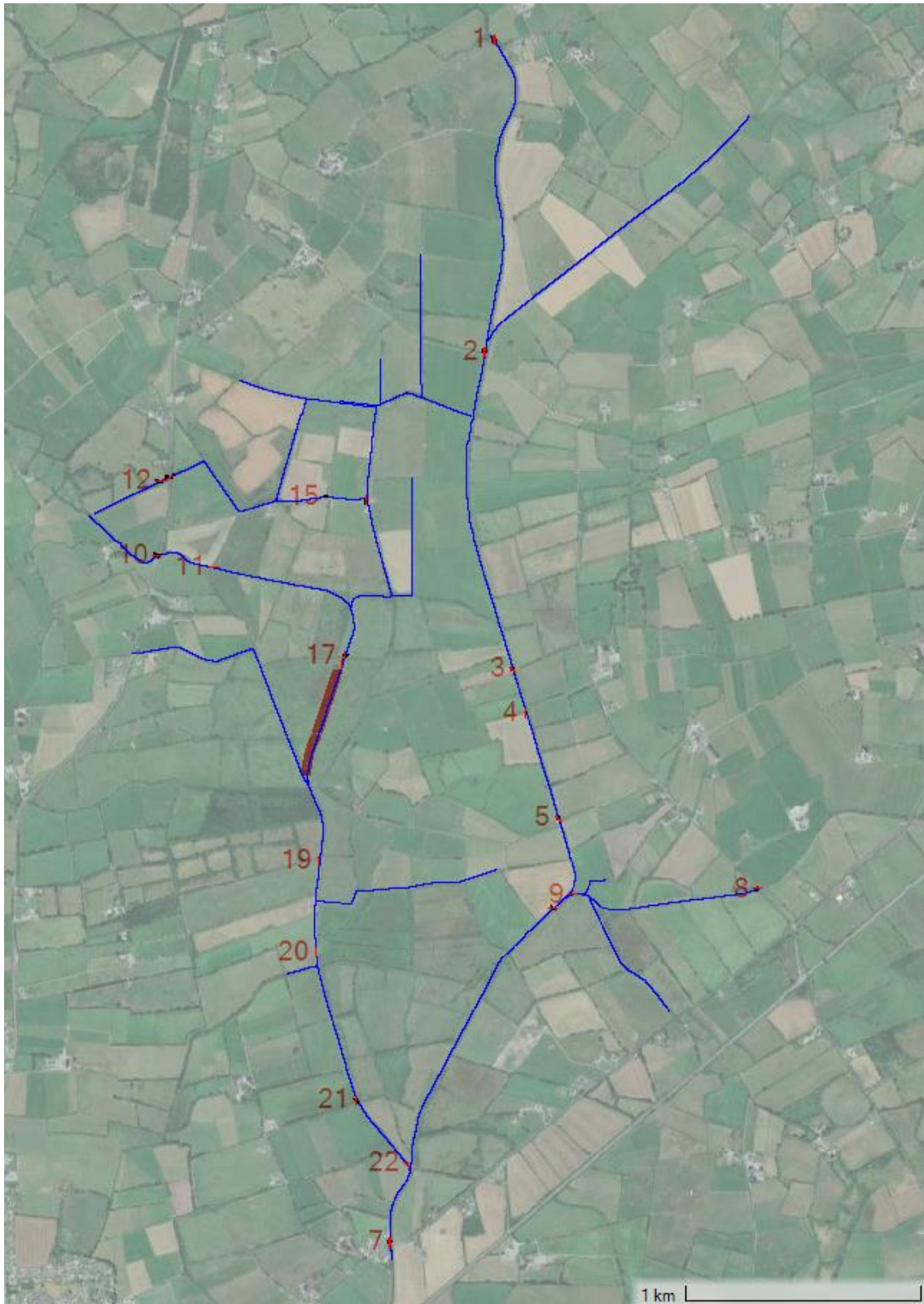
## 7 References



- [1] The Planning System and Flood Risk Management - Guidelines for Planning Authorities, OPW and the Department of the Environment, Heritage and Local Government, November 2009.
- [2] Fluvio R&D Ltd., Hydraulic Assessment of Eastwood Stream Restoration at Borrisbeg, November 2023.
- [3] OPW Planning and Development Flood Policy, published on [www.flooding.ie](http://www.flooding.ie).
- [4] Arterial Drainage Act, 1945.
- [5] Arterial Drainage (Amendment) Act, 1995.
- [6] OPW Flood Hazard Mapping, [www.floodmaps.ie](http://www.floodmaps.ie)
- [7] IPCC 4th Assessment report, 2007.
- [8] Irish Committee on Climate Change – Ireland and the IPCC 4th Assessment Report, 2007.
- [9] IPCC 4th Assessment report, 2007.
- [10] OPW, Flood Risk Management Plan, River Basin (16) Suir, 2018.
- [11] Tipperary Co.Co. & CAAS Ltd., Strategic Flood Risk Assessment – Draft Tipperary County Development Plan 2022-2028, July 2021.
- [12] Tipperary Co.Co, Renewable Energy Strategy - Draft Tipperary County Development Plan 2022-2028, July 2021.
- [13] OPW, The National Preliminary Flood Risk Assessment, March 2012.
- [14] OPW, Suir CFRAM Study - UoM16 Preliminary Options Report, 2016.
- [15] Office of Public Works, Flood Studies Update, Technical Research Report, Volume I, 2014.
- [16] Office of Public Works, Flood Studies Update, Technical Research Report, Volume II, 2014.
- [17] Office of Public Works, Flood Studies Update, Technical Research Report, Volume III, 2014.
- [18] Office of Public Works, Flood Studies Update, Technical Research Report, Volume IV, 2014.

# 8 Appendices

8.1	Annex A - Photos of hydrological features .....	8-2
8.2	Annex B - Existing Flood Maps.....	8-14
8.3	Annex C - Predictive Flood Zones and Flood Maps.....	8-19
8.4	Annex D - Relevant Legislation and Regulations.....	8-28
8.5	Annex E - National Flood Policy .....	8-30
8.6	Annex F - Local Policy on Flood Management .....	8-32
8.7	Annex G - Lap Zonning / Settlement Map .....	8-41
8.8	Annex H - HEC-RAS output tables .....	8-42
8.9	Annex I – Met Eireann DDF table.....	8-58
8.10	Annex J - FSU Report.....	8-59




## 8.1 ANNEX A - PHOTOS OF HYDROLOGICAL FEATURES



Type of structure	Detail
Bridge	<p data-bbox="357 367 1366 448">01-Knockanroe Bridge L3248 road – Three span Arch 2.3m, Beam 3m and 2.2m Arch u/s elevation</p>  <p data-bbox="357 1223 517 1258">d/s elevation</p> 



Type of structure	Detail
Bridge	<p data-bbox="355 331 1374 365">02-Single span 6m concrete bridge Downstream of confluence with Shanakill Stream</p> 
Bridge	<p data-bbox="355 1344 1002 1377">03-Farmer Crossing Single Span beam 4m wide bridge</p> 



Type of structure	Detail
Bridge	<p>04-Farmer Crossing Single Span beam 5m wide bridge</p> 
Bridge	<p>05-Site Road at the bend Single Span beam 4m wide bridge u/s elevation</p>  <p>d/s elevation</p> 
Bridge	<p>06-Metal bridge with stone abutments single span 5m wide Not available</p>

Type of structure	Detail
<p>Bridge</p>	<p>07-Knocknageragh Bridge R433 road arch stone 7m wide span u/s elevation</p>  <p>d/s elevation</p> 
<p>Bridge</p>	<p>08-Single span 4m Arch Stone Road bridge L7039 Not available</p>

Type of structure	Detail
Bridge	<p data-bbox="357 331 863 365">09-Fishing mobile metal bridge single span</p> 
Bridge	<p data-bbox="357 1220 1102 1254">10-College Bridge - N62 road Two span (2m) arch stone bridge</p> 

Type of structure	Detail
Bridge	<p data-bbox="357 331 849 365">11-Farm wooden deck single span bridge</p> 
Culvert	<p data-bbox="357 1220 798 1254">12-Farm Access Culvert 600mm pipe</p> 



Type of structure	Detail
Culvert	<p data-bbox="357 331 1101 365">13-N62 road bridge North 770x1000mm box old stone culvert</p> 
Culvert	<p data-bbox="357 1247 798 1281">14-Farm Access Culvert 600mm pipe</p> 

Type of structure	Detail
Culvert	<p data-bbox="357 331 798 365">15-Farm Access Culvert 600mm pipe</p> 
Culvert	<p data-bbox="357 1198 1366 1232">16-Farm Access Partially collapsed old stone box culvert 850x500mm (d/s elevation)</p> 

Type of structure	Detail
<p>Bridge</p>	<p>17-Farm Access road concrete bridge single span c. 4m wide (u/s elevation)</p> 
<p>Bridge</p>	<p>18-Farm Access road concrete bridge single span 2m wide (u/s elevation)</p> 

Type of structure	Detail
<p>Bridge</p>	<p>19-Cattle Access metal bridge single span 3.2m wide (d/s elevation)</p> 
<p>Bridge</p>	<p>20-Farm Access Bridge single span 2.2m wide (downstream elevation)</p> 



Type of structure	Detail
<p>Bridge</p>	<p>21-Farm Access Bridge single spide 3m wide</p> 
<p>Bridge</p>	<p>22-Metal mobile bridge single span</p> 

## 8.2 ANNEX B - EXISTING FLOOD MAPS

## 8.2.1 Existing Velocity distribution

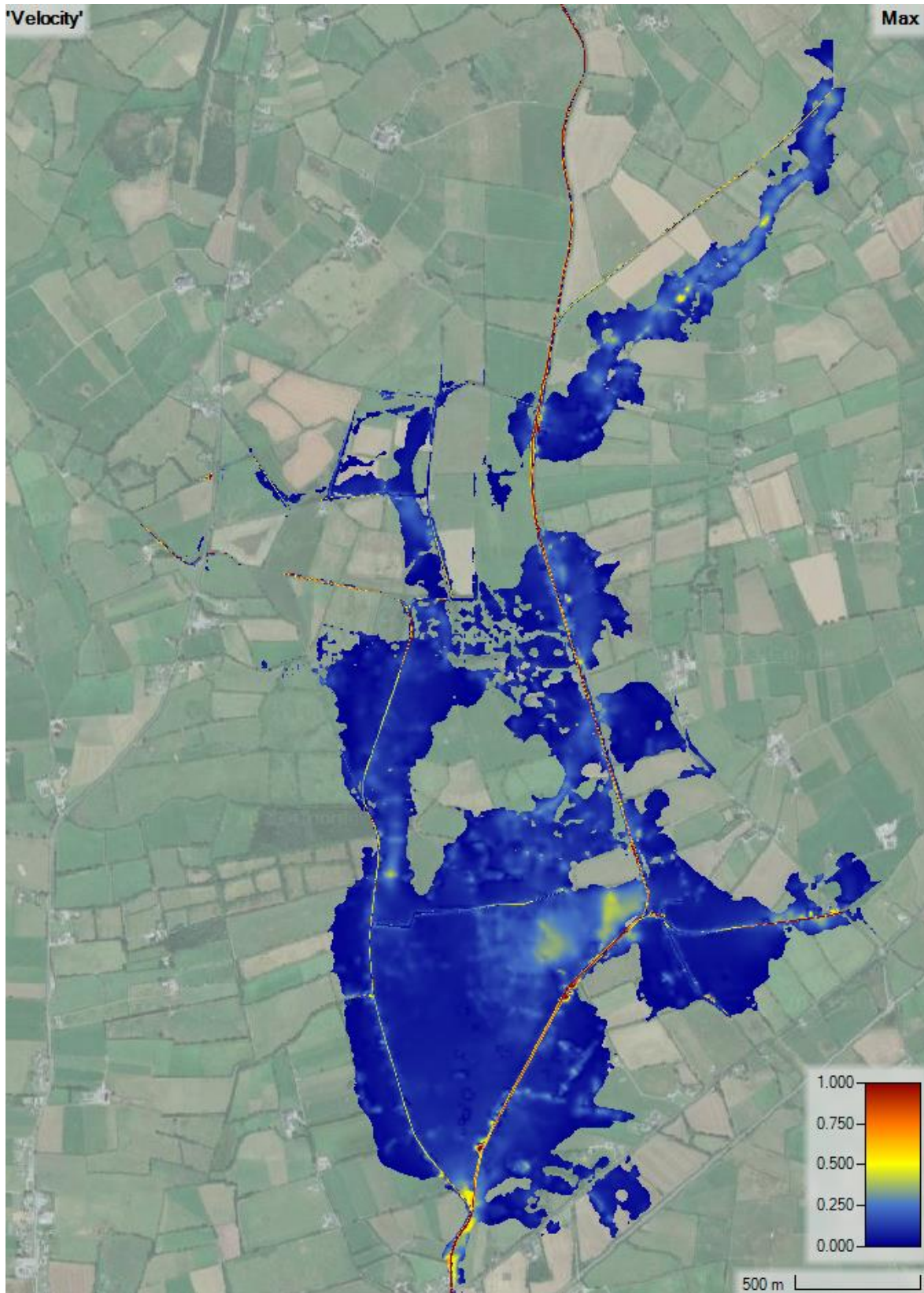


Figure 8.1. Flow Velocity distribution for Existing River System for  $Q_{100cc}$ .

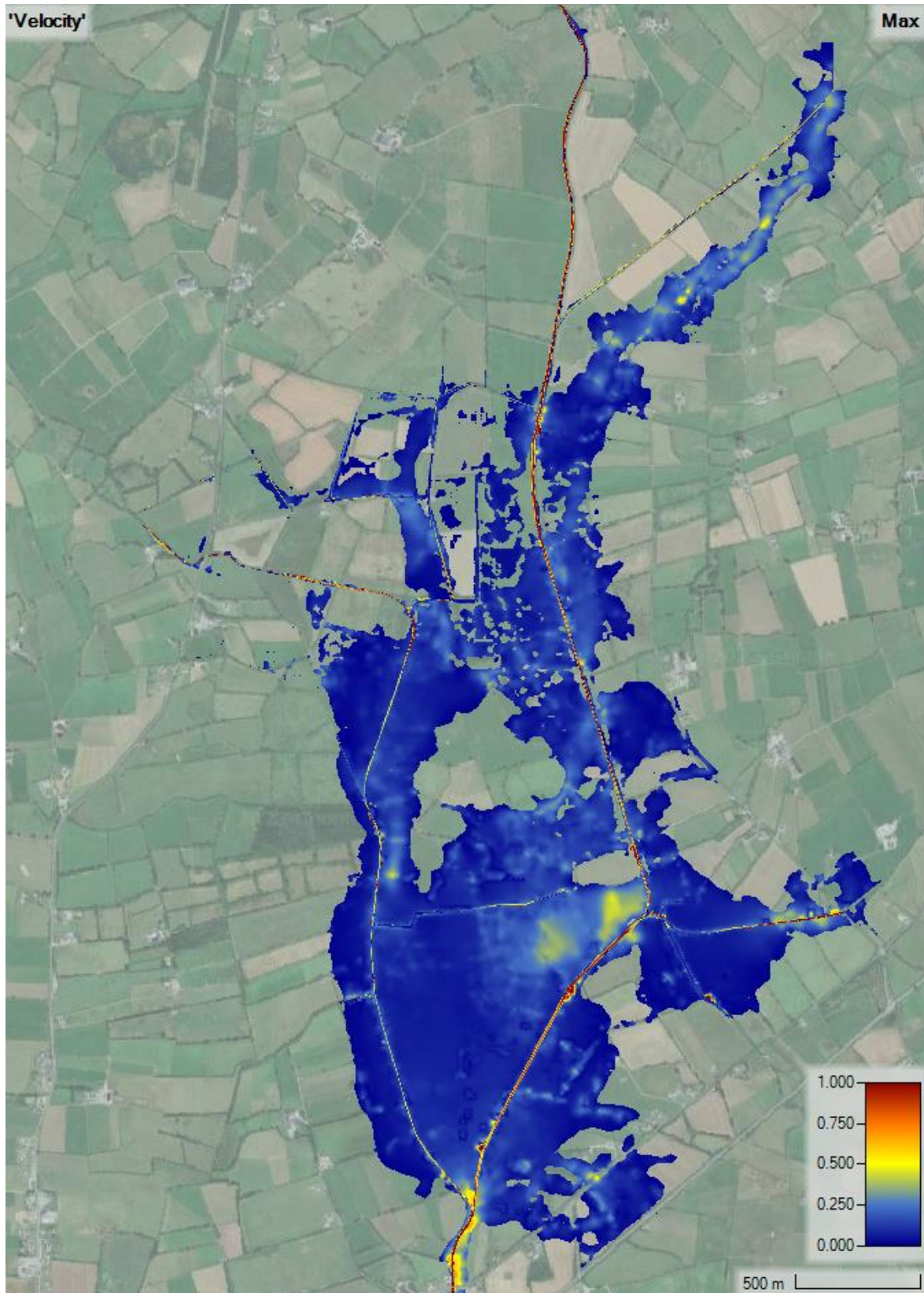


Figure 8.2. Flow Velocity distribution for Existing River System for  $Q_{1000cc}$ .

## 8.2.2 Existing Flood Maps

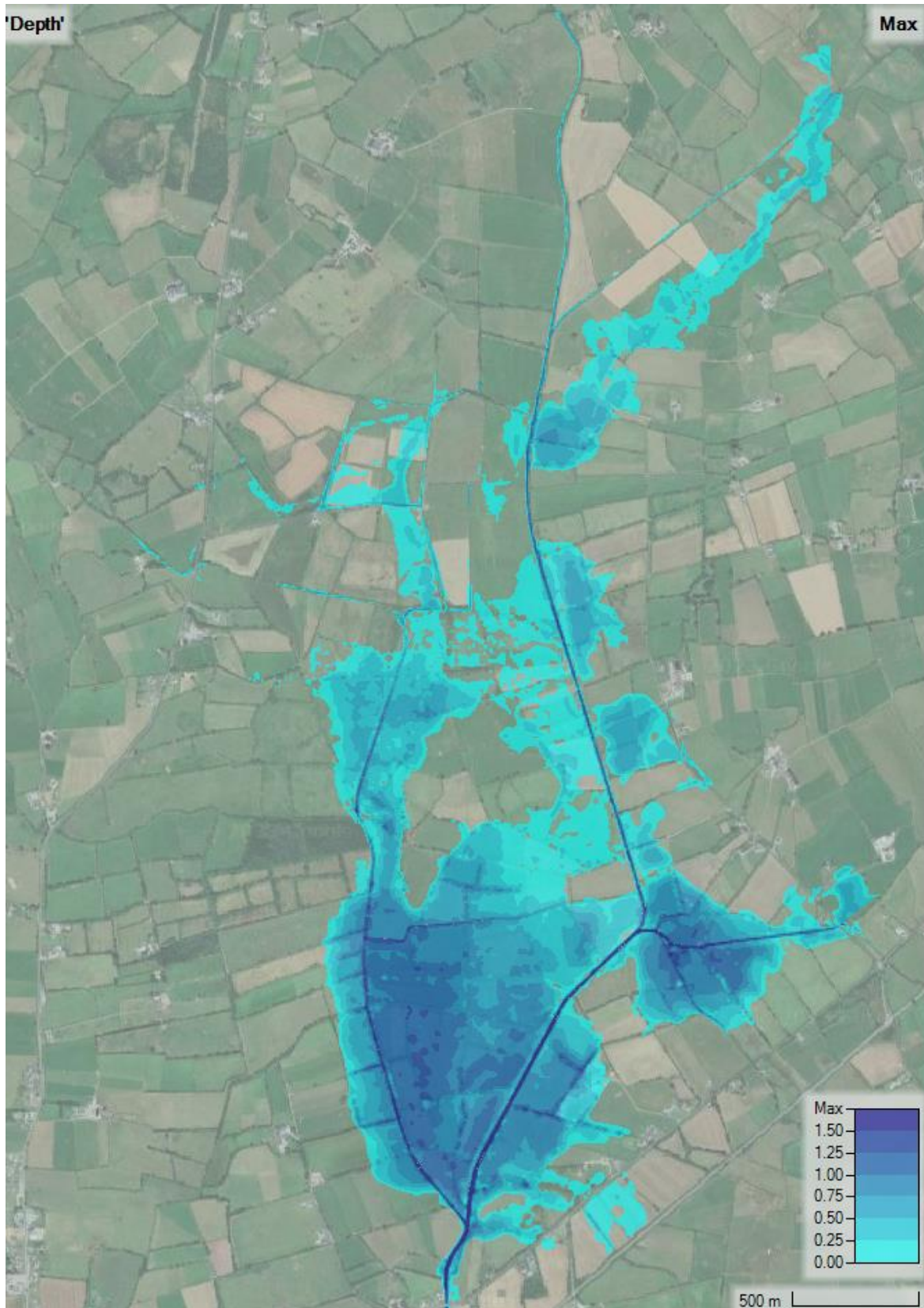


Figure 8.3. Flood map with water depths for Existing River System and  $Q_{100cc}$  design flow.

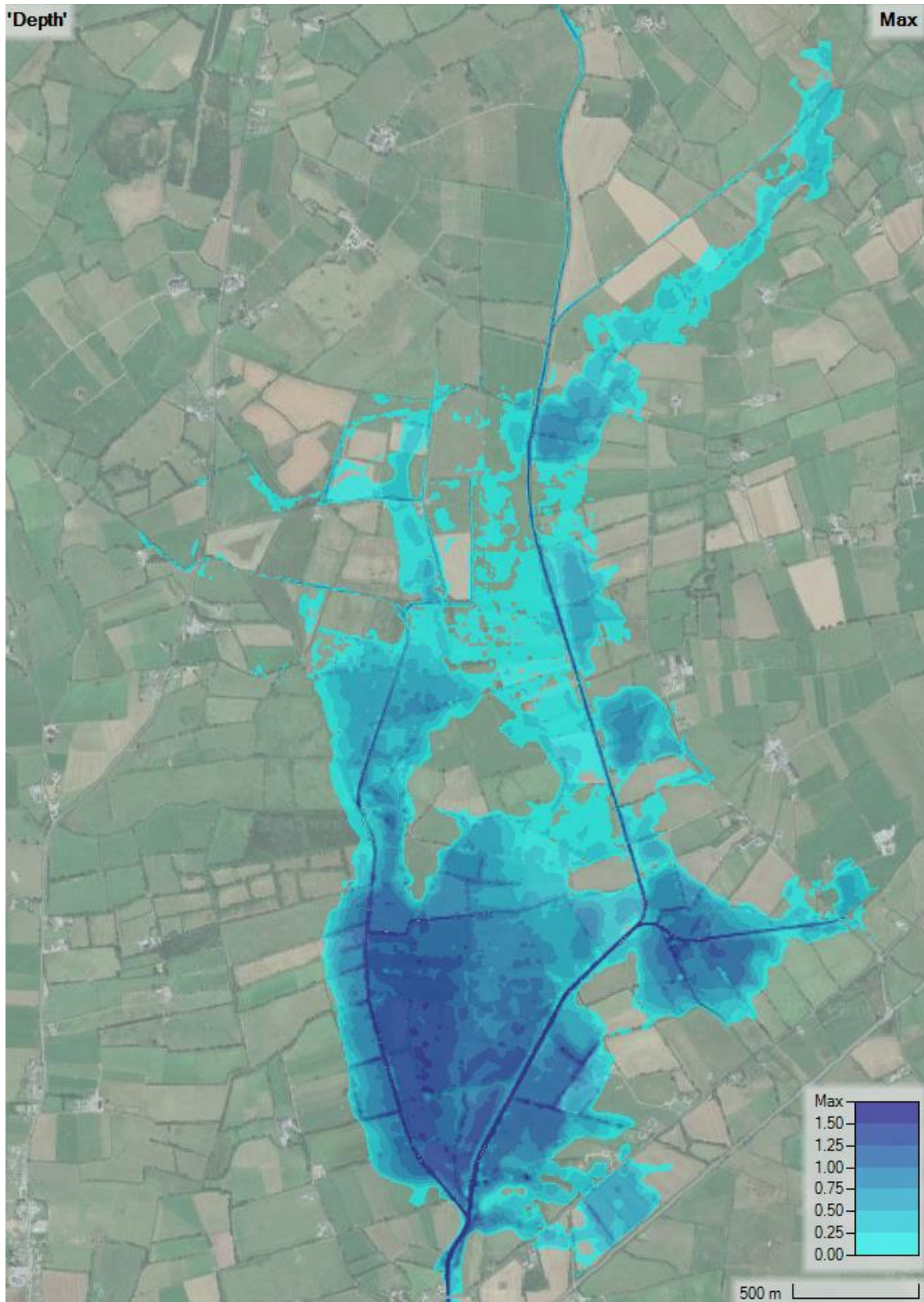


Figure 8.4. Flood map with water depths for Existing River System and  $Q_{100cc}$  design flow.

## 8.3 ANNEX C - PREDICTIVE FLOOD ZONES AND FLOOD MAPS

### 8.3.1 Existing Velocity distribution

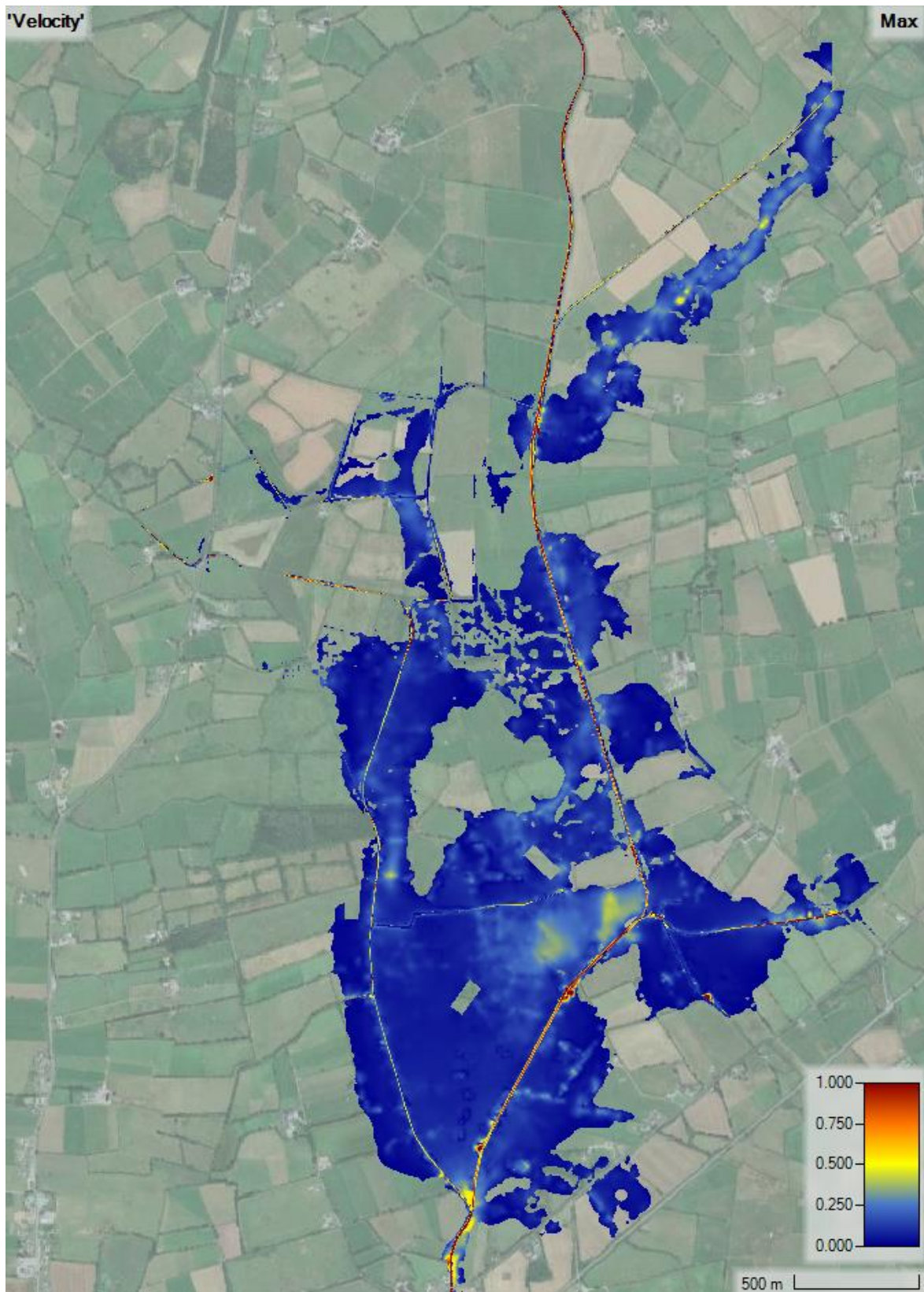


Figure 8.5. Flow Velocity distribution for Design River System for  $Q_{100cc}$ .



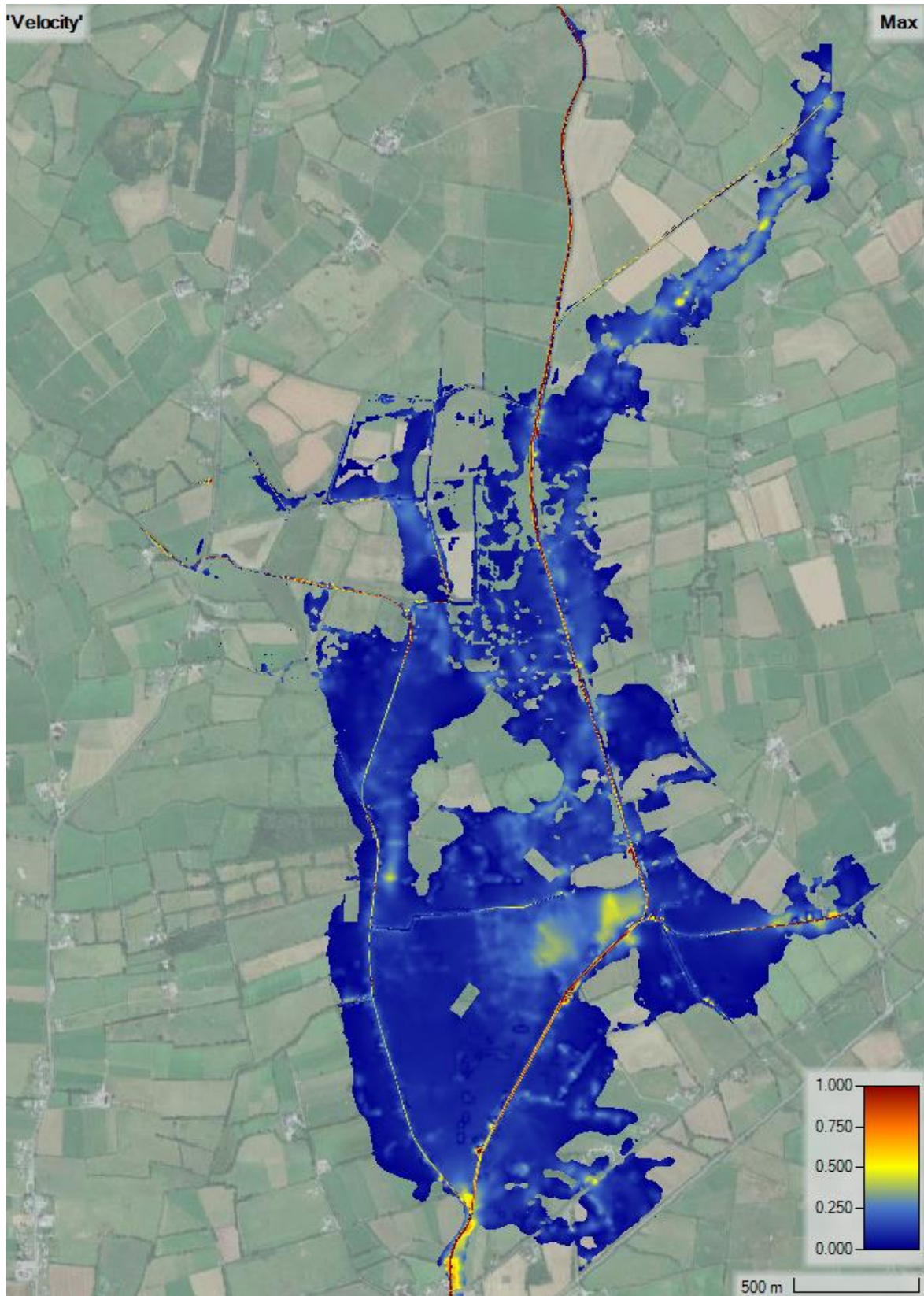


Figure 8.6. Flow Velocity distribution for Design River System for  $Q_{1000cc}$ .

### 8.3.2 Existing Flood Maps

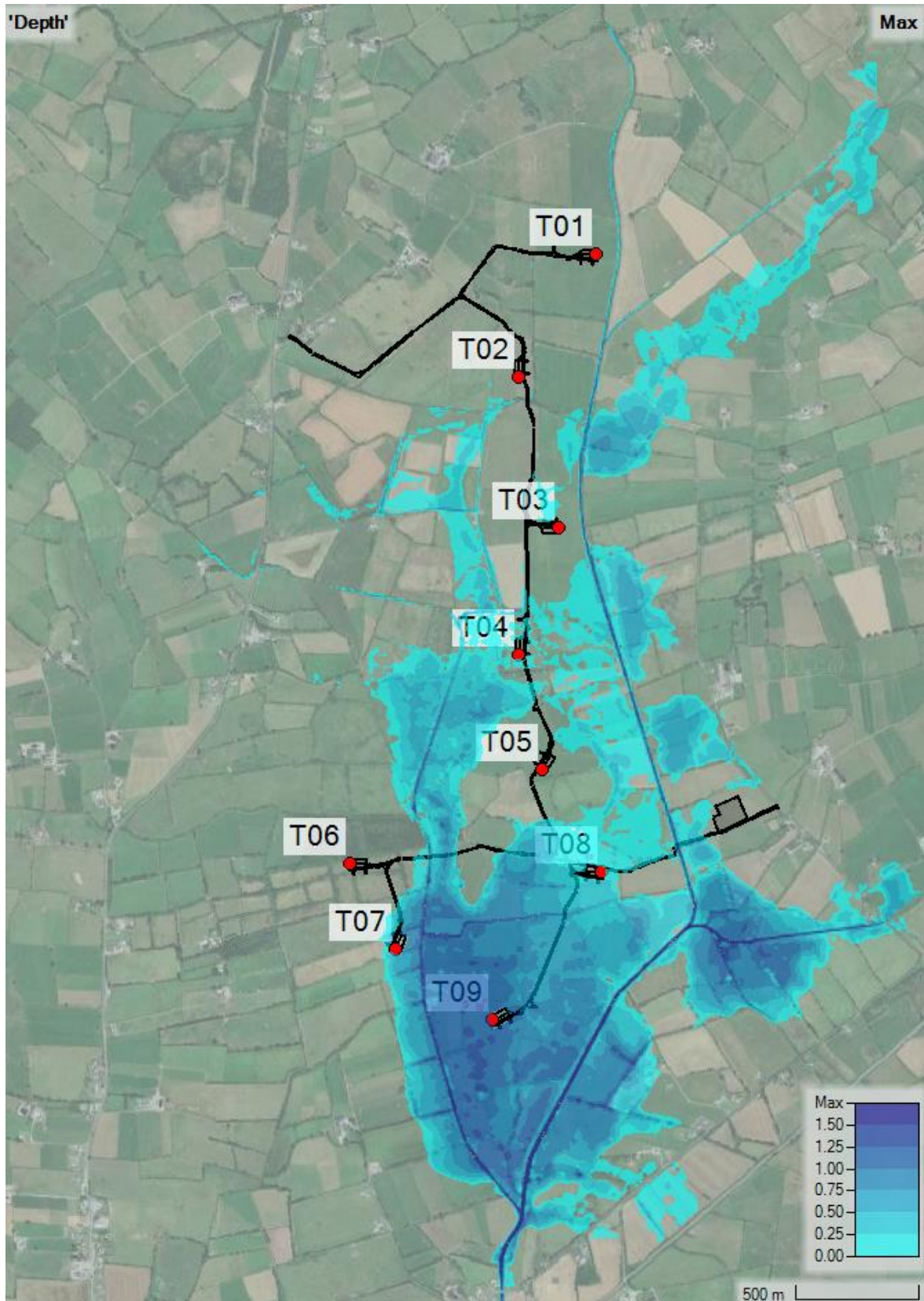


Figure 8.7. Flood map with water depths for Design River System and  $Q_{100cc}$  design flow – Zone A.

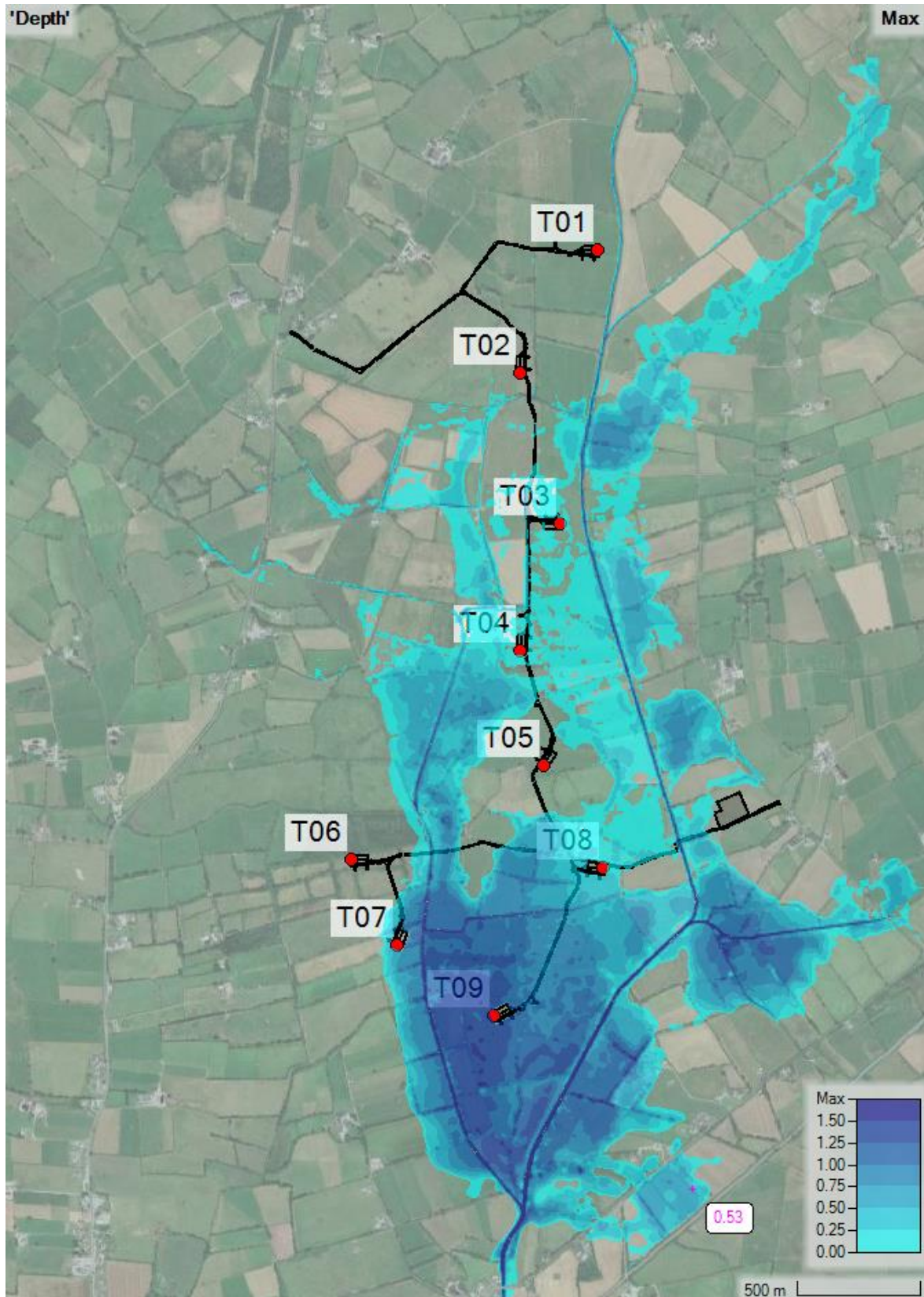


Figure 8.8. Flood map with water depths for Design River System and  $Q_{1000cc}$  design flow – Zone B.

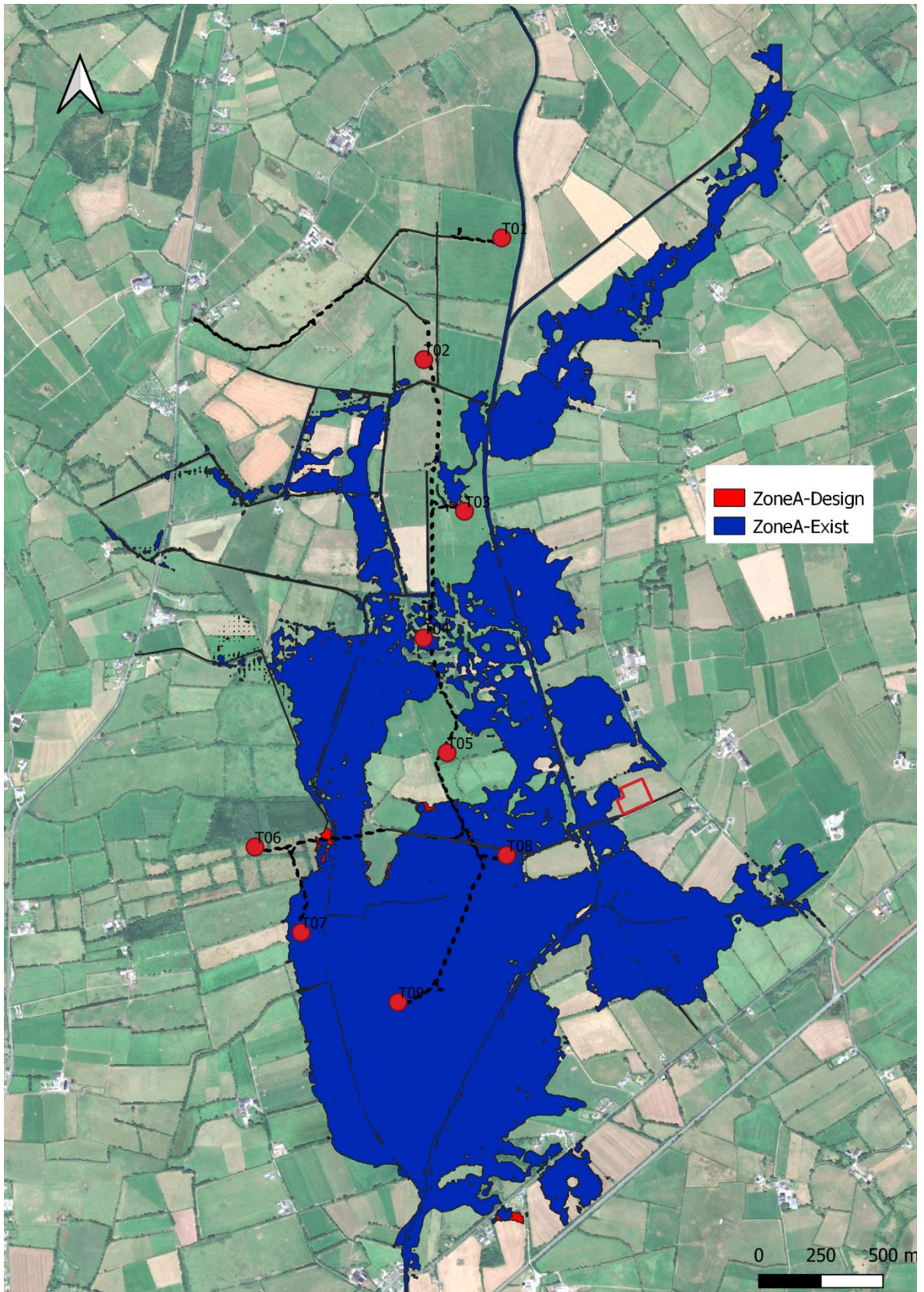


Figure 8.9. Comparison of Existing and Design River System flood extent (Flood extent for Design System is shown in red hatch) for  $Q_{100cc}$  design flow – Zone A.

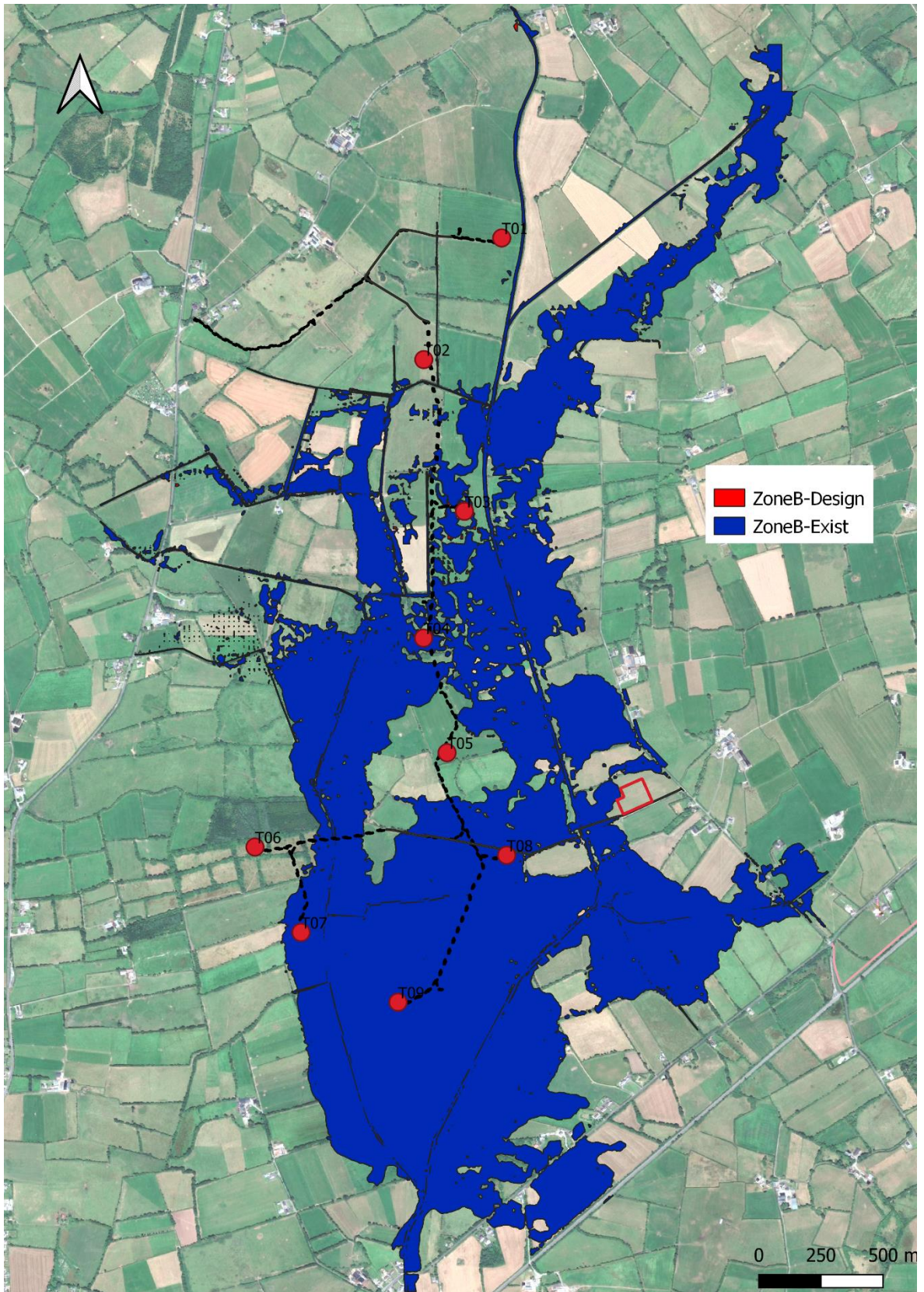
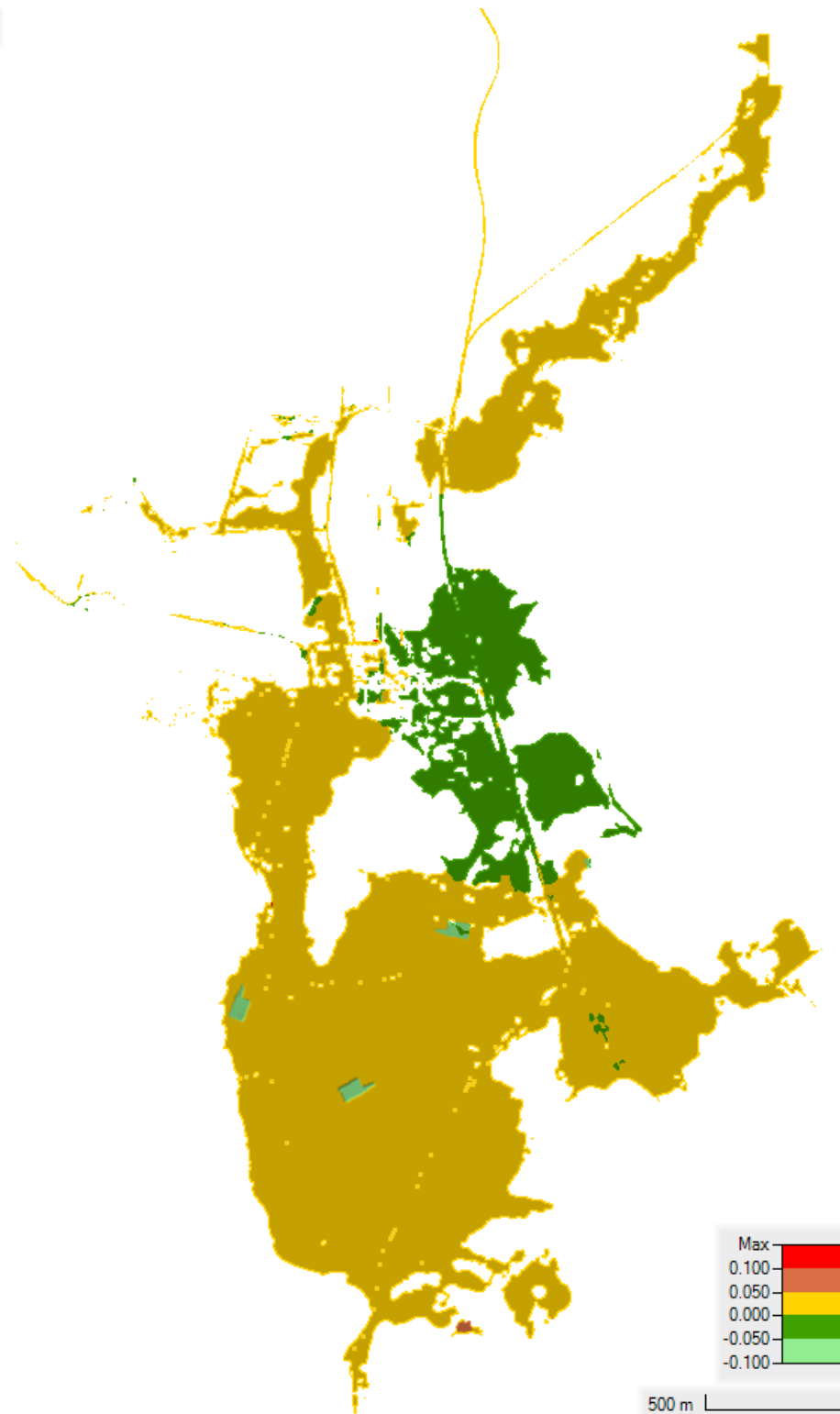


Figure 8.10. Comparison of Existing and Design River System flood extent (Flood extent for Design System is shown in red hatch) for  $Q_{1000cc}$  design flow – Zone B.

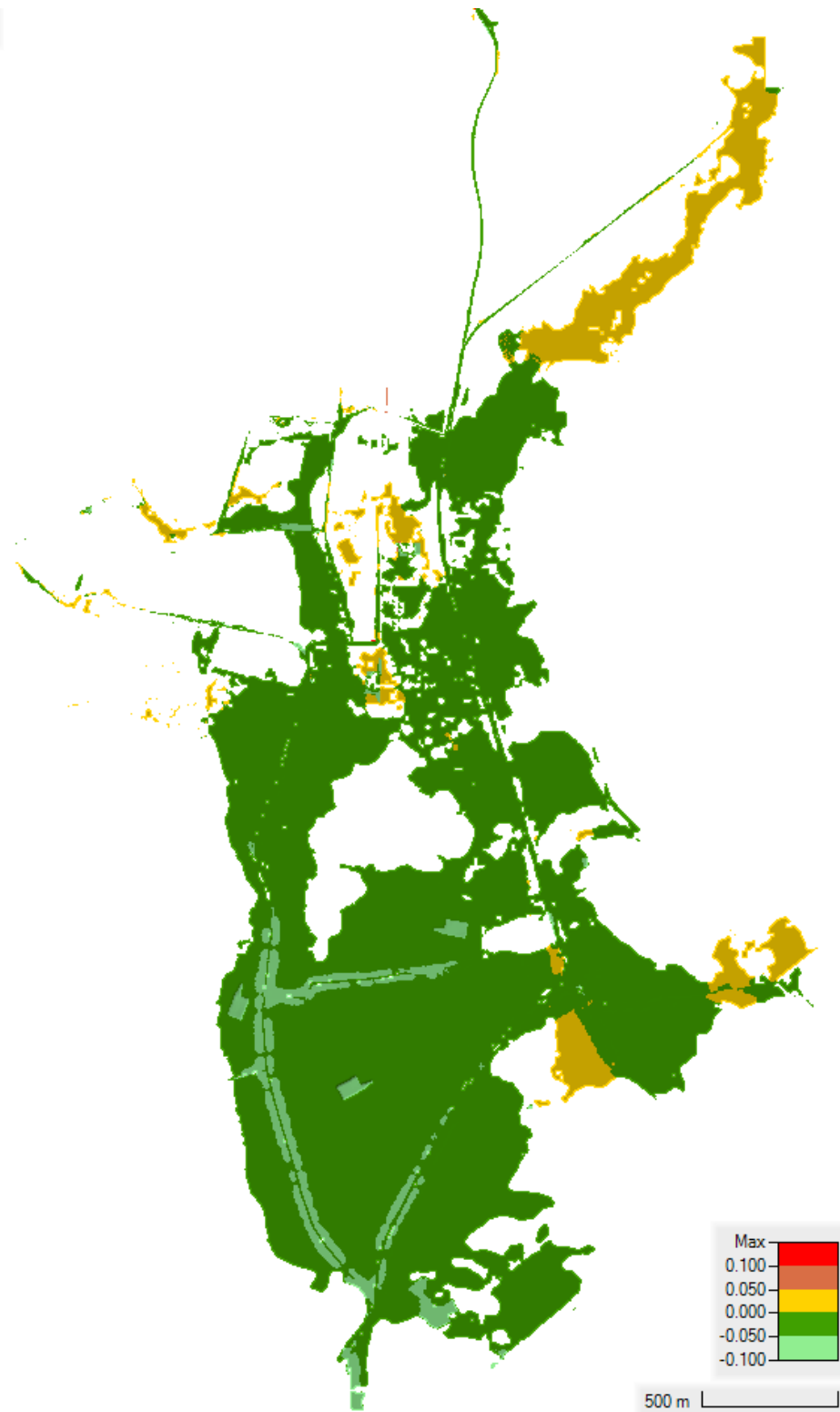
'CompareWSE-ZoneA'



\*Design water level on average higher for +0.01m

**Figure 8.11. Comparison of Existing and Design River System water levels for  $Q_{100cc}$  design flow – Zone A (negative values – green show lower WL in Design).**

'CompareWSE-ZoneB'



\*Design water level on average lower for -0.04m

**Figure 8.12. Comparison of Existing and Design River System water levels for  $Q_{1000cc}$  design flow – Zone B (negative values – green show lower WL in Design).**

## 8.4 ANNEX D - Relevant Legislation and Regulations

### 8.4.1 Arterial Drainage Acts

The most important of these acts are the Arterial Drainage Act 1945 and the Arterial Drainage (Amendment) Act, 1995. These Acts provide for the drainage and improvement of land by the execution of works of arterial drainage and the maintenance of these works.

- Weirs: Subject to some exceptions, Section 47 of the 1945 Arterial Drainage Act requires the consent of OPW to erect, enlarge or alter any weir or other like construction in a watercourse where such erection, enlargement or alteration might cause flooding of any land.
- Bridges: Section 50 of the 1945 Arterial Drainage Act requires that no local authority, no railway company, canal company, or other similar body, and no industrial concern shall construct any new bridge or alter, reconstruct, or restore any existing bridge over any watercourse without the consent of the OPW.

### 8.4.2 Environmental Legislation and Regulations

This category covers a wide range of Acts and Regulations, both National and European, dealing with the protection and conservation of the environment. The most important of which are the various Wildlife Acts, Natural Habitat Regulations, and the Water Framework Directive. Significant aspects of the Arterial Water Framework Directive to flood risk management are specified in EU Floods Directive. The new Directive on the assessment and management of flood risks ("Floods Directive") which has been agreed between the EU Parliament and Council will increase the growing emphasis on flood risk management. This Directive is due to be transposed into Irish law by late 2009. This Directive will require that Member States take a long-term planning approach to reducing flood risks in three stages:

1. Member States will by 2011 undertake a preliminary flood risk assessment of their river basins and associated coastal zones.
2. Where real risks of flood damage exist, they must by 2013 develop flood hazard maps and flood risk maps.
3. Finally, by 2015 flood risk management plans must be drawn up for these zones.

These plans are to include measures to reduce the probability of flooding and its potential consequences. They will address all phases of the flood risk management cycle but focus particularly on prevention (i.e. preventing damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas or by adapting future developments to the risk of flooding), protection (by taking measures to reduce the likelihood of floods and/or the impact of floods in a specific location such as restoring flood plains and wetlands) and preparedness (e.g. providing instructions to the public on what to do in the event of flooding). These three steps are to be repeated in a six-year cycle to ensure that long-term developments are taken into account.



### 8.4.3 Planning and Development Management

The publication of the Guidelines on "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" (November 2009) have emphasised the importance of the FRA. Further information on the Guidelines is available through the document.

Extract from the Guidelines, Box 3.2 - Justification Test:

Where a planning authority is considering the future development of areas at a high or moderate probability of flooding that would include types of development that are inappropriate under the screening process set out in paragraphs 3.6 and 3.7, either in a development plan or development management context, the planning authority must be satisfied that the development is necessary on the basis of all of the following criteria:

#### **PART 1**

1. The area is within or adjoining the centre\* of a city or town designated for growth in key policy documents such as the National Development Plan, the National Spatial Strategy, any Regional Planning Guidelines in force, planning guidelines/directives under Sections 28/29 of the Planning and Development Act 2000 and/or an operative City/County development plan which has been adopted taking adequate account of these guidelines.
2. The area comprises significant previously developed and/or underutilised lands within the urban envelope.
3. Development of the area is essential to facilitate regeneration or town and city centre expansion, as demonstrated in city and county development plans that have been assessed in accordance with these guidelines.
4. Strategic Environmental Assessment has been undertaken, where applicable, taking full account of flood risk.
5. There are no reasonable and available alternative development areas or sites that meet the wider strategic policy requirements as outlined at 1 above, within low or lower flood probability areas.

#### **PART 2**

If the requirements of Part 1 are satisfied, then the following additional detailed criterion should also be met. The development has been the subject of a sufficiently detailed flood risk assessment, as appropriate to the nature and scale of the development, and the potential risk that may arise, which demonstrates that:

- a) the development will not increase flood risk elsewhere and, if possible, will reduce overall flood risk;
- b) the development proposal includes measures to minimise flood risk to people, property and the economy and the environment as far as reasonably possible and 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.

## 8.5 ANNEX E - NATIONAL FLOOD POLICY

The current Irish National policy on flood risk is outlined in the OPW document "OPW Planning and Development Flood Policy" published on [www.flooding.ie](http://www.flooding.ie). The document states that development should not itself be subject to an inappropriate risk of flooding nor should it cause or exacerbate such a risk at other locations, which is stated through the following guidelines:

1. **Development that is sensitive to the effects of flooding will generally not be permitted in flood prone or marginal areas.** Preventing such development, where flooding would result in significant hardship, financial losses or costs, will avoid increasing the existing level of risk and will protect the proposed new development from the human (stress and ill-health, for example) and financial costs of flood events. It will also eliminate or reduce expenditure on flood protection measures and compensation.
2. **Appropriately designed development, which is not sensitive to the effects of flooding, may be permissible in flood plains provided it does not reduce the flood plain area or otherwise restrict flow across floodplains.** Examples of such development might include park areas, sports pitches, certain types of industry, warehousing, etc. designed to be flood resistant and/or insensitive. Such development should only be permitted provided it incorporates adequate measures to cope with the ever-existent flood risk, e.g. adequate drainage systems, safety measures, emergency response facilities and/or warning and response systems and where it is considered that flooding would not result in significant hardship/financial loss or cost.
3. **Development must so far as is reasonably practicable incorporate the maximum provision to reduce the rate and quantity of runoff, e.g.:**
  - a. Hard surface areas (car parks, etc.), should be constructed in permeable or semi-permeable materials.
  - b. On site storm water ponds to store and/or attenuate additional runoff from the development should be provided.
  - c. Soak-aways or french drains should be provided to increase infiltration and minimise additional runoff.

Such sustainable design/construction measures are desirable in most areas and essential in floodplains, areas liable to flooding, and areas where the conveyancing capacity of watercourses is marginal. In all of these cases development that reduces the rate of absorption or increases the rate of runoff increases the risk of flooding of lands and properties downstream.

4. **For developments adjacent to watercourses of a significant conveyance capacity any structures (including hard landscaping) must be set back from the edge of the watercourse to allow access for channel clearing/maintenance.** A setback of 5m-10m is required depending on the width of the watercourse.
5. **Development consisting of construction of embankments, wide bridge piers, or similar structures will not normally be permitted in or across flood plains or river channels.** Such structures restrict/obstruct flow and increase the risk of flooding to property and land upstream. If it is considered necessary, in exceptional cases, to permit such structures, they should be designed to minimise and/or compensate for any potential negative effects.
6. **All new development must be designed and constructed to meet the following minimum flood design standards:**
  - a. For Urban areas or where developments (existing, proposed or anticipated) are involved - the 100 year flood.
  - b. For Rural areas or where further developments (existing, proposed or anticipated) are not involved - the 25 year flood.

- c. Along the Coast and Estuaries - the 200 year tide level.
- d. Where streams open drains or other watercourses are being culverted – the minimum permissible culvert diameter is 900mm. (Access should be provided for maintenance as appropriate.)

The application of higher design standards may be appropriate in certain cases where the level of risk and/or uncertainty warrant it e.g. hospitals or other emergency services, main roads, chemical plants, cultural repositories, areas of karst etc.

- 7. A flood impact assessment and proposals for the storage or attenuation of run/off discharges** (including foul drains) to ensure the development does not increase the flood risk in the relevant catchment **must accompany applications for Planning Permission** for development of **areas exceeding 1 hectare**.
- 8. A certificate from a competent person that the development will not contribute to flooding** within the relevant catchment must accompany applications for Planning Permission **for development of areas of 1 hectare or less**.

## 8.6 ANNEX F - LOCAL POLICY ON FLOOD MANAGEMENT

### 8.6.1 Renewable Energy Strategy from Draft Tipperary County Development Plan 2022-2028

Four main strategic renewable energy aims of Tipperary county council development plan are set as:

#### 1 A low Carbon Future for Tipperary

The White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030' sets out a national objective for a low carbon economy with reduced green house gas (GHG) emissions and greater investment in renewable energy technologies. This Renewable Energy Strategy recognises that Ireland (and Tipperary) is a long way off meeting its own energy demands from renewable resources, and it is recognised that significant and immediate commitment to energy (and better energy efficiency) is now required. Continued support for investment in energy production in Tipperary will confer economic advantages in the form of jobs and investment. In addition to meeting its own energy needs, Tipperary will benefit through its contribution to national renewable targets, in a renewable energy framework that will also ensure the protection of local environmental assets. It is strategic aim of this Renewable Energy Strategy to facilitate a low-carbon future in Tipperary by supporting the sustainable development of the renewable energy sector in Tipperary.

#### 2 Achieving Climate Change Adaptation

There are two main policy responses to climate change: mitigation and adaptation. Mitigation addresses the root causes of climate change, by reducing GHG emissions, while adaptation seeks to lower the risks posed by the consequences of climatic changes. This Renewable Energy Strategy will facilitate the mitigation of climate change by supporting renewable energy sources as an alternative to fossil fuels thereby reducing GHG emissions.

#### 3 Low-Carbon Economy and job Creation

The Council is committed to employment creation as a direct result of a policy to secure better investment in renewable energy and energy efficiency in Tipperary. This commitment is also reflected in the Council's Local Economic and Community Plan (LECP) with a key objective to improve the sustainability of the county's energy use to enable sustainable economic development. This Renewable Energy Strategy supports the objectives of the LECP as they relate to a green economy and it is expected that the development of a sustainable energy base along with investment in efficiency will confer an economic advantage to the county in the form of jobs and investment.

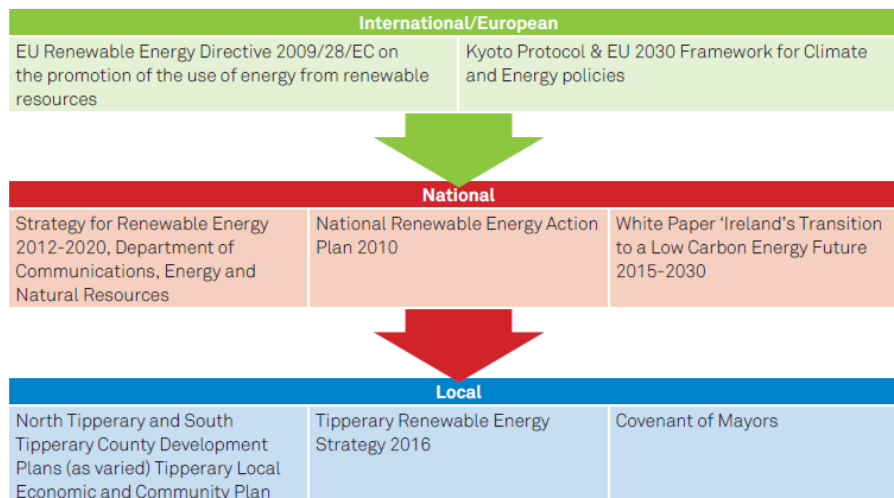
#### 4 A Strategic Planning Framework for Renewable Energy

It is intended to put in place a planning and regulatory framework for renewable energy development in Tipperary to provide certainty and clarity to both investors and communities alike and to ensure consistency in planning decisions. In order to achieve this objective, the Council is mindful that renewable energy resources, catchments, infrastructure and in many cases, new developments, may extend across county boundaries. In this respect, this Strategy was prepared having consideration to the energy and environmental policies of adjoining counties.

#### Policy overview and Local policy

The Renewable Energy Strategy is set in a hierarchy of international and national legislation which

provides the statutory basis for planning policy for the development and use of renewable energy resources and for the protection of the environment



### 2.5.1 County Development Plan (As Varied)

There are two County Development Plans in place in Tipperary:

- The South Tipperary County Development Plan 2009 (as varied)
- The North Tipperary County Development Plan 2010 (as varied)

The County Development Plans (as varied) provide a strategic, cohesive and consistent planning framework for the full county in all areas including energy and energy efficiency. The Renewable Energy Strategy has been incorporated into the County Development Plans by way of Variations number 3 and will supplement and inform the current county planning framework as set out and will go forward to underpin and support any review of the County Development Plans.

### 2.5.2 Sustainable Energy Action Plan for Tipperary

In line with the commitment to the Covenant of Mayors, the Council, with the support of the TEA will prepare a Sustainable Energy Action Plan (SEAP) for the county. It is expected to be completed in 2016 and will set out a ranges of actions aimed at reducing CO2 emissions in the county. The preparation of a SEAP is a key action of this Strategy.

### 2.5.3 Local Economic and Community Plan

The LECP 2015 was developed by the Tipperary Local Community Development Committee (LCDC) and Tipperary County Council’s Economic Development and Enterprise Strategic Policy Committee. It contains high level goals and actions to drive economic, social and community development in the county over the next six years and was developed in consultation with key stakeholders, the broader community and business interests.

It is a high level economic objective of the LECP **to improve the sustainability of the County’s energy use by supporting enterprises in energy, efficiency reduction/improvements and by growing the renewable energy enterprise sector.**

Strategic Actions are set out below:

- Maximise competitiveness of businesses through best practice energy management by increasing awareness of supports available,
- Provision of energy management training across all sectors e.g. manufacturing, tourism, retail, agriculture, etc. as appropriate,
- Piloting of energy programmes, sustainable transport programme etc,
- Support and encourage public sector bodies to achieve current ISO Energy Standard, and,

- Support research, education & training on sustainable energy technologies.

### Section 2.5.4 Adjoining Counties

Tipperary shares common boundaries with the following counties; Cork, Limerick, Clare, Galway, Offaly, Laois, Kilkenny and Waterford. Each of these counties share a common purpose to facilitate renewable energy developments, whilst protecting environmental assets. The Council will endeavour to manage and support renewable energy development in consultation with adjoining local authorities.

## Tipperary Energy Case Studies

Tipperary has been a leader in the area and there have been a number of local and community-led renewable energy and energy efficiency schemes in the county that demonstrate the benefits of investment in the area and that will be used as examples for further investment. The following are examples of:

- Direct Community investment in energy
- Direct Community investment in energy efficiency
- Local Authority investment in energy
- Community Gain Scheme

### 3.5.1 Direct Community Investment in energy - Templederry Wind Farm

In 2001, the local community in Templederry sought to investigate ways to increase employment and investment in their area. Renewable energy was examined as an investment opportunity and 'Templederry Energy Resources' was set up and 30 shares in the company were allocated. The TEA and the North Tipperary LEADER assisted in the planning and development phase of a new wind farm consisting of two wind turbines. This entailed assessment of the wind resource in the area, acquiring finance, a connection to the national grid and securing planning permission. The group is now producing enough electricity to power 3,500 houses per annum.

### 3.5.2 Community Investment in Energy Efficiency - Drumbane/Upperchurch

Upperchurch/Drombane is a community of around 1,200 people and 400 houses. A community team called the Drombane Upperchurch Energy Team (DUET) surveyed the areas energy spend in 2011 and found that the community was spending €1 million per annum on domestic energy (heating and electricity). Over two years with the help of the TEA, Limerick Institute of Technology and North Tipperary LEADER Partnership, retrofit works were carried out on 50 homes and two community halls by local contractors, and retrofitting work continues. Householders have lower energy bills, and the local economy has benefited from the project.

### 3.5.3 Local Authority investment in energy - Council Photovoltaic scheme

In 2014, in conjunction with the TEA the Council installed solar photovoltaic (PV) panels on 9 local authority buildings to provide renewable electricity and reduce demand by 171,000 kWh annually. The buildings include 3 Civic Offices, 2 Fire Stations, 2 Libraries, a Machinery Yard and a Leisure Centre.

All photovoltaic arrays began generating power in early November 2014 and have an expected life in excess of 25 years. The power produced equates to an average annual reduction in electricity demand of approximately 11% and the Council is saving over €27,000 per annum on its electricity bills with a payback of 7 years.

### 3.5.4 Community Fund - Lisheen Wind Farm, Co Tipperary

A number of wind energy projects in Tipperary have entered into agreements with communities to deliver particular and agreed financial benefits to the local community. Such community funds can empower communities to have direct benefit from renewable energy projects while also contributing to a low carbon economy.

Lisheen Wind Farm is operated by Brookfield Renewable Ireland and is located 15km north of Thurles, Co. Tipperary and is located within the grounds of a zinc mine. During the design process

and after discussion with the local community it was agreed to set up a Community Fund known as the Moyne/Templetouhy Community Trust Fund. This was established in 2009 on commissioning of the windfarm. Whilst this is not an example of direct community investment, it is an example a partnership with the local community who has, through this trust fund been able to invest in a number of community projects. In this respect, the Irish Wind energy Association (IWEA) supports the provision of financial contributions by wind farm operators to local communities and have prepared 'Best Practice Principles in Community Engagement & Community Commitment' 2013 for delivering extended benefits to local communities for wind farm developments of 5 Megawatts (MW) or above.

## 6.5 Wind Energy Strategy

The Tipperary County Wind Energy Strategy contained in Appendix 1, sets out a planning framework for development of wind energy in the county. The Strategy, which has been informed by a LCA and SEA/HDA, identifies areas where wind energy development is 'open for consideration' and where wind energy developments are considered 'unsuitable'. The Strategy also set out the appropriate planning policy and development management standards to support and manage sustainable wind energy development.

## 3.2 Tipperary in the National Context:

According to the Irish Wind Energy Association in 2015 there were 18 operational wind farms in County Tipperary. A total of around 132 turbines have been erected with a generation capacity of approximately 268 MW<sup>1</sup>. To put this in the context of the national picture, just over 11% of the 2400MW wind energy capacity installed nationally was located in Tipperary.

## 3.3 Tipperary Developments to date

Up to February 2016 there have been 94 planning applications in relation to wind energy in Tipperary; 48 applications related to the north of the county and 46 applications related to the south. In County Tipperary overall, 47 applications were granted, 31 have been commenced of which 18 are connected to the grid. 16 have not yet commenced and the planning permission for 3 of these has since expired. As of February 2016, 6 applications are currently under consideration and 42 applications have been refused. Multiple applications per wind farm account for the discrepancy between the numbers of granted and constructed applications and the number of operational wind farms. In terms of turbine numbers, approximately 317 turbines have been permitted, and approximately 203 of these have been commenced. The location of the planning applications overlaid on the existing wind energy development policy areas is shown in Map 1.

### 3.3.1 South Tipperary Development Plan Area 2009 (as varied)

In the South Tipperary Development Plan area, wind energy development policy has been guided since 2006 by the Landscape Character Assessment covering the upland areas. As of February 2016, 98 turbines have been granted and 80 of these have already been constructed. The majority of these are in areas preferred for wind energy development, approximately 20 are in areas open for consideration (as discussed in section 2.3.2 of this strategy), but within 1km of the preferred areas and approximately 16 turbines were in areas classified as unsuitable for wind energy development. In all granted applications turbine power output has remained below 3MW per individual turbine. In terms of refusals, 8 applications from 21 were in areas preferred for wind energy development, 1 in areas open to consideration and 11 applications in unsuitable areas for wind energy development. This has led to a pattern of distinct clustering of wind energy development in the areas preferred for wind energy development. One of this areas, located in and around the Hollyford Hills and Mountain Mosaic in the Northwest of South Tipperary holds the highest concentration of both operational, granted and submitted applications for wind farms, as shown in Map 1. The other area with clustered projects is located near Slieveardagh Hills Farmland Mosaic in the east of Tipperary.

### 3.3.2 North Tipperary Development Plan Area 2010 (as varied)

The existing policy on wind energy development in the North Tipperary Development Plan area was based on the North Tipperary Wind Capacity Strategy and Outline Landscape Strategy (2009). These identified areas with adequate wind resources and then differentiated between those deemed suitable for wind energy development and those deemed unsuitable due to scenic, ecological, historic or tourism considerations. This approach did not specifically identify preferred areas for wind energy development. As

of February 2016, 198 turbines from 27 wind energy applications have been granted or are pending (decision awaiting) from which 105 have been commenced. In the areas deemed suitable, approximately 99 turbines have been granted/pending. In areas where wind resource is not adequate but not deemed as unsuitable 66 turbines have been granted (one third of the total) and 33 turbines (one sixth) were granted in areas deemed unsuitable for wind energy development. In all granted applications turbine power output has remained at 3MW or less. In terms of refusals, 21 applications have been refused, 11 of these were in areas deemed suitable for Wind Energy Development with Adequate Wind Resources, 6 in areas deemed suitable but where wind resource is not adequate and 4 applications were in areas deemed unsuitable for wind energy development.

The majority of the applications have been in the Silvermines – Rearcross area and the Upperchurch – Kilcommon area in the west of Tipperary. This development cluster is compatible with the wind energy policy in South Tipperary, where there is an adjacent wind farm development cluster in the Hollyford Hills and Mountain Mosaic area. The remaining wind energy developments are concentrated on the Devilsbit Uplands and the Templemore Plains in the east of the county. The latter area is adjacent to the Kilkenny County boundary and compatible with the Kilkenny wind energy policy of “Acceptable in Principle”. It can be seen from this that the presence of wind energy policy areas has effectively guided the distribution of wind energy development to-date in Tipperary. Over half of the wind energy applications have been in “preferred areas for wind development” and these areas account for three-quarters of the granted or pending applications. The applications in “Areas open for Consideration” were generally granted while conversely around 70% of the applications in “areas unsuitable for wind energy development” were refused.

### 3.4 Future prospects on Wind Energy Developments in Tipperary

Future projections under the NEEAP/NREAP scenario are targeted to achieve 4000MW of installed wind energy in the RoI. The White Paper: Ireland’s Transition to a Low Carbon Energy Future (2015 - 2030) extends this growth in renewable energy in its vision where Ireland becomes a leader in renewable energy deployment of large and small-scale renewable energy technologies. As individual renewable energy targets are not set out at the county level it is difficult to identify how much wind energy power is to be generated in County Tipperary to meet these the NREAP or subsequent targets.

Tipperary County Council however, fully supports the strategic national goals and recognises the importance of progressing towards the development of a sustainable renewable energy sector.

The assignment of Gate 3 grid connections to accommodate new wind energy developments in County Tipperary have been approved and the approved MW at Gate 3 together with the actual operational capacity and forecasts for 2020. If the forecasted 575MW of wind energy is installed in Tipperary by 2020 by Gates 1, 2 and 3, this would account for c. 14% of the national installed wind energy capacity (assuming the NREAP target of 4,000MW is reached at a national level). This target for 2020 would require the installation of more than double the existing installed capacity in a 5-year period. This reflects the national situation, noted in the 2015 White Paper, where it is calculated that to achieve the 2020 40% target, the average rate of build of onshore wind generation will need to increase to up to 260 MW per year from the current rate of build of about 170 MW per year.

The existing Wind Energy Strategies have actively encouraged and successfully guided Tipperary’s wind energy development to-date. However, there are barriers to its further development (ref Chapter 4 and Chapter 5) that will need to be addressed if Tipperary is to continue to develop in line with the Strategic goals set out by the Department of Communications, Energy and National Resources for 2020. In addition, there have been significant legislative changes in relation to the requirements for Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), Appropriate Assessment (AA) and Flood Risk Assessment (FRA) as well as planning law in the intervening time since the existing strategies were developed. The incorporation of these changes will require amendments to the existing policy areas. The most notable example of this will be the exclusion of the European Environmental Designated sites (Natura 2000) from areas considered suitable for wind energy development.



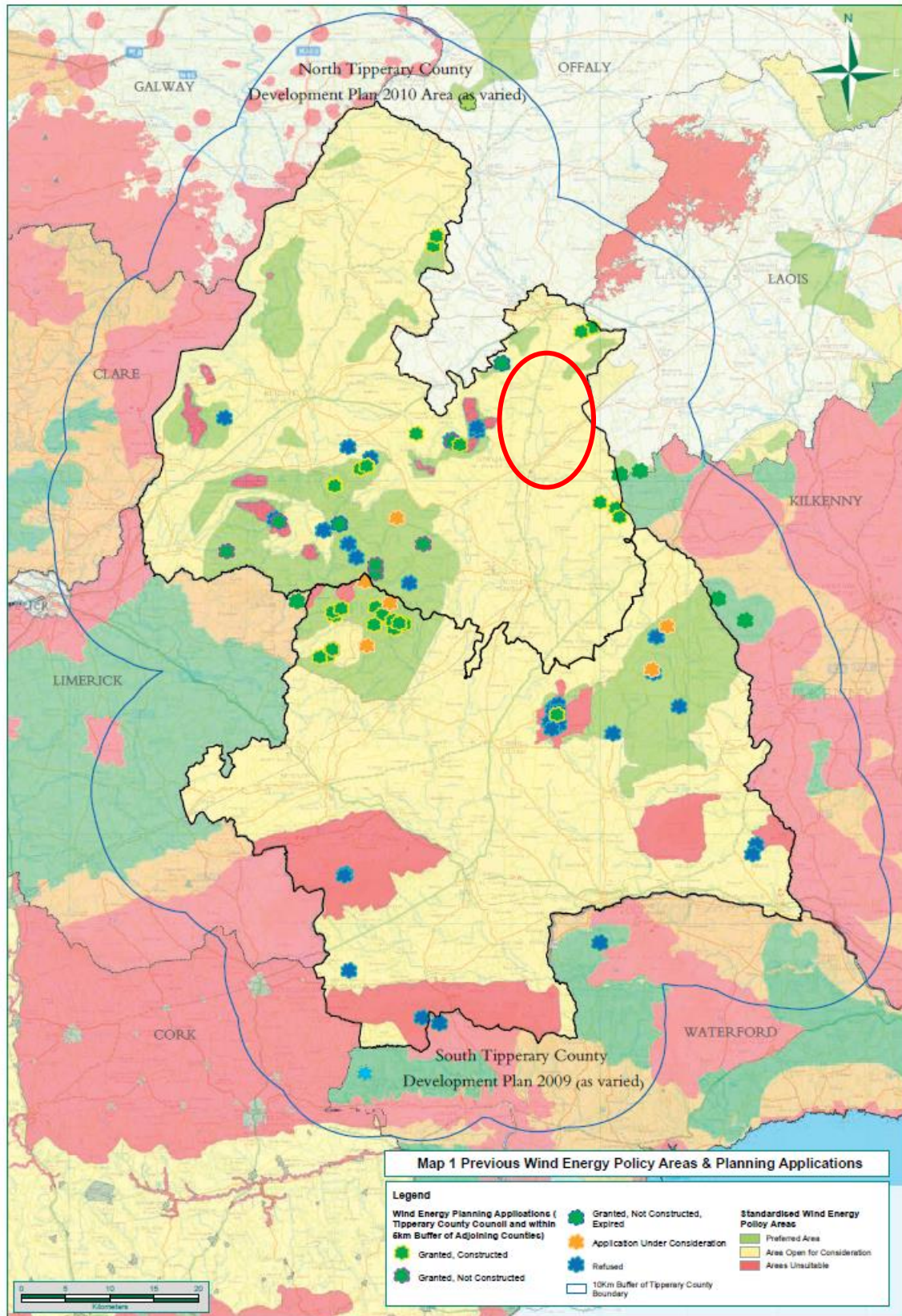


Figure 8.13. Suitability of wind farm development for Tipperary Co. Co.

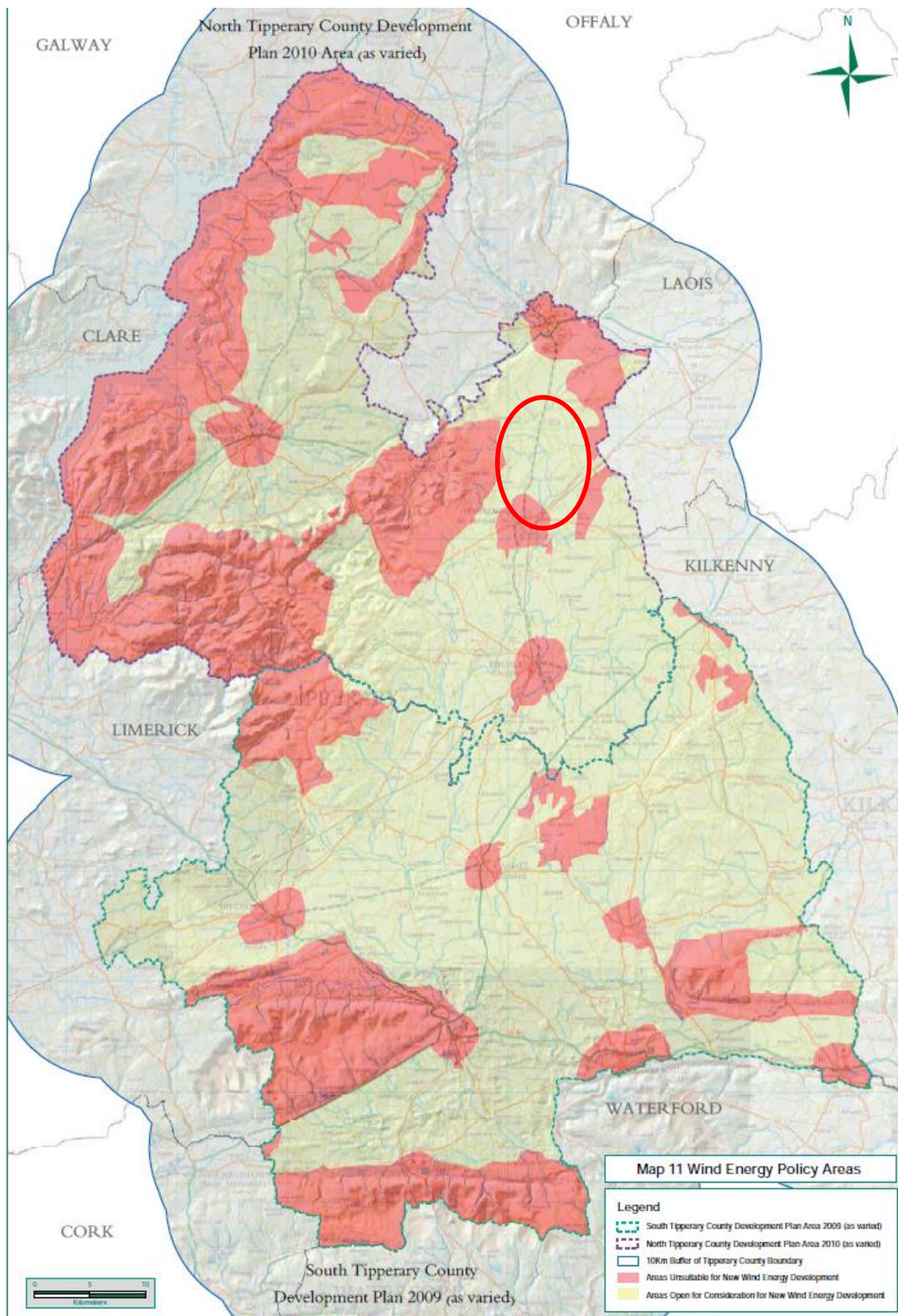
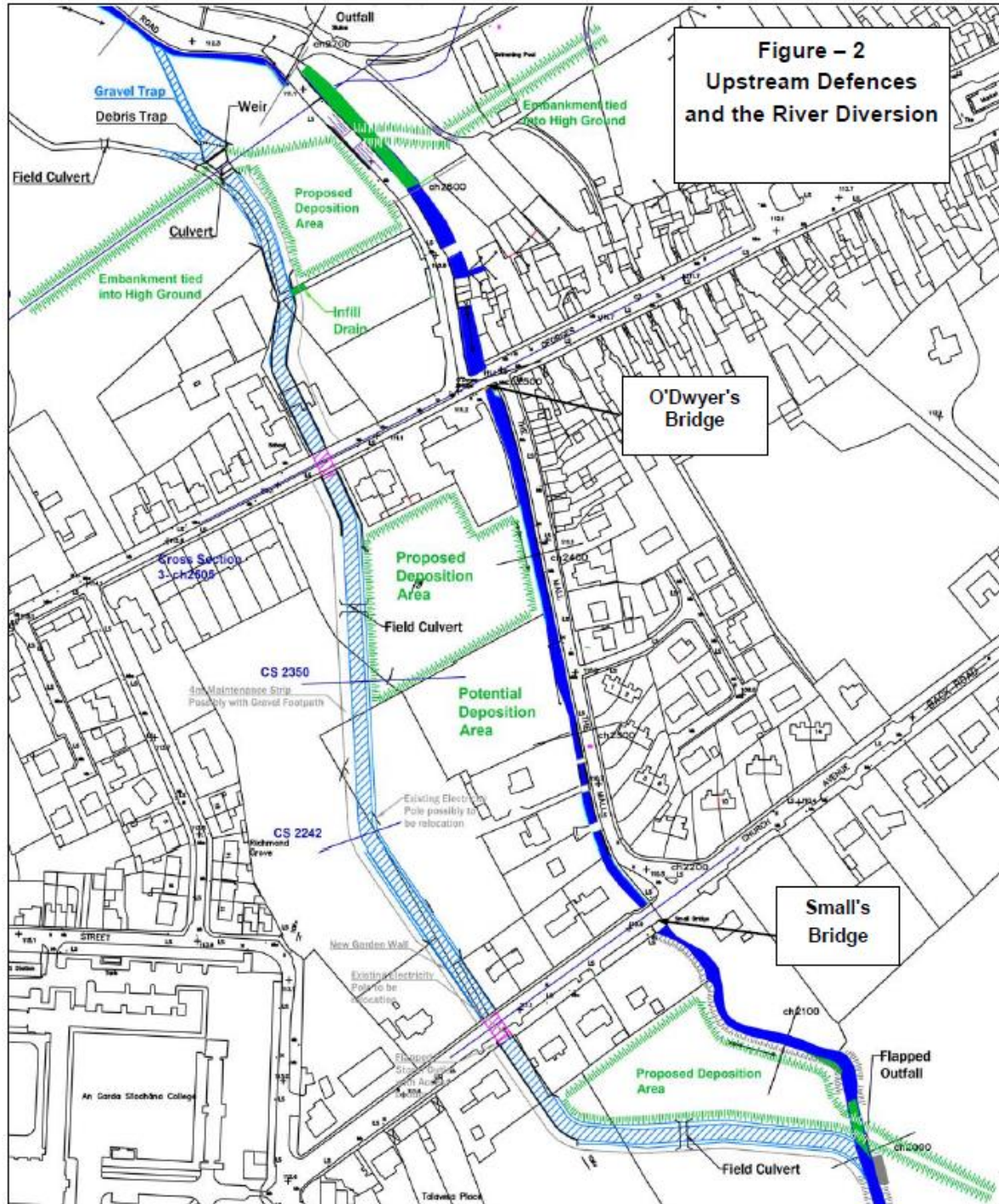


Figure 8.14. Map 2 Wind Energy Policy Areas

## 8.6.2 Templemore Flood Relief Scheme

Templemore, Co. Tipperary Flood relief scheme is focused on works on river Mall only and it does not provide any relevant information for river Suir or Eastwood stream.



### 8.6.3 OPW Flood Risk Management Plan for Suir

Although town of Templemore and surrounding areas are not included in OPW flood risk management plan for Suir because flood relief scheme is to be implemented for the town of Templemore, some guides on Maintenance of Drainage Districts are relevant for the site. This is because the site falls within Arterial drainage district.

“Existing Measure: around the proposed Wind Farm development is Maintenance of Arterial Drainage Schemes.

Outline: The OPW has a statutory duty under the Arterial Drainage Act, 1945, and the Amendment of the Act, 1995, to maintain the Arterial Drainage and Flood Relief Schemes constructed by it under those Acts.

Existing Measure: Maintenance of Drainage Districts

Outline: The statutory duty of maintenance for 4,600 km of river channel benefiting from Drainage District Schemes rests with the relevant Local Authorities.”

Abstract from Tipperary County Development Plan of Flood Risk Management for Suir.

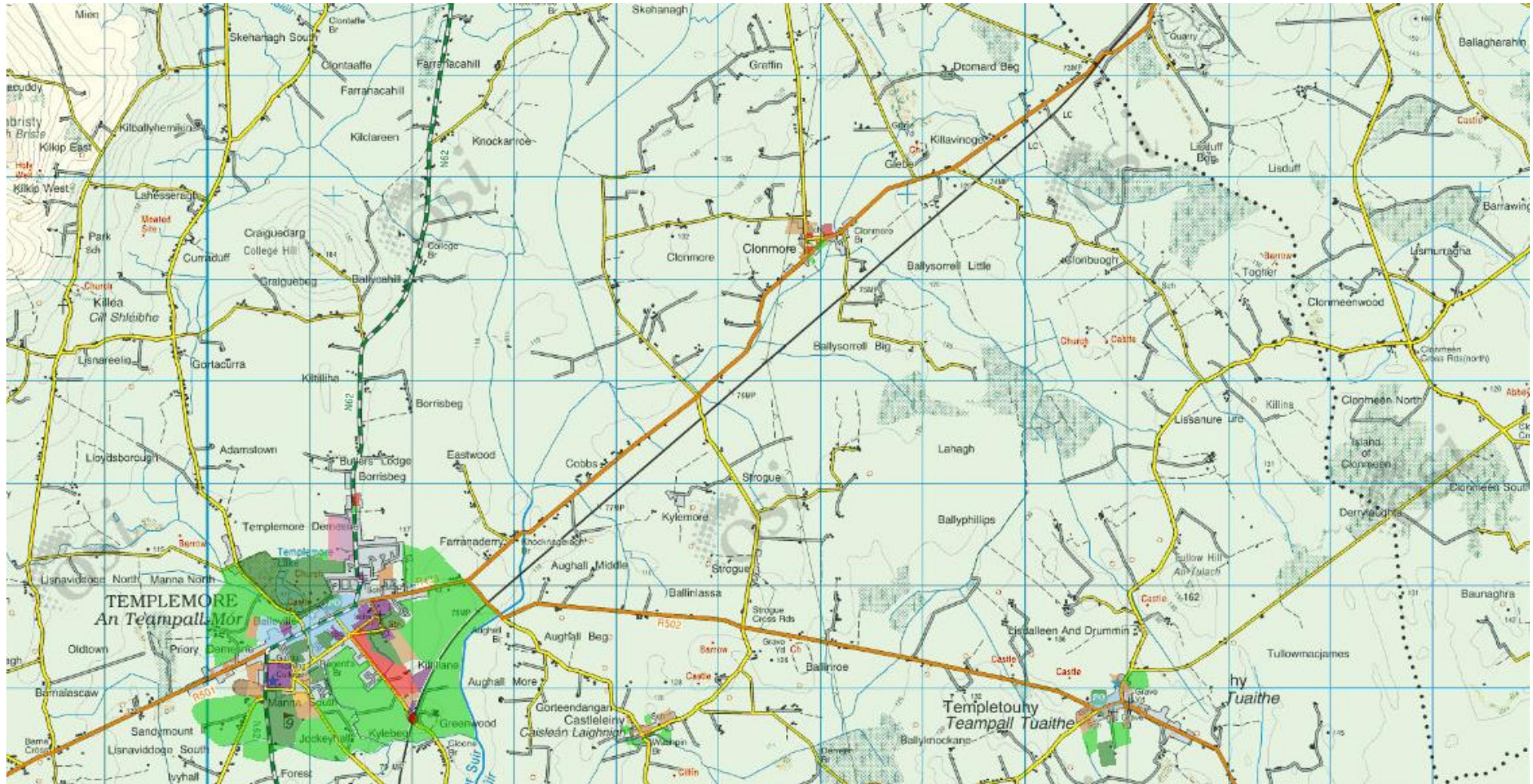
“7.4.1.8 Protection: Maintenance of Drainage Districts

There are four Drainage Districts within the Suir River Basin, namely the Templemore DD, Clodiagh DD, Cromoge DD and Farneybridge DD. The local authorities have a statutory duty to maintain the Drainage Districts, and this Plan does not amend these responsibilities to provide additional flood relief. The Plan therefore does not set out additional measures in relation to the maintenance of Drainage Districts.

7.4.1.9 Maintenance of Channels Not Part of a Scheme

Outside of the Arterial Drainage and Drainage District Schemes, landowners who have watercourses on their lands have a responsibility for their maintenance. Guidance to clarify the rights and responsibilities of landowners in relation to the maintenance of watercourses on or near their lands is available at [www.flooding.ie](http://www.flooding.ie).”

## 8.7 ANNEX G - LAP ZONING / SETTLEMENT MAP



Source: myplan.ie

## 8.8 ANNEX H - HEC-RAS OUTPUT TABLES

### 8.8.1 Hec-Ras output tables for Q<sub>100cc</sub> - Zone A

**Table 8.1. HEC-RAS results showing water levels and velocities for Existing and Design Systems for Q<sub>100cc</sub> (Zone A).**

No	River	Reach	River Station [m]	Min Ch El [mOD]	Q [m3/s]			W.S. Elev [mOD]			Vel Chnl [m/s]					
					Exist	Design	ΔQ [m3/s]	Exist	Design	ΔH [m]	Exist	Design	Δv [m/s]			
1	Suir	Suir Upstream	5551.8	113.12	10.70	10.70	0.00	114.63	114.63	0.00	1.65	1.65	0.00			
2	Suir	Suir Upstream	5543.5	113.26	10.65	10.65	0.00	114.51	114.51	0.00	1.95	1.95	0.00			
3	Suir	Suir Upstream	5534.14	113.29	10.79	10.79	0.00	114.52	114.52	0.00	1.06	1.06	0.00			
4	Suir	Suir Upstream	5531.33	113.32	10.82	10.82	0.00	114.44	114.44	0.00	1.64	1.64	0.00			
5	Suir	Suir Upstream	5528.58		Bridge											
6	Suir	Suir Upstream	5524.26	113.14	10.82	10.82	0.00	114.51	114.51	0.00	1.01	1.01	0.00			
7	Suir	Suir Upstream	5508.63	112.91	10.74	10.74	0.00	114.44	114.44	0.00	1.17	1.17	0.00			
8	Suir	Suir Upstream	5472.29	112.94	10.74	10.74	0.00	114.31	114.31	0.00	1.19	1.19	0.00			
9	Suir	Suir Upstream	5425.81	112.59	10.74	10.74	0.00	114.15	114.15	0.00	1.11	1.11	0.00			
10	Suir	Suir Upstream	5379.36	112.57	10.74	10.74	0.00	113.94	113.94	0.00	1.32	1.32	0.00			
11	Suir	Suir Upstream	5359.02	112.35	10.74	10.74	0.00	113.84	113.84	0.00	1.34	1.34	0.00			
12	Suir	Suir Upstream	5319.68	112.19	10.74	10.74	0.00	113.61	113.61	0.00	1.46	1.46	0.00			
13	Suir	Suir Upstream	5290.57	112.04	10.74	10.74	0.00	113.47	113.47	0.00	1.35	1.35	0.00			
14	Suir	Suir Upstream	5251.13	111.72	10.74	10.74	0.00	113.28	113.28	0.00	1.35	1.35	0.00			
15	Suir	Suir Upstream	5226.9	111.69	10.74	10.74	0.00	113.15	113.15	0.00	1.41	1.41	0.00			
16	Suir	Suir Upstream	5182.5	111.61	10.74	10.74	0.00	112.96	112.96	0.00	1.27	1.27	0.00			
17	Suir	Suir Upstream	5145.7	111.33	10.73	10.73	0.00	112.81	112.81	0.00	1.23	1.23	0.00			
18	Suir	Suir Upstream	5120.65	111.19	10.73	10.73	0.00	112.70	112.70	0.00	1.30	1.30	0.00			
19	Suir	Suir Upstream	5103.48	111.07	10.73	10.73	0.00	112.65	112.65	0.00	1.17	1.17	0.00			
20	Suir	Suir Upstream	5086.56	111.16	10.73	10.73	0.00	112.62	112.62	0.00	1.06	1.06	0.00			
21	Suir	Suir Upstream	5071.77	111.09	10.73	10.73	0.00	112.56	112.56	0.00	1.12	1.12	0.00			
22	Suir	Suir Upstream	5053.7	110.97	10.73	10.73	0.00	112.52	112.52	0.00	1.06	1.06	0.00			
23	Suir	Suir Upstream	5028.3	110.95	10.73	10.73	0.00	112.46	112.46	0.00	0.97	0.97	0.00			
24	Suir	Suir Upstream	5002.24	110.84	10.73	10.73	0.00	112.32	112.32	0.00	1.30	1.30	0.00			
25	Suir	Suir Upstream	4983.89	110.78	10.73	10.73	0.00	112.29	112.29	0.00	0.89	0.89	0.00			
26	Suir	Suir Upstream	4957.66	110.71	10.73	10.73	0.00	112.23	112.23	0.00	0.91	0.91	0.00			
27	Suir	Suir Upstream	4950.6	110.52	10.73	10.73	0.00	112.22	112.22	0.00	0.91	0.91	0.00			
28	Suir	Suir Upstream	4919.64	110.51	10.73	10.73	0.00	112.14	112.14	0.00	1.03	1.03	0.00			
29	Suir	Suir Upstream	4886.21	110.48	10.73	10.73	0.00	112.07	112.07	0.00	0.99	0.99	0.00			
30	Suir	Suir Upstream	4854.05	110.26	10.73	10.73	0.00	112.02	112.02	0.00	0.85	0.85	0.00			
31	Suir	Suir Upstream	4834.08	110.21	10.73	10.73	0.00	111.98	111.98	0.00	0.94	0.94	0.00			
32	Suir	Suir Upstream	4793.14	110.25	10.73	10.73	0.00	111.89	111.89	0.00	1.02	1.02	0.00			
33	Suir	Suir Upstream	4728.88	110.01	10.73	10.73	0.00	111.74	111.74	0.00	1.03	1.03	0.00			
34	Suir	Suir Upstream	4692.44	109.98	10.73	10.73	0.00	111.66	111.66	0.00	1.03	1.03	0.00			

35	Suir	Suir Upstream	4675.95	109.94	10.73	10.73	0.00	111.61	111.61	0.00	1.08	1.08	0.00
36	Suir	Suir Upstream	4642.81	109.86	10.73	10.73	0.00	111.54	111.54	0.00	0.95	0.95	0.00
37	Suir	Suir Upstream	4620.13	109.8	10.73	10.73	0.00	111.47	111.47	0.00	1.10	1.10	0.00
38	Suir	Suir Upstream	4549.53	109.61	10.73	10.73	0.00	111.32	111.32	0.00	0.95	0.95	0.00
39	Suir	Suir Upstream	4523.16	109.48	10.73	10.72	-0.01	111.27	111.27	0.00	0.97	0.97	0.00
40	Suir	Suir Upstream	4514.12	109.41	10.72	10.72	0.00	111.25	111.25	0.00	0.93	0.93	0.00
42	Suir	Suir Upstream	4505.23	109.49	10.72	10.72	0.00	111.23	111.23	0.00	0.95	0.95	0.00
43	Suir	Suir Upstream	4503.56	109.42	10.73	10.72	-0.01	111.23	111.23	0.00	0.94	0.94	0.00
44	Suir	Suir Upstream	4485.26	109.45	10.72	10.72	0.00	111.19	111.19	0.00	0.97	0.97	0.00
45	Suir	Suir Upstream	4465.42	109.42	10.72	10.72	0.00	111.16	111.16	0.00	0.90	0.90	0.00
46	Suir	Suir Upstream	4428.95	109.16	10.72	10.72	0.00	111.09	111.09	0.00	0.97	0.97	0.00
47	Suir	Suir Upstream	4395.78	109.28	10.72	10.72	0.00	111.04	111.04	0.00	0.84	0.84	0.00
48	Suir	Suir Upstream	4381.28	109.31	10.72	10.72	0.00	111.01	111.01	0.00	0.94	0.94	0.00
49	Suir	Suir Upstream	4350.17	109.08	10.72	10.72	0.00	110.96	110.96	0.00	0.89	0.89	0.00
50	Suir	Suir Upstream	4320.12	109.27	10.71	10.71	0.00	110.91	110.91	0.00	0.91	0.91	0.00
51	Suir	Suir Upstream	4287.94	109.07	10.70	10.70	0.00	110.85	110.85	0.00	0.89	0.89	0.00
52	Suir	Suir Upstream	4255.79	108.85	10.70	10.70	0.00	110.82	110.82	0.00	0.78	0.78	0.00
53	Suir	Suir Upstream	4222.49	108.93	10.68	10.69	0.01	110.76	110.76	0.00	0.91	0.91	0.00
54	Suir	Suir Upstream	4217.47	108.9	10.65	10.65	0.00	110.75	110.75	0.00	0.95	0.95	0.00
55	Suir	Suir Middle	4206.25	109.07	13.15	13.15	0.00	110.75	110.75	0.00	0.84	0.84	0.00
56	Suir	Suir Middle	4187.29	108.89	13.15	13.15	0.00	110.72	110.72	0.00	0.89	0.89	0.00
57	Suir	Suir Middle	4166.56	108.84	13.76	13.76	0.00	110.66	110.66	0.00	1.14	1.14	0.00
58	Suir	Suir Middle	4162.31		Bridge								
59	Suir	Suir Middle	4158.16	108.78	13.74	13.73	-0.01	110.59	110.59	0.00	1.24	1.24	0.00
60	Suir	Suir Middle	4128.16	108.83	13.73	13.72	-0.01	110.56	110.56	0.00	0.97	0.97	0.00
61	Suir	Suir Middle	4093.2	108.69	13.71	13.71	0.00	110.51	110.51	0.00	0.89	0.89	0.00
62	Suir	Suir Middle	4080.51	108.76	13.69	13.69	0.00	110.48	110.48	0.00	0.99	0.99	0.00
63	Suir	Suir Middle	4045.44	108.57	13.61	13.61	0.00	110.44	110.44	0.00	0.83	0.83	0.00
64	Suir	Suir Middle	4018.92	108.63	13.63	13.63	0.00	110.40	110.40	0.00	0.85	0.85	0.00
65	Suir	Suir Middle	3995.44	108.42	13.57	13.57	0.00	110.37	110.37	0.00	0.86	0.86	0.00
66	Suir	Suir Middle	3937.26	108.45	13.42	13.45	0.03	110.30	110.30	0.00	0.77	0.77	0.00
67	Suir	Suir Middle	3887.66	108.27	11.68	11.54	-0.14	110.23	110.23	0.00	0.90	0.89	-0.01
68	Suir	Suir Middle	3862.41	108.36	10.17	10.16	-0.01	110.23	110.23	0.00	0.62	0.62	0.00
69	Suir	Suir Middle	3839.99	107.89	9.48	9.49	0.01	110.20	110.20	0.00	0.67	0.67	0.00
70	Suir	Suir Middle	3804.81	108.25	11.46	11.45	-0.01	110.15	110.15	0.00	0.74	0.74	0.00
71	Suir	Suir Middle	3791.86	108.12	12.22	12.22	0.00	110.11	110.12	0.01	0.80	0.80	0.00
72	Suir	Suir Middle	3752.47	108	14.03	14.04	0.01	110.05	110.05	0.00	0.81	0.81	0.00
73	Suir	Suir Middle	3735.14	108	14.78	14.79	0.01	110.03	110.03	0.00	0.73	0.73	0.00
74	Suir	Suir Middle	3658.49	107.91	16.26	16.27	0.01	109.92	109.92	0.00	0.91	0.91	0.00
75	Suir	Suir Middle	3616.67	107.43	16.25	16.26	0.01	109.87	109.87	0.00	0.84	0.84	0.00
76	Suir	Suir Middle	3553.11	107.5	16.24	16.25	0.01	109.77	109.77	0.00	0.95	0.95	0.00
77	Suir	Suir Middle	3509.18	107.49	16.22	16.24	0.02	109.72	109.72	0.00	0.86	0.87	0.01
78	Suir	Suir Middle	3504.08	107.38	16.22	16.23	0.01	109.70	109.70	0.00	0.95	0.95	0.00
79	Suir	Suir Middle	3458.94	107.22	16.22	16.22	0.00	109.63	109.63	0.00	0.87	0.87	0.00
80	Suir	Suir Middle	3411.93	107.54	16.21	16.22	0.01	109.53	109.53	0.00	1.07	1.07	0.00

81	Suir	Suir Middle	3385.6	107.44	15.97	15.98	0.01	109.50	109.50	0.00	0.90	0.90	0.00
82	Suir	Suir Middle	3361.54	107.31	15.03	14.99	-0.04	109.47	109.47	0.00	0.99	0.99	0.00
83	Suir	Suir Middle	3334.57	107.32	14.57	14.55	-0.02	109.43	109.43	0.00	1.02	1.03	0.01
84	Suir	Suir Middle	3286.13	107.29	13.12	12.60	-0.52	109.38	109.38	0.00	0.84	0.80	-0.04
85	Suir	Suir Middle	3218.56	107.14	10.27	9.80	-0.47	109.35	109.34	-0.01	0.68	0.65	-0.03
86	Suir	Suir Middle	3153.93	107.01	7.75	7.38	-0.37	109.32	109.32	0.00	0.59	0.56	-0.03
87	Suir	Suir Middle	3073.79	106.75	7.20	7.37	0.17	109.30	109.29	-0.01	0.42	0.43	0.01
88	Suir	Suir Middle	2949.15	106.48	10.36	10.45	0.09	109.22	109.22	0.00	0.61	0.61	0.00
89	Suir	Suir Middle	2854.92	106.55	12.38	12.16	-0.22	109.14	109.14	0.00	0.71	0.70	-0.01
90	Suir	Suir Middle	2790.53	106.28	15.18	15.02	-0.16	109.00	108.99	-0.01	1.10	1.09	-0.01
91	Suir	Suir Middle	2781.61	106.45	15.17	15.09	-0.08	108.95	108.95	0.00	1.30	1.30	0.00
92	Suir	Suir Middle	2779.79		Bridge								
93	Suir	Suir Middle	2772.74	106.53	15.17	15.09	-0.08	108.96	108.95	-0.01	0.87	0.87	0.00
94	Suir	Suir Middle	2703.27	106.34	15.27	15.25	-0.02	108.88	108.88	0.00	0.85	0.84	-0.01
95	Suir	Suir Middle	2641.44	106.18	12.94	12.92	-0.02	108.84	108.84	0.00	0.75	0.75	0.00
96	Suir	Suir Middle	2605.87	106.36	11.57	11.56	-0.01	108.80	108.80	0.00	0.83	0.83	0.00
97	Suir	Suir Middle	2588.19	106.43	11.23	11.22	-0.01	108.74	108.74	0.00	1.12	1.12	0.00
98	Suir	Suir Middle	2586.89		Bridge								
99	Suir	Suir Middle	2585	106.51	11.23	11.22	-0.01	108.72	108.72	0.00	1.00	1.00	0.00
100	Suir	Suir Middle	2579.9	106.03	11.23	11.22	-0.01	108.74	108.74	0.00	0.81	0.81	0.00
101	Suir	Suir Middle	2567.99	106.45	11.25	11.25	0.00	108.72	108.72	0.00	0.87	0.87	0.00
102	Suir	Suir Middle	2540.8	106.44	11.02	11.01	-0.01	108.70	108.70	0.00	0.72	0.72	0.00
103	Suir	Suir Middle	2503.22	106.34	9.65	9.65	0.00	108.68	108.68	0.00	0.65	0.65	0.00
104	Suir	Suir Middle	2423	106.41	10.34	10.34	0.00	108.57	108.57	0.00	0.86	0.86	0.00
105	Suir	Suir Middle	2331.96	106.16	10.49	10.48	-0.01	108.49	108.49	0.00	0.67	0.67	0.00
106	Suir	Suir Middle	2312.37	106.08	10.10	10.10	0.00	108.49	108.48	-0.01	0.54	0.54	0.00
107	Suir	Suir Middle	2300.51	106.03	10.11	10.27	0.16	108.48	108.47	-0.01	0.65	0.66	0.01
108	Suir	Suir Middle	2243.81	105.81	9.14	9.16	0.02	108.43	108.43	0.00	0.62	0.63	0.01
109	Suir	Suir Middle	2134.59	105.96	6.70	6.34	-0.36	108.38	108.38	0.00	0.52	0.50	-0.02
110	Suir	Suir Middle	2125.5	106.03	6.32	6.25	-0.07	108.37	108.37	0.00	0.54	0.53	-0.01
111	Suir	Suir Middle	2123.78	105.96	6.37	6.30	-0.07	108.37	108.37	0.00	0.63	0.63	0.00
112	Suir	Suir Middle	2120.98		Bridge								
113	Suir	Suir Middle	2117.48	106.05	6.37	6.29	-0.08	108.36	108.36	0.00	0.56	0.55	-0.01
114	Suir	Suir Middle	2109.51	106.03	5.97	5.90	-0.07	108.38	108.38	0.00	0.36	0.36	0.00
115	Suir	Suir Middle	2083.43	105.89	5.95	5.86	-0.09	108.37	108.37	0.00	0.38	0.38	0.00
116	Suir	Suir Middle	2057.15	105.54	8.59	8.54	-0.05	108.36	108.36	0.00	0.61	0.60	-0.01
117	Suir	Suir Middle	1986.93	105.62	9.03	8.97	-0.06	108.33	108.33	0.00	0.64	0.63	-0.01
118	Suir	Suir Middle	1926.65	105.54	7.31	7.22	-0.09	108.28	108.28	0.00	0.45	0.45	0.00
119	Suir	Suir Middle	1902.78	105.35	5.95	5.85	-0.10	108.28	108.28	0.00	0.38	0.37	-0.01
120	Suir	Suir Middle	1878.42	105.76	5.48	5.40	-0.08	108.27	108.28	0.01	0.35	0.34	-0.01
121	Suir	Suir Middle	1834.36	105.1	3.82	3.72	-0.10	108.27	108.28	0.01	0.23	0.22	-0.01
122	Suir	Suir Middle	1818.73	105.25	2.75	2.62	-0.13	108.28	108.28	0.00	0.15	0.15	0.00
123	Suir	Suir Middle	1810.5	105.33	2.04	1.95	-0.09	108.28	108.28	0.00	0.12	0.12	0.00
124	Suir	Suir Middle	1795	105.17	0.65	0.55	-0.10	108.28	108.29	0.01	0.04	0.03	-0.01
125	Suir	Suir Middle	1779.83	105.57	0.84	0.74	-0.10	108.29	108.30	0.01	0.05	0.05	0.00



126	Suir	Suir Middle	1771.29	105.51	2.08	1.98	-0.10	108.29	108.29	0.00	0.15	0.14	-0.01
127	Suir	Suir Lower	1761.1	105.68	8.70	8.66	-0.04	108.29	108.29	0.00	0.39	0.39	0.00
128	Suir	Suir Lower	1731.85	105.66	8.34	8.24	-0.10	108.27	108.28	0.01	0.34	0.34	0.00
129	Suir	Suir Lower	1699.08	105.61	21.20	21.28	0.08	108.17	108.18	0.01	0.92	0.92	0.00
130	Suir	Suir Lower	1688.91	105.47	17.18	18.18	1.00	108.03	108.04	0.01	1.48	1.56	0.08
131	Suir	Suir Lower	1687.69		Bridge								
132	Suir	Suir Lower	1686.59	105.51	21.37	18.78	-2.59	108.08	108.09	0.01	1.51	1.32	-0.19
133	Suir	Suir Lower	1680.14	105.53	21.70	21.79	0.09	108.12	108.12	0.00	0.94	0.94	0.00
134	Suir	Suir Lower	1592.13	105.4	15.83	16.43	0.60	108.06	108.07	0.01	0.67	0.69	0.02
135	Suir	Suir Lower	1568.53	105.36	14.79	14.97	0.18	108.04	108.05	0.01	0.71	0.71	0.00
136	Suir	Suir Lower	1543.63	105.32	13.72	13.90	0.18	108.04	108.05	0.01	0.44	0.45	0.01
137	Suir	Suir Lower	1511.48	105.27	11.92	11.91	-0.01	108.02	108.03	0.01	0.60	0.59	-0.01
138	Suir	Suir Lower	1498.45	104.8	11.54	11.40	-0.14	108.02	108.03	0.01	0.51	0.50	-0.01
139	Suir	Suir Lower	1430.48	104.72	9.52	9.34	-0.18	108.01	108.02	0.01	0.41	0.40	-0.01
140	Suir	Suir Lower	1391.8	105.04	8.82	8.69	-0.13	108.00	108.01	0.01	0.38	0.38	0.00
141	Suir	Suir Lower	1386.56	105.09	8.59	8.46	-0.13	108.00	108.01	0.01	0.37	0.36	-0.01
142	Suir	Suir Lower	1343.08	105.41	8.35	8.19	-0.16	107.98	107.99	0.01	0.42	0.41	-0.01
143	Suir	Suir Lower	1323.55	105.27	7.83	7.74	-0.09	107.98	107.99	0.01	0.29	0.29	0.00
144	Suir	Suir Lower	1265.56	104.84	6.56	6.45	-0.11	107.98	107.99	0.01	0.20	0.20	0.00
145	Suir	Suir Lower	1121.76	104.51	3.68	3.67	-0.01	107.98	107.99	0.01	0.12	0.12	0.00
146	Suir	Suir Lower	979.924	104.65	3.19	3.20	0.01	107.98	107.99	0.01	0.12	0.12	0.00
147	Suir	Suir Lower	956.006	104.35	2.69	2.69	0.00	107.98	107.99	0.01	0.09	0.09	0.00
148	Suir	Suir Lower	887.735	104.92	1.85	1.84	-0.01	107.98	107.99	0.01	0.07	0.07	0.00
149	Suir	Suir Lower	780.578	104.34	2.91	2.91	0.00	107.98	107.99	0.01	0.12	0.12	0.00
150	Suir	Suir Lower	720.666	104.33	3.40	3.39	-0.01	107.98	107.99	0.01	0.09	0.09	0.00
151	Suir	Suir Lower	647.406	104.27	4.35	4.36	0.01	107.98	107.99	0.01	0.16	0.16	0.00
152	Suir	Suir Lower	643.471	104.29	4.98	5.01	0.03	107.98	107.99	0.01	0.13	0.13	0.00
153	Suir	Suir Lower	533.199	104.72	9.56	9.49	-0.07	107.96	107.97	0.01	0.32	0.32	0.00
154	Suir	Suir Lower	413.562	104.55	15.60	15.61	0.01	107.90	107.91	0.01	0.71	0.70	-0.01
155	Suir	Suir Lower	408.34	104.64	15.69	15.71	0.02	107.89	107.90	0.01	0.74	0.73	-0.01
156	Suir	Suir Downstream	390.489	104.88	26.04	26.10	0.06	107.89	107.90	0.01	0.91	0.91	0.00
157	Suir	Suir Downstream	384.581	105.08	25.15	25.19	0.04	107.89	107.90	0.01	0.90	0.90	0.00
158	Suir	Suir Downstream	379.785	104.59	25.15	25.19	0.04	107.87	107.88	0.01	0.87	0.87	0.00
159	Suir	Suir Downstream	378.023	104.49	25.29	25.33	0.04	107.87	107.88	0.01	0.87	0.87	0.00
160	Suir	Suir Downstream	361.265	104.53	27.43	27.51	0.08	107.84	107.85	0.01	0.95	0.95	0.00
161	Suir	Suir Downstream	347.287	104.48	28.30	28.39	0.09	107.83	107.84	0.01	0.93	0.92	-0.01
162	Suir	Suir Downstream	325.376	104.52	30.15	30.28	0.13	107.79	107.80	0.01	1.03	1.03	0.00
163	Suir	Suir Downstream	301.029	104.55	29.72	29.84	0.12	107.77	107.78	0.01	0.97	0.96	-0.01
164	Suir	Suir Downstream	273.085	104.55	28.18	28.94	0.76	107.74	107.76	0.02	0.96	0.99	0.03
165	Suir	Suir Downstream	251.032	104.51	27.58	28.38	0.80	107.72	107.73	0.01	0.97	0.99	0.02
166	Suir	Suir Downstream	212.459	104.41	27.03	27.58	0.55	107.69	107.70	0.01	0.97	0.98	0.01
167	Suir	Suir Downstream	194.064	104.24	29.64	30.05	0.41	107.64	107.66	0.02	1.16	1.17	0.01
168	Suir	Suir Downstream	156.034	104.32	35.17	35.38	0.21	107.56	107.57	0.01	1.21	1.21	0.00
169	Suir	Suir Downstream	132.858	104.29	35.95	36.10	0.15	107.43	107.44	0.01	1.60	1.59	-0.01
170	Suir	Suir Downstream	98.5741	104.3	38.31	38.62	0.31	107.18	107.19	0.01	2.06	2.07	0.01

171	Suir	Suir Downstream	91.7583	104.31	38.36	38.67	0.31	107.16	107.18	0.02	1.93	1.94	0.01
172	Suir	Suir Downstream	82.0593	104.38	38.10	38.37	0.27	107.09	107.11	0.02	2.11	2.11	0.00
173	Suir	Suir Downstream	75.6761		Bridge								
174	Suir	Suir Downstream	68.5994	104.37	38.08	38.37	0.29	106.88	106.89	0.01	1.90	1.90	0.00
175	Suir	Suir Downstream	60.5481	104.35	38.20	38.49	0.29	106.90	106.91	0.01	1.58	1.58	0.00
176	Suir	Suir Downstream	30.6031	104.18	38.26	38.57	0.31	106.68	106.69	0.01	2.03	2.03	0.00
177	Suir	Suir Downstream	1.83059	104.14	38.26	38.57	0.31	106.45	106.46	0.01	2.22	2.23	0.01
178	Eastwood	Eastwood UP	3729.06	114.59	4.32	4.32	0.00	115.48	115.48	0.00	1.74	1.74	0.00
179	Eastwood	Eastwood UP	3650.86	113.76	3.53	3.53	0.00	114.84	114.85	0.01	1.15	1.15	0.00
180	Eastwood	Eastwood UP	3637.47	113.69	3.25	3.25	0.00	114.80	114.80	0.00	1.13	1.13	0.00
181	Eastwood	Eastwood UP	3622.6	113.53	4.04	4.04	0.00	114.57	114.57	0.00	1.93	1.93	0.00
182	Eastwood	Eastwood UP	3616.01	113.48	4.17	4.17	0.00	114.53	114.53	0.00	1.49	1.49	0.00
183	Eastwood	Eastwood UP	3613.64	113.47	4.19	4.19	0.00	114.53	114.53	0.00	1.32	1.32	0.00
184	Eastwood	Eastwood UP	3589.52	113.36	3.85	3.87	0.02	114.37	114.37	0.00	1.42	1.42	0.00
185	Eastwood	Eastwood UP	3571.19	113.13	3.96	3.97	0.01	114.22	114.22	0.00	1.49	1.49	0.00
186	Eastwood	Eastwood UP	3556	113.01	4.35	4.35	0.00	114.13	114.13	0.00	1.31	1.31	0.00
187	Eastwood	Eastwood UP	3543.45	112.95	4.31	4.32	0.01	114.08	114.08	0.00	1.11	1.11	0.00
188	Eastwood	Eastwood UP	3493.99	112.53	4.31	4.31	0.00	113.75	113.75	0.00	1.47	1.47	0.00
189	Eastwood	Eastwood UP	3483.65	112.54	4.30	4.30	0.00	113.66	113.66	0.00	1.51	1.51	0.00
190	Eastwood	Eastwood UP	3475.1	112.42	4.30	4.30	0.00	113.62	113.62	0.00	1.32	1.32	0.00
191	Eastwood	Eastwood UP	3467.73	112.4	4.30	4.30	0.00	113.55	113.55	0.00	1.47	1.47	0.00
192	Eastwood	Eastwood UP	3458.12	112.31	4.30	4.30	0.00	113.46	113.46	0.00	1.53	1.53	0.00
193	Eastwood	Eastwood UP	3447.92	112.25	4.30	4.30	0.00	113.39	113.39	0.00	1.46	1.46	0.00
194	Eastwood	Eastwood UP	3444.02	112.3	4.30	4.30	0.00	113.39	113.39	0.00	1.19	1.19	0.00
195	Eastwood	Eastwood UP	3440.72	112.3	4.30	4.30	0.00	113.34	113.34	0.00	1.52	1.52	0.00
196	Eastwood	Eastwood UP	3435.91	112.2	4.30	4.30	0.00	113.33	113.33	0.00	1.23	1.23	0.00
197	Eastwood	Eastwood UP	3432.19	112.16	4.31	4.31	0.00	113.32	113.32	0.00	1.19	1.19	0.00
198	Eastwood	Eastwood UP	3428.28	112.22	4.51	4.51	0.00	113.31	113.31	0.00	1.05	1.05	0.00
199	Eastwood	Eastwood UP	3425.52	112.21	4.55	4.56	0.01	113.30	113.31	0.01	1.03	1.03	0.00
200	Eastwood	Eastwood UP	3423.12	112.15	4.49	4.49	0.00	113.32	113.32	0.00	0.76	0.76	0.00
201	Eastwood	Eastwood UP	3422.29	112.1	4.30	4.30	0.00	113.32	113.32	0.00	0.88	0.88	0.00
202	Eastwood	Eastwood UP	3413.84		Bridge								
203	Eastwood	Eastwood UP	3406	112.05	4.30	4.30	0.00	112.75	112.75	0.00	1.35	1.35	0.00
204	Eastwood	Eastwood UP	3404.37	111.84	4.30	4.31	0.01	112.79	112.79	0.00	0.94	0.94	0.00
205	Eastwood	Eastwood UP	3389	111.8	4.32	4.33	0.01	112.68	112.69	0.01	1.20	1.20	0.00
206	Eastwood	Eastwood UP	3356.18	111.58	4.31	4.31	0.00	112.38	112.38	0.00	1.56	1.57	0.01
207	Eastwood	Eastwood UP	3326.47	111.17	4.30	4.30	0.00	112.01	112.01	0.00	1.69	1.69	0.00
208	Eastwood	Eastwood UP	3322.62	111.12	4.30	4.30	0.00	111.95	111.95	0.00	1.73	1.73	0.00
209	Eastwood	Eastwood UP	3310.1	111.02	4.30	4.30	0.00	111.79	111.79	0.00	1.64	1.64	0.00
210	Eastwood	Eastwood UP	3261.08	110.29	4.30	4.30	0.00	111.32	111.32	0.00	1.31	1.31	0.00
211	Eastwood	Eastwood UP	3258.27	110.28	4.29	4.30	0.01	111.29	111.29	0.00	1.40	1.40	0.00
212	Eastwood	Eastwood UP	3232.97	110.02	4.29	4.29	0.00	110.97	110.97	0.00	1.83	1.83	0.00
213	Eastwood	Eastwood UP	3157.99	109.11	4.26	4.26	0.00	110.03	110.03	0.00	1.46	1.46	0.00
214	Eastwood	Eastwood UP	3156.38		Bridge								
215	Eastwood	Eastwood UP	3154.51	109	4.26	4.26	0.00	109.97	109.97	0.00	1.58	1.58	0.00

216	Eastwood	Eastwood UP	3108.81	108.59	4.26	4.26	0.00	109.50	109.50	0.00	1.50	1.50	0.00
217	Eastwood	Eastwood UP	3068.74	108.19	4.17	4.17	0.00	109.32	109.32	0.00	0.80	0.80	0.00
218	Eastwood	Eastwood UP	3035.3	108.05	4.10	4.09	-0.01	109.26	109.26	0.00	0.73	0.73	0.00
219	Eastwood	Eastwood UP	2896.79	107.4	4.35	4.35	0.00	108.95	108.95	0.00	0.82	0.82	0.00
220	Eastwood	Eastwood UP	2769.41	107.33	4.40	4.40	0.00	108.71	108.71	0.00	0.72	0.72	0.00
221	Eastwood	Eastwood UP	2665.24	107.28	4.29	4.27	-0.02	108.59	108.59	0.00	0.66	0.66	0.00
222	Eastwood	Eastwood UP	2660.2	107.25	4.24	4.22	-0.02	108.58	108.58	0.00	0.70	0.70	0.00
223	Eastwood	Eastwood UP	2621.08	107.05	4.19	4.15	-0.04	108.50	108.50	0.00	0.88	0.87	-0.01
224	Eastwood	Eastwood UP	2600.61	106.95	4.10	4.07	-0.03	108.48	108.48	0.00	0.77	0.76	-0.01
225	Eastwood	Eastwood UP	2590.9	106.9	4.04	3.97	-0.07	108.45	108.45	0.00	0.89	0.87	-0.02
226	Eastwood	Eastwood UP	2572.59	106.79	3.96	3.93	-0.03	108.44	108.44	0.00	0.78	0.77	-0.01
227	Eastwood	Eastwood UP	2557.29	106.8	3.98	3.96	-0.02	108.44	108.44	0.00	0.51	0.51	0.00
228	Eastwood	Eastwood UP	2554.63	106.79	3.98	3.96	-0.02	108.44	108.44	0.00	0.51	0.51	0.00
229	Eastwood	Eastwood UP	2536.87	106.73	4.86	4.81	-0.05	108.37	108.37	0.00	0.86	0.85	-0.01
230	Eastwood	Eastwood Middle	2529.21	106.7	6.72	6.71	-0.01	108.37	108.37	0.00	0.76	0.76	0.00
231	Eastwood	Eastwood Middle	2525.58	106.69	6.72	6.71	-0.01	108.36	108.36	0.00	0.83	0.83	0.00
232	Eastwood	Eastwood Middle	2500.57	106.64	6.69	6.69	0.00	108.22	108.22	0.00	1.45	1.45	0.00
233	Eastwood	Eastwood Middle	2474.79	106.59	6.73	6.74	0.01	108.18	108.18	0.00	0.92	0.92	0.00
234	Eastwood	Eastwood Middle	2444.89	106.54	6.73	6.70	-0.03	108.12	108.12	0.00	0.96	0.96	0.00
235	Eastwood	Eastwood Middle	2431.92	106.41	6.15	5.78	-0.37	108.08	108.08	0.00	0.93	0.87	-0.06
236	Eastwood	Eastwood Middle	2389.44	106.31	4.38	4.34	-0.04	108.04	108.05	0.01	0.61	0.60	-0.01
237	Eastwood	Eastwood Middle	2332.94	106.19	2.25	2.22	-0.03	108.04	108.05	0.01	0.36	0.35	-0.01
238	Eastwood	Eastwood Middle	2326.43	106.33	2.38	2.35	-0.03	108.03	108.04	0.01	0.50	0.49	-0.01
239	Eastwood	Eastwood Middle	2324.57		Bridge								
240	Eastwood	Eastwood Middle	2321.53	106.09	2.39	2.36	-0.03	108.03	108.04	0.01	0.40	0.39	-0.01
241	Eastwood	Eastwood Middle	2320.14	106.07	2.43	2.40	-0.03	108.03	108.04	0.01	0.38	0.37	-0.01
242	Eastwood	Eastwood Middle	2318.18	105.98	2.46	2.43	-0.03	108.03	108.04	0.01	0.35	0.34	-0.01
243	Eastwood	Eastwood Middle	2307.97	106.03	2.44	2.41	-0.03	108.03	108.04	0.01	0.31	0.31	0.00
244	Eastwood	Eastwood Middle	2295.28	106.05	2.33	2.30	-0.03	108.03	108.04	0.01	0.27	0.26	-0.01
245	Eastwood	Eastwood Middle	2290.92	105.88	2.25	2.22	-0.03	108.03	108.04	0.01	0.29	0.29	0.00
246	Eastwood	Eastwood Middle	2289		Bridge								
247	Eastwood	Eastwood Middle	2286.93	106.04	2.25	2.21	-0.04	108.03	108.04	0.01	0.30	0.30	0.00
248	Eastwood	Eastwood Middle	2282.8	106.37	2.20	2.17	-0.03	108.03	108.04	0.01	0.30	0.29	-0.01
249	Eastwood	Eastwood Middle	2231.44	106.28	1.70	1.68	-0.02	108.03	108.04	0.01	0.17	0.16	-0.01
250	Eastwood	Eastwood Middle	2115.69	105.96	1.65	1.62	-0.03	108.03	108.04	0.01	0.16	0.15	-0.01
251	Eastwood	Eastwood Middle	2106.79	105.94	1.74	1.69	-0.05	108.03	108.04	0.01	0.16	0.15	-0.01
252	Eastwood	Eastwood Middle	2089.83	105.91	1.99	1.95	-0.04	108.02	108.03	0.01	0.17	0.17	0.00
253	Eastwood	Eastwood Middle	1983.71	105.54	1.86	1.84	-0.02	108.02	108.03	0.01	0.16	0.15	-0.01
254	Eastwood	Eastwood Middle	1975.34	105.53	1.77	1.76	-0.01	108.02	108.03	0.01	0.26	0.26	0.00
255	Eastwood	Eastwood Middle	1969.14	105.53	1.79	1.77	-0.02	108.02	108.03	0.01	0.23	0.23	0.00
256	Eastwood	Eastwood Middle	1903.54	105.5	2.31	2.28	-0.03	108.01	108.02	0.01	0.21	0.20	-0.01
257	Eastwood	Eastwood Middle	1829.69	105.46	1.89	1.91	0.02	108.01	108.02	0.01	0.14	0.14	0.00
258	Eastwood	Eastwood Middle	1784.35	105.44	2.02	2.10	0.08	108.01	108.02	0.01	0.13	0.13	0.00
259	Eastwood	Eastwood Middle	1769.22	105.64	1.98	2.06	0.08	108.01	108.02	0.01	0.12	0.12	0.00
260	Eastwood	Eastwood Middle	1752.91	105.86	1.97	2.05	0.08	108.01	108.02	0.01	0.16	0.17	0.01

261	Eastwood	Eastwood Lower	1751.56	105.88	1.54	1.52	-0.02	108.01	108.02	0.01	0.08	0.08	0.00
262	Eastwood	Eastwood Lower	1737.94	106.07	1.53	1.50	-0.03	108.01	108.02	0.01	0.14	0.14	0.00
263	Eastwood	Eastwood Lower	1726.89	106.09	1.52	1.50	-0.02	108.01	108.02	0.01	0.20	0.20	0.00
264	Eastwood	Eastwood Lower	1688.34	106.16	1.44	1.42	-0.02	108.00	108.01	0.01	0.26	0.25	-0.01
265	Eastwood	Eastwood Lower	1631.25	105.95	1.68	1.72	0.04	108.00	108.01	0.01	0.15	0.15	0.00
266	Eastwood	Eastwood Lower	1611.42	105.92	1.85	1.93	0.08	108.00	108.01	0.01	0.18	0.18	0.00
267	Eastwood	Eastwood Lower	1598.18	105.93	1.83	1.92	0.09	108.00	108.01	0.01	0.13	0.14	0.01
268	Eastwood	Eastwood Lower	1558.08	106.93	2.01	2.57	0.56	108.00	108.00	0.00	0.18	0.23	0.05
269	Eastwood	Eastwood Lower	1555		Culvert								
270	Eastwood	Eastwood Lower	1468.55	105.84	2.11	2.57	0.46	107.99	108.00	0.01	0.15	0.18	0.03
271	Eastwood	Eastwood Lower	1425.68	105.82	1.57	1.72	0.15	107.99	108.00	0.01	0.13	0.14	0.01
272	Eastwood	Eastwood Lower	1419.37	105.66	1.40	1.61	0.21	107.99	108.00	0.01	0.15	0.17	0.02
273	Eastwood	Eastwood Lower	1416.83		Bridge								
274	Eastwood	Eastwood Lower	1414.13	105.84	1.40	1.61	0.21	107.99	108.00	0.01	0.15	0.17	0.02
275	Eastwood	Eastwood Lower	1409.78	105.78	1.31	1.54	0.23	107.99	108.00	0.01	0.15	0.18	0.03
276	Eastwood	Eastwood Lower	1385.87	105.73	1.21	1.39	0.18	107.99	108.00	0.01	0.10	0.11	0.01
277	Eastwood	Eastwood Lower	1379.22	105.78	1.14	1.33	0.19	107.99	108.00	0.01	0.08	0.09	0.01
278	Eastwood	Eastwood Lower	1373.79	105.81	1.05	1.23	0.18	107.99	108.01	0.02	0.06	0.07	0.01
279	Eastwood	Eastwood Lower	1367.76	105.85	1.07	1.24	0.17	107.99	108.01	0.02	0.05	0.06	0.01
280	Eastwood	Eastwood Lower	1347.46	105.75	0.67	0.80	0.13	107.99	108.00	0.01	0.07	0.08	0.01
281	Eastwood	Eastwood Lower	1289.41	105.67	1.27	1.37	0.10	107.99	108.00	0.01	0.11	0.12	0.01
282	Eastwood	Eastwood Lower	1279.02	105.76	0.49	0.56	0.07	108.00	108.01	0.01	0.04	0.05	0.01
283	Eastwood	Eastwood Lower	1252	105.58	0.41	0.48	0.07	107.99	108.00	0.01	0.03	0.04	0.01
284	Eastwood	Eastwood MidLow	1238.99	105.5	1.05	0.94	-0.11	107.99	108.00	0.01	0.09	0.08	-0.01
285	Eastwood	Eastwood MidLow	1203.25	105.61	1.66	1.47	-0.19	107.99	108.00	0.01	0.15	0.13	-0.02
286	Eastwood	Eastwood MidLow	1178.05	105.56	1.33	1.22	-0.11	107.99	108.00	0.01	0.12	0.11	-0.01
287	Eastwood	Eastwood MidLow	1160.74	105.46	0.94	0.99	0.05	107.99	108.00	0.01	0.08	0.08	0.00
288	Eastwood	Eastwood MidLow	1141.13	105.44	0.79	1.01	0.22	107.99	108.00	0.01	0.06	0.08	0.02
289	Eastwood	Eastwood MidLow	1104.68	105.49	0.89	1.03	0.14	107.99	108.00	0.01	0.07	0.09	0.02
290	Eastwood	Eastwood MidLow	1029.94	105.21	0.90	1.07	0.17	107.99	108.00	0.01	0.07	0.08	0.01
291	Eastwood	Eastwood MidLow	1026.88		Bridge								
292	Eastwood	Eastwood MidLow	1023.66	105.35	0.90	1.07	0.17	107.99	108.00	0.01	0.07	0.08	0.01
293	Eastwood	Eastwood MidLow	980.716	105.39	1.13	1.32	0.19	107.99	108.00	0.01	0.08	0.10	0.02
294	Eastwood	Eastwood MidLow	973.443	105.44	1.79	1.99	0.20	107.99	108.00	0.01	0.10	0.11	0.01
295	Eastwood	Eastwood DN	966.972	105.44	2.54	2.75	0.21	107.99	108.00	0.01	0.14	0.16	0.02
296	Eastwood	Eastwood DN	856.701	105.47	1.49	1.58	0.09	107.98	108.00	0.02	0.12	0.12	0.00
297	Eastwood	Eastwood DN	753.091	105.39	1.06	1.13	0.07	107.99	108.00	0.01	0.07	0.08	0.01
298	Eastwood	Eastwood DN	632.196	105.15	0.76	0.80	0.04	107.98	107.99	0.01	0.05	0.05	0.00
299	Eastwood	Eastwood DN	532.555	105.37	0.65	0.70	0.05	107.98	107.99	0.01	0.03	0.04	0.01
300	Eastwood	Eastwood DN	506.277	105.31	1.15	1.20	0.05	107.98	108.00	0.02	0.07	0.08	0.01
301	Eastwood	Eastwood DN	459.994	105.33	0.99	1.07	0.08	107.98	107.99	0.01	0.06	0.07	0.01
302	Eastwood	Eastwood DN	420.226	105.33	0.81	0.93	0.12	107.98	107.99	0.01	0.05	0.06	0.01
303	Eastwood	Eastwood DN	387.011	105.33	0.58	0.68	0.10	107.98	107.99	0.01	0.04	0.04	0.00
304	Eastwood	Eastwood DN	382.006	105.4	0.56	0.56	0.00	107.98	107.99	0.01	0.04	0.04	0.00
305	Eastwood	Eastwood DN	377.969	105.28	0.52	0.48	-0.04	107.98	107.99	0.01	0.04	0.03	-0.01

306	Eastwood	Eastwood DN	375.829		Bridge								
307	Eastwood	Eastwood DN	373.189	105.34	0.52	0.48	-0.04	107.98	107.99	0.01	0.04	0.04	0.00
308	Eastwood	Eastwood DN	367.945	105.32	0.65	0.69	0.04	107.98	107.99	0.01	0.04	0.05	0.01
309	Eastwood	Eastwood DN	333.348	105.25	0.89	0.97	0.08	107.98	107.99	0.01	0.05	0.06	0.01
310	Eastwood	Eastwood DN	281.341	105.09	1.56	1.52	-0.04	107.98	107.99	0.01	0.10	0.10	0.00
311	Eastwood	Eastwood DN	269.683	105.07	1.53	1.53	0.00	107.98	107.99	0.01	0.09	0.09	0.00
312	Eastwood	Eastwood DN	223.169	105.17	2.10	2.10	0.00	107.98	107.99	0.01	0.14	0.14	0.00
313	Eastwood	Eastwood DN	169.306	105.22	3.51	3.46	-0.05	107.97	107.98	0.01	0.26	0.25	-0.01
314	Eastwood	Eastwood DN	105.13	105.54	5.93	5.92	-0.01	107.95	107.96	0.01	0.42	0.41	-0.01
315	Eastwood	Eastwood DN	71.8761	105.22	6.97	6.97	0.00	107.94	107.95	0.01	0.46	0.46	0.00
316	Eastwood	Eastwood DN	36.8629	104.84	7.49	7.52	0.03	107.93	107.94	0.01	0.47	0.47	0.00
317	Eastwood	Eastwood DN	36.0798		Bridge								
318	Eastwood	Eastwood DN	35.1494	104.83	7.49	7.52	0.03	107.92	107.94	0.02	0.49	0.49	0.00
319	Eastwood	Eastwood DN	26.5665	104.79	7.51	7.53	0.02	107.92	107.93	0.01	0.50	0.49	-0.01
320	Eastwood	Eastwood DN	20.6975	104.78	8.00	8.02	0.02	107.92	107.93	0.01	0.55	0.55	0.00
321	Eastwood	Eastwood DN	13.253	104.75	10.35	10.38	0.03	107.89	107.90	0.01	0.73	0.72	-0.01

## 8.8.2 Hec-Ras output tables for Q<sub>1000cc</sub> - Zone B

Table 8.2. HEC-RAS results showing water levels and velocities for Existing and Design Systems for Q<sub>1000cc</sub> (Zone B)

No	River	Reach	River Station [m]	Min Ch El [mOD]	Q [m3/s]			W.S. Elev [mOD]			Vel Chnl [m/s]		
					Exist	Design	ΔQ [m3/s]	Exist	Design	ΔH [m]	Exist	Design	Δv [m/s]
1	Suir	Suir Upstream	5551.8	113.12	13.52	13.52	0.00	114.80	114.80	0.00	1.82	1.82	0.00
2	Suir	Suir Upstream	5543.5	113.26	13.42	13.46	0.04	114.68	114.68	0.00	2.09	2.10	0.01
3	Suir	Suir Upstream	5534.14	113.29	13.70	13.56	-0.14	114.70	114.69	-0.01	1.15	1.14	-0.01
4	Suir	Suir Upstream	5531.33	113.32	13.75	13.58	-0.17	114.61	114.61	0.00	1.74	1.73	-0.01
5	Suir	Suir Upstream	5528.58		Bridge								
6	Suir	Suir Upstream	5524.26	113.14	13.75	13.58	-0.17	114.70	114.69	-0.01	1.09	1.08	-0.01
7	Suir	Suir Upstream	5508.63	112.91	13.56	13.52	-0.04	114.63	114.62	-0.01	1.26	1.25	-0.01
8	Suir	Suir Upstream	5472.29	112.94	13.51	13.49	-0.02	114.49	114.49	0.00	1.26	1.26	0.00
9	Suir	Suir Upstream	5425.81	112.59	13.47	13.45	-0.02	114.34	114.34	0.00	1.18	1.18	0.00
10	Suir	Suir Upstream	5379.36	112.57	13.55	13.52	-0.03	114.13	114.13	0.00	1.39	1.39	0.00
11	Suir	Suir Upstream	5359.02	112.35	13.55	13.52	-0.03	114.03	114.03	0.00	1.44	1.44	0.00
12	Suir	Suir Upstream	5319.68	112.19	13.55	13.52	-0.03	113.81	113.80	-0.01	1.55	1.55	0.00
13	Suir	Suir Upstream	5290.57	112.04	13.55	13.52	-0.03	113.66	113.66	0.00	1.44	1.44	0.00
14	Suir	Suir Upstream	5251.13	111.72	13.55	13.52	-0.03	113.47	113.47	0.00	1.45	1.45	0.00
15	Suir	Suir Upstream	5226.9	111.69	13.55	13.52	-0.03	113.34	113.34	0.00	1.51	1.51	0.00
16	Suir	Suir Upstream	5182.5	111.61	13.55	13.52	-0.03	113.15	113.15	0.00	1.35	1.35	0.00
17	Suir	Suir Upstream	5145.7	111.33	13.55	13.52	-0.03	113.01	113.01	0.00	1.32	1.32	0.00
18	Suir	Suir Upstream	5120.65	111.19	13.54	13.52	-0.02	112.90	112.89	-0.01	1.40	1.39	-0.01
19	Suir	Suir Upstream	5103.48	111.07	13.54	13.52	-0.02	112.85	112.84	-0.01	1.27	1.27	0.00
20	Suir	Suir Upstream	5086.56	111.16	13.54	13.52	-0.02	112.81	112.81	0.00	1.12	1.12	0.00
21	Suir	Suir Upstream	5071.77	111.09	13.54	13.52	-0.02	112.76	112.76	0.00	1.20	1.20	0.00
22	Suir	Suir Upstream	5053.7	110.97	13.54	13.52	-0.02	112.71	112.71	0.00	1.14	1.14	0.00
23	Suir	Suir Upstream	5028.3	110.95	13.54	13.52	-0.02	112.66	112.66	0.00	1.03	1.03	0.00
24	Suir	Suir Upstream	5002.24	110.84	13.54	13.52	-0.02	112.53	112.53	0.00	1.30	1.30	0.00
25	Suir	Suir Upstream	4983.89	110.78	13.54	13.52	-0.02	112.51	112.51	0.00	0.90	0.90	0.00
26	Suir	Suir Upstream	4957.66	110.71	13.54	13.52	-0.02	112.45	112.45	0.00	0.95	0.95	0.00
27	Suir	Suir Upstream	4950.6	110.52	13.54	13.52	-0.02	112.44	112.44	0.00	0.96	0.96	0.00
28	Suir	Suir Upstream	4919.64	110.51	13.54	13.52	-0.02	112.36	112.36	0.00	1.10	1.09	-0.01
29	Suir	Suir Upstream	4886.21	110.48	13.54	13.52	-0.02	112.29	112.29	0.00	1.06	1.06	0.00
30	Suir	Suir Upstream	4854.05	110.26	13.54	13.52	-0.02	112.24	112.24	0.00	0.91	0.91	0.00
31	Suir	Suir Upstream	4834.08	110.21	13.54	13.52	-0.02	112.20	112.20	0.00	1.00	1.00	0.00
32	Suir	Suir Upstream	4793.14	110.25	13.54	13.52	-0.02	112.11	112.10	-0.01	1.10	1.10	0.00
33	Suir	Suir Upstream	4728.88	110.01	13.54	13.51	-0.03	111.96	111.95	-0.01	1.10	1.10	0.00
34	Suir	Suir Upstream	4692.44	109.98	13.54	13.51	-0.03	111.87	111.87	0.00	1.11	1.11	0.00
35	Suir	Suir Upstream	4675.95	109.94	13.54	13.51	-0.03	111.82	111.82	0.00	1.17	1.17	0.00
36	Suir	Suir Upstream	4642.81	109.86	13.54	13.51	-0.03	111.76	111.76	0.00	1.00	1.00	0.00

37	Suir	Suir Upstream	4620.13	109.8	13.54	13.51	-0.03	111.69	111.69	0.00	1.16	1.16	0.00
38	Suir	Suir Upstream	4549.53	109.61	13.54	13.51	-0.03	111.53	111.53	0.00	1.03	1.03	0.00
39	Suir	Suir Upstream	4523.16	109.48	13.54	13.51	-0.03	111.48	111.48	0.00	1.05	1.05	0.00
40	Suir	Suir Upstream	4514.12	109.41	13.54	13.51	-0.03	111.47	111.46	-0.01	1.01	1.01	0.00
42	Suir	Suir Upstream	4505.23	109.49	13.54	13.51	-0.03	111.45	111.44	-0.01	1.04	1.04	0.00
43	Suir	Suir Upstream	4503.56	109.42	13.54	13.51	-0.03	111.44	111.44	0.00	1.03	1.02	-0.01
44	Suir	Suir Upstream	4485.26	109.45	13.54	13.51	-0.03	111.41	111.40	-0.01	1.05	1.05	0.00
45	Suir	Suir Upstream	4465.42	109.42	13.54	13.51	-0.03	111.38	111.37	-0.01	0.96	0.96	0.00
46	Suir	Suir Upstream	4428.95	109.16	13.54	13.51	-0.03	111.30	111.30	0.00	1.04	1.04	0.00
47	Suir	Suir Upstream	4395.78	109.28	13.53	13.51	-0.02	111.25	111.25	0.00	0.90	0.90	0.00
48	Suir	Suir Upstream	4381.28	109.31	13.51	13.51	0.00	111.22	111.21	-0.01	1.01	1.01	0.00
49	Suir	Suir Upstream	4350.17	109.08	13.47	13.50	0.03	111.17	111.16	-0.01	0.96	0.97	0.01
50	Suir	Suir Upstream	4320.12	109.27	13.59	13.51	-0.08	111.11	111.11	0.00	1.00	0.99	-0.01
51	Suir	Suir Upstream	4287.94	109.07	13.55	13.51	-0.04	111.05	111.05	0.00	0.96	0.96	0.00
52	Suir	Suir Upstream	4255.79	108.85	13.54	13.50	-0.04	111.01	111.01	0.00	0.86	0.86	0.00
53	Suir	Suir Upstream	4222.49	108.93	13.54	13.50	-0.04	110.95	110.95	0.00	1.02	1.02	0.00
54	Suir	Suir Upstream	4217.47	108.9	13.54	13.50	-0.04	110.94	110.93	-0.01	1.07	1.07	0.00
55	Suir	Suir Middle	4206.25	109.07	16.27	16.22	-0.05	110.94	110.93	-0.01	0.91	0.91	0.00
56	Suir	Suir Middle	4187.29	108.89	16.27	16.22	-0.05	110.90	110.90	0.00	0.98	0.98	0.00
57	Suir	Suir Middle	4166.56	108.84	17.04	16.99	-0.05	110.83	110.82	-0.01	1.28	1.28	0.00
58	Suir	Suir Middle	4162.31		Bridge								
59	Suir	Suir Middle	4158.16	108.78	17.04	16.99	-0.05	110.74	110.74	0.00	1.42	1.42	0.00
60	Suir	Suir Middle	4128.16	108.83	17.03	16.98	-0.05	110.72	110.71	-0.01	1.07	1.07	0.00
61	Suir	Suir Middle	4093.2	108.69	17.02	16.97	-0.05	110.66	110.65	-0.01	0.99	0.99	0.00
62	Suir	Suir Middle	4080.51	108.76	17.01	16.96	-0.05	110.62	110.62	0.00	1.10	1.10	0.00
63	Suir	Suir Middle	4045.44	108.57	16.79	16.68	-0.11	110.57	110.57	0.00	0.93	0.92	-0.01
64	Suir	Suir Middle	4018.92	108.63	17.01	16.89	-0.12	110.53	110.53	0.00	0.96	0.95	-0.01
65	Suir	Suir Middle	3995.44	108.42	16.87	16.86	-0.01	110.49	110.48	-0.01	0.98	0.98	0.00
66	Suir	Suir Middle	3937.26	108.45	16.59	16.58	-0.01	110.41	110.41	0.00	0.89	0.89	0.00
67	Suir	Suir Middle	3887.66	108.27	13.52	13.73	0.21	110.34	110.33	-0.01	0.98	1.00	0.02
68	Suir	Suir Middle	3862.41	108.36	11.83	12.19	0.36	110.33	110.32	-0.01	0.67	0.69	0.02
69	Suir	Suir Middle	3839.99	107.89	10.18	9.78	-0.40	110.32	110.31	-0.01	0.66	0.64	-0.02
70	Suir	Suir Middle	3804.81	108.25	10.81	10.76	-0.05	110.28	110.28	0.00	0.63	0.63	0.00
71	Suir	Suir Middle	3791.86	108.12	11.48	11.41	-0.07	110.26	110.26	0.00	0.68	0.68	0.00
72	Suir	Suir Middle	3752.47	108	13.62	13.93	0.31	110.21	110.20	-0.01	0.71	0.73	0.02
73	Suir	Suir Middle	3735.14	108	15.16	14.89	-0.27	110.19	110.19	0.00	0.68	0.67	-0.01
74	Suir	Suir Middle	3658.49	107.91	19.47	19.32	-0.15	110.06	110.05	-0.01	0.98	0.98	0.00
75	Suir	Suir Middle	3616.67	107.43	19.40	19.31	-0.09	110.00	110.00	0.00	0.92	0.92	0.00
76	Suir	Suir Middle	3553.11	107.5	19.38	19.30	-0.08	109.90	109.89	-0.01	1.04	1.04	0.00
77	Suir	Suir Middle	3509.18	107.49	19.37	19.30	-0.07	109.83	109.83	0.00	0.95	0.95	0.00
78	Suir	Suir Middle	3504.08	107.38	19.31	19.28	-0.03	109.82	109.81	-0.01	1.03	1.03	0.00
79	Suir	Suir Middle	3458.94	107.22	19.29	19.27	-0.02	109.74	109.73	-0.01	0.96	0.96	0.00
80	Suir	Suir Middle	3411.93	107.54	19.41	19.00	-0.41	109.61	109.61	0.00	1.21	1.18	-0.03
81	Suir	Suir Middle	3385.6	107.44	19.11	19.16	0.05	109.57	109.57	0.00	1.03	1.03	0.00
82	Suir	Suir Middle	3361.54	107.31	17.89	18.00	0.11	109.53	109.52	-0.01	1.15	1.16	0.01

83	Suir	Suir Middle	3334.57	107.32	16.82	16.71	-0.11	109.48	109.47	-0.01	1.15	1.14	-0.01
84	Suir	Suir Middle	3286.13	107.29	14.51	14.52	0.01	109.44	109.43	-0.01	0.90	0.90	0.00
85	Suir	Suir Middle	3218.56	107.14	10.57	10.71	0.14	109.40	109.40	0.00	0.68	0.69	0.01
86	Suir	Suir Middle	3153.93	107.01	7.81	7.83	0.02	109.38	109.38	0.00	0.57	0.58	0.01
87	Suir	Suir Middle	3073.79	106.75	6.65	6.76	0.11	109.36	109.36	0.00	0.38	0.38	0.00
88	Suir	Suir Middle	2949.15	106.48	10.18	10.29	0.11	109.29	109.29	0.00	0.57	0.58	0.01
89	Suir	Suir Middle	2854.92	106.55	12.90	13.01	0.11	109.22	109.21	-0.01	0.71	0.72	0.01
90	Suir	Suir Middle	2790.53	106.28	16.61	16.61	0.00	109.05	109.05	0.00	1.16	1.16	0.00
91	Suir	Suir Middle	2781.61	106.45	16.69	16.79	0.10	109.00	108.99	-0.01	1.40	1.41	0.01
92	Suir	Suir Middle	2779.79		Bridge								
93	Suir	Suir Middle	2772.74	106.53	16.69	16.79	0.10	109.00	108.99	-0.01	0.90	0.91	0.01
94	Suir	Suir Middle	2703.27	106.34	16.77	16.72	-0.05	108.91	108.91	0.00	0.91	0.91	0.00
95	Suir	Suir Middle	2641.44	106.18	13.74	13.65	-0.09	108.87	108.87	0.00	0.78	0.78	0.00
96	Suir	Suir Middle	2605.87	106.36	11.93	11.92	-0.01	108.84	108.84	0.00	0.84	0.84	0.00
97	Suir	Suir Middle	2588.19	106.43	11.31	11.34	0.03	108.78	108.78	0.00	1.09	1.10	0.01
98	Suir	Suir Middle	2586.89		Bridge								
99	Suir	Suir Middle	2585	106.51	11.31	11.34	0.03	108.76	108.75	-0.01	0.99	0.99	0.00
100	Suir	Suir Middle	2579.9	106.03	11.30	11.33	0.03	108.77	108.77	0.00	0.80	0.80	0.00
101	Suir	Suir Middle	2567.99	106.45	11.32	11.42	0.10	108.76	108.75	-0.01	0.86	0.87	0.01
102	Suir	Suir Middle	2540.8	106.44	11.15	11.36	0.21	108.74	108.73	-0.01	0.72	0.73	0.01
103	Suir	Suir Middle	2503.22	106.34	9.69	9.83	0.14	108.72	108.72	0.00	0.63	0.65	0.02
104	Suir	Suir Middle	2423	106.41	10.53	11.09	0.56	108.61	108.60	-0.01	0.86	0.91	0.05
105	Suir	Suir Middle	2331.96	106.16	10.44	10.62	0.18	108.53	108.52	-0.01	0.65	0.67	0.02
106	Suir	Suir Middle	2312.37	106.08	10.35	10.58	0.23	108.52	108.52	0.00	0.54	0.55	0.01
107	Suir	Suir Middle	2300.51	106.03	10.37	10.61	0.24	108.51	108.50	-0.01	0.65	0.67	0.02
108	Suir	Suir Middle	2243.81	105.81	9.14	9.31	0.17	108.48	108.47	-0.01	0.61	0.62	0.01
109	Suir	Suir Middle	2134.59	105.96	6.13	6.08	-0.05	108.43	108.42	-0.01	0.47	0.46	-0.01
110	Suir	Suir Middle	2125.5	106.03	5.57	5.74	0.17	108.43	108.42	-0.01	0.46	0.48	0.02
111	Suir	Suir Middle	2123.78	105.96	5.61	5.71	0.10	108.43	108.42	-0.01	0.54	0.55	0.01
112	Suir	Suir Middle	2120.98		Bridge								
113	Suir	Suir Middle	2117.48	106.05	5.61	5.70	0.09	108.42	108.41	-0.01	0.48	0.48	0.00
114	Suir	Suir Middle	2109.51	106.03	5.40	6.11	0.71	108.43	108.41	-0.02	0.32	0.36	0.04
115	Suir	Suir Middle	2083.43	105.89	5.23	6.42	1.19	108.43	108.40	-0.03	0.33	0.41	0.08
116	Suir	Suir Middle	2057.15	105.54	5.51	6.47	0.96	108.49	108.43	-0.06	0.37	0.44	0.07
117	Suir	Suir Middle	1986.93	105.62	9.12	7.95	-1.17	108.41	108.38	-0.03	0.62	0.55	-0.07
118	Suir	Suir Middle	1926.65	105.54	7.74	7.09	-0.65	108.35	108.35	0.00	0.46	0.42	-0.04
119	Suir	Suir Middle	1902.78	105.35	5.93	5.43	-0.50	108.35	108.35	0.00	0.36	0.33	-0.03
120	Suir	Suir Middle	1878.42	105.76	4.99	4.57	-0.42	108.35	108.35	0.00	0.31	0.28	-0.03
121	Suir	Suir Middle	1834.36	105.1	2.52	1.90	-0.62	108.35	108.35	0.00	0.14	0.11	-0.03
122	Suir	Suir Middle	1818.73	105.25	1.06	0.53	-0.53	108.36	108.35	-0.01	0.06	0.03	-0.03
123	Suir	Suir Middle	1810.5	105.33	0.15	-0.33	-0.48	108.36	108.35	-0.01	0.01	-0.02	-0.03
124	Suir	Suir Middle	1795	105.17	-1.60	-1.51	0.09	108.36	108.35	-0.01	0.09	-0.08	0.01
125	Suir	Suir Middle	1779.83	105.57	-1.46	-1.19	0.27	108.38	108.35	-0.03	0.09	-0.07	0.02



126	Suir	Suir Middle	1771.29	105.51	-0.09	-0.43	-0.34	108.37	108.35	-0.02	0.01	-0.03	-0.02
127	Suir	Suir Lower	1761.1	105.68	6.91	5.57	-1.34	108.37	108.35	-0.02	0.30	0.24	-0.06
128	Suir	Suir Lower	1731.85	105.66	5.83	5.52	-0.31	108.36	108.35	-0.01	0.23	0.22	-0.01
129	Suir	Suir Lower	1699.08	105.61	15.53	18.30	2.77	108.28	108.27	-0.01	0.64	0.76	0.12
130	Suir	Suir Lower	1688.91	105.47	13.16	14.77	1.61	108.22	108.18	-0.04	1.05	1.19	0.14
131	Suir	Suir Lower	1687.69		Bridge								
132	Suir	Suir Lower	1686.59	105.51	14.20	15.99	1.79	108.24	108.21	-0.03	0.92	1.05	0.13
133	Suir	Suir Lower	1680.14	105.53	14.80	16.50	1.70	108.25	108.23	-0.02	0.60	0.68	0.08
134	Suir	Suir Lower	1592.13	105.4	11.96	13.93	1.97	108.24	108.21	-0.03	0.46	0.55	0.09
135	Suir	Suir Lower	1568.53	105.36	11.39	13.29	1.90	108.23	108.19	-0.04	0.49	0.58	0.09
136	Suir	Suir Lower	1543.63	105.32	10.57	12.42	1.85	108.23	108.20	-0.03	0.31	0.37	0.06
137	Suir	Suir Lower	1511.48	105.27	8.99	10.56	1.57	108.22	108.19	-0.03	0.40	0.48	0.08
138	Suir	Suir Lower	1498.45	104.8	8.50	10.06	1.56	108.22	108.19	-0.03	0.34	0.41	0.07
139	Suir	Suir Lower	1430.48	104.72	7.11	8.23	1.12	108.22	108.17	-0.05	0.27	0.32	0.05
140	Suir	Suir Lower	1391.8	105.04	6.82	7.58	0.76	108.21	108.17	-0.04	0.27	0.31	0.04
141	Suir	Suir Lower	1386.56	105.09	6.67	7.41	0.74	108.21	108.17	-0.04	0.26	0.30	0.04
142	Suir	Suir Lower	1343.08	105.41	6.36	7.02	0.66	108.21	108.16	-0.05	0.29	0.32	0.03
143	Suir	Suir Lower	1323.55	105.27	5.73	6.76	1.03	108.21	108.16	-0.05	0.19	0.23	0.04
144	Suir	Suir Lower	1265.56	104.84	4.92	5.70	0.78	108.21	108.16	-0.05	0.14	0.16	0.02
145	Suir	Suir Lower	1121.76	104.51	3.08	3.44	0.36	108.21	108.16	-0.05	0.10	0.11	0.01
146	Suir	Suir Lower	979.924	104.65	3.11	2.69	-0.42	108.20	108.16	-0.04	0.10	0.09	-0.01
147	Suir	Suir Lower	956.006	104.35	2.50	2.55	0.05	108.20	108.16	-0.04	0.08	0.08	0.00
148	Suir	Suir Lower	887.735	104.92	1.15	1.44	0.29	108.20	108.16	-0.04	0.04	0.05	0.01
149	Suir	Suir Lower	780.578	104.34	2.36	2.71	0.35	108.21	108.16	-0.05	0.09	0.10	0.01
150	Suir	Suir Lower	720.666	104.33	2.78	3.55	0.77	108.21	108.16	-0.05	0.07	0.09	0.02
151	Suir	Suir Lower	647.406	104.27	3.88	4.46	0.58	108.21	108.16	-0.05	0.13	0.15	0.02
152	Suir	Suir Lower	643.471	104.29	4.89	5.11	0.22	108.20	108.16	-0.04	0.12	0.13	0.01
153	Suir	Suir Lower	533.199	104.72	7.13	7.56	0.43	108.19	108.15	-0.04	0.22	0.24	0.02
154	Suir	Suir Lower	413.562	104.55	13.66	14.86	1.20	108.14	108.10	-0.04	0.57	0.63	0.06
155	Suir	Suir Lower	408.34	104.64	15.71	15.90	0.19	108.13	108.09	-0.04	0.68	0.70	0.02
156	Suir	Suir Downstream	390.489	104.88	26.71	26.28	-0.43	108.13	108.09	-0.04	0.85	0.85	0.00
157	Suir	Suir Downstream	384.581	105.08	25.85	25.78	-0.07	108.13	108.08	-0.05	0.84	0.85	0.01
158	Suir	Suir Downstream	379.785	104.59	25.79	25.78	-0.01	108.11	108.07	-0.04	0.81	0.83	0.02
159	Suir	Suir Downstream	378.023	104.49	26.01	25.98	-0.03	108.11	108.07	-0.04	0.81	0.83	0.02
160	Suir	Suir Downstream	361.265	104.53	29.20	28.87	-0.33	108.08	108.04	-0.04	0.92	0.93	0.01
161	Suir	Suir Downstream	347.287	104.48	30.43	30.16	-0.27	108.07	108.02	-0.05	0.91	0.91	0.00
162	Suir	Suir Downstream	325.376	104.52	33.62	33.13	-0.49	108.03	107.98	-0.05	1.04	1.05	0.01
163	Suir	Suir Downstream	301.029	104.55	33.25	32.68	-0.57	108.01	107.96	-0.05	0.98	0.98	0.00
164	Suir	Suir Downstream	273.085	104.55	31.52	31.10	-0.42	107.99	107.94	-0.05	0.98	0.98	0.00
165	Suir	Suir Downstream	251.032	104.51	30.25	30.18	-0.07	107.97	107.92	-0.05	0.96	0.98	0.02
166	Suir	Suir Downstream	212.459	104.41	28.48	27.98	-0.50	107.95	107.90	-0.05	0.92	0.92	0.00
167	Suir	Suir Downstream	194.064	104.24	30.66	30.38	-0.28	107.91	107.85	-0.06	1.10	1.11	0.01
168	Suir	Suir Downstream	156.034	104.32	35.39	35.36	-0.03	107.83	107.78	-0.05	1.08	1.10	0.02
169	Suir	Suir Downstream	132.858	104.29	36.97	36.69	-0.28	107.75	107.69	-0.06	1.40	1.43	0.03

170	Suir	Suir Downstream	98.5741	104.3	41.34	41.21	-0.13	107.54	107.47	-0.07	1.87	1.93	0.06		
171	Suir	Suir Downstream	91.7583	104.31	42.17	41.95	-0.22	107.52	107.45	-0.07	1.79	1.84	0.05		
172	Suir	Suir Downstream	82.0593	104.38	43.01	42.55	-0.46	107.43	107.36	-0.07	2.09	2.12	0.03		
173	Suir	Suir Downstream	75.6761		Bridge										
174	Suir	Suir Downstream	68.5994	104.37	43.01	42.55	-0.46	107.16	107.10	-0.06	1.76	1.80	0.04		
175	Suir	Suir Downstream	60.5481	104.35	43.80	43.13	-0.67	107.15	107.09	-0.06	1.57	1.59	0.02		
176	Suir	Suir Downstream	30.6031	104.18	45.71	44.32	-1.39	106.92	106.87	-0.05	2.11	2.11	0.00		
177	Suir	Suir Downstream	1.83059	104.14	46.57	44.63	-1.94	106.68	106.62	-0.06	2.35	2.32	-0.03		
178	Eastwood	Eastwood UP	3729.06	114.59	5.45	5.45	0.00	115.58	115.58	0.00	1.89	1.89	0.00		
179	Eastwood	Eastwood UP	3650.86	113.76	3.92	3.92	0.00	114.96	114.96	0.00	1.13	1.13	0.00		
180	Eastwood	Eastwood UP	3637.47	113.69	3.66	3.66	0.00	114.92	114.92	0.00	1.13	1.13	0.00		
181	Eastwood	Eastwood UP	3622.6	113.53	4.80	4.80	0.00	114.68	114.68	0.00	2.04	2.04	0.00		
182	Eastwood	Eastwood UP	3616.01	113.48	5.02	5.02	0.00	114.63	114.63	0.00	1.58	1.58	0.00		
183	Eastwood	Eastwood UP	3613.64	113.47	5.05	5.05	0.00	114.64	114.64	0.00	1.39	1.39	0.00		
184	Eastwood	Eastwood UP	3589.52	113.36	4.60	4.60	0.00	114.49	114.49	0.00	1.47	1.47	0.00		
185	Eastwood	Eastwood UP	3571.19	113.13	4.61	4.60	-0.01	114.37	114.37	0.00	1.49	1.49	0.00		
186	Eastwood	Eastwood UP	3556	113.01	5.35	5.34	-0.01	114.27	114.27	0.00	1.37	1.37	0.00		
187	Eastwood	Eastwood UP	3543.45	112.95	5.43	5.43	0.00	114.23	114.23	0.00	1.16	1.16	0.00		
188	Eastwood	Eastwood UP	3493.99	112.53	5.33	5.34	0.01	113.92	113.92	0.00	1.52	1.52	0.00		
189	Eastwood	Eastwood UP	3483.65	112.54	5.34	5.34	0.00	113.85	113.85	0.00	1.52	1.52	0.00		
190	Eastwood	Eastwood UP	3475.1	112.42	5.30	5.30	0.00	113.83	113.83	0.00	1.29	1.29	0.00		
191	Eastwood	Eastwood UP	3467.73	112.4	5.27	5.27	0.00	113.77	113.78	0.01	1.40	1.40	0.00		
192	Eastwood	Eastwood UP	3458.12	112.31	5.45	5.45	0.00	113.69	113.69	0.00	1.53	1.53	0.00		
193	Eastwood	Eastwood UP	3447.92	112.25	5.66	5.67	0.01	113.61	113.61	0.00	1.51	1.51	0.00		
194	Eastwood	Eastwood UP	3444.02	112.3	5.67	5.68	0.01	113.62	113.63	0.01	1.22	1.22	0.00		
195	Eastwood	Eastwood UP	3440.72	112.3	5.68	5.69	0.01	113.57	113.57	0.00	1.50	1.50	0.00		
196	Eastwood	Eastwood UP	3435.91	112.2	5.73	5.74	0.01	113.57	113.57	0.00	1.25	1.25	0.00		
197	Eastwood	Eastwood UP	3432.19	112.16	5.87	5.88	0.01	113.55	113.55	0.00	1.25	1.26	0.01		
198	Eastwood	Eastwood UP	3428.28	112.22	6.00	6.01	0.01	113.56	113.56	0.00	1.11	1.11	0.00		
199	Eastwood	Eastwood UP	3425.52	112.21	5.66	5.67	0.01	113.57	113.57	0.00	1.00	1.00	0.00		
200	Eastwood	Eastwood UP	3423.12	112.15	5.50	5.50	0.00	113.59	113.59	0.00	0.70	0.70	0.00		
201	Eastwood	Eastwood UP	3422.29	112.1	5.13	5.13	0.00	113.59	113.59	0.00	0.77	0.77	0.00		
202	Eastwood	Eastwood UP	3413.84		Bridge										
203	Eastwood	Eastwood UP	3406	112.05	5.13	5.13	0.00	112.88	112.88	0.00	1.25	1.25	0.00		
204	Eastwood	Eastwood UP	3404.37	111.84	5.19	5.19	0.00	112.91	112.90	-0.01	0.98	0.98	0.00		
205	Eastwood	Eastwood UP	3389	111.8	5.42	5.42	0.00	112.79	112.79	0.00	1.28	1.28	0.00		
206	Eastwood	Eastwood UP	3356.18	111.58	5.41	5.41	0.00	112.48	112.48	0.00	1.68	1.68	0.00		
207	Eastwood	Eastwood UP	3326.47	111.17	5.41	5.41	0.00	112.11	112.11	0.00	1.82	1.82	0.00		
208	Eastwood	Eastwood UP	3322.62	111.12	5.39	5.39	0.00	112.06	112.06	0.00	1.84	1.84	0.00		
209	Eastwood	Eastwood UP	3310.1	111.02	5.40	5.40	0.00	111.90	111.90	0.00	1.72	1.72	0.00		
210	Eastwood	Eastwood UP	3261.08	110.29	5.43	5.44	0.01	111.44	111.44	0.00	1.42	1.42	0.00		
211	Eastwood	Eastwood UP	3258.27	110.28	5.43	5.44	0.01	111.41	111.41	0.00	1.52	1.52	0.00		
212	Eastwood	Eastwood UP	3232.97	110.02	5.43	5.44	0.01	111.09	111.09	0.00	1.95	1.95	0.00		
213	Eastwood	Eastwood UP	3157.99	109.11	5.43	5.43	0.00	110.15	110.15	0.00	1.61	1.61	0.00		
214	Eastwood	Eastwood UP	3156.38		Bridge										

215	Eastwood	Eastwood UP	3154.51	109	5.43	5.43	0.00	110.08	110.09	0.01	1.73	1.72	-0.01
216	Eastwood	Eastwood UP	3108.81	108.59	5.43	5.43	0.00	109.63	109.62	-0.01	1.59	1.61	0.02
217	Eastwood	Eastwood UP	3068.74	108.19	5.44	5.40	-0.04	109.46	109.44	-0.02	0.90	0.91	0.01
218	Eastwood	Eastwood UP	3035.3	108.05	5.28	5.38	0.10	109.41	109.38	-0.03	0.80	0.84	0.04
219	Eastwood	Eastwood UP	2896.79	107.4	5.04	4.80	-0.24	109.11	109.08	-0.03	0.82	0.80	-0.02
220	Eastwood	Eastwood UP	2769.41	107.33	5.30	5.27	-0.03	108.83	108.82	-0.01	0.77	0.77	0.00
221	Eastwood	Eastwood UP	2665.24	107.28	5.14	5.24	0.10	108.71	108.68	-0.03	0.71	0.74	0.03
222	Eastwood	Eastwood UP	2660.2	107.25	5.13	5.23	0.10	108.70	108.67	-0.03	0.77	0.80	0.03
223	Eastwood	Eastwood UP	2621.08	107.05	5.10	5.17	0.07	108.61	108.57	-0.04	0.96	1.01	0.05
224	Eastwood	Eastwood UP	2600.61	106.95	4.95	5.07	0.12	108.59	108.54	-0.05	0.84	0.90	0.06
225	Eastwood	Eastwood UP	2590.9	106.9	4.86	4.97	0.11	108.56	108.50	-0.06	0.97	1.05	0.08
226	Eastwood	Eastwood UP	2572.59	106.79	4.71	4.80	0.09	108.54	108.48	-0.06	0.85	0.92	0.07
227	Eastwood	Eastwood UP	2557.29	106.8	4.82	4.46	-0.36	108.54	108.49	-0.05	0.56	0.55	-0.01
228	Eastwood	Eastwood UP	2554.63	106.79	4.85	4.31	-0.54	108.54	108.49	-0.05	0.57	0.53	-0.04
229	Eastwood	Eastwood UP	2536.87	106.73	6.30	5.45	-0.85	108.45	108.42	-0.03	1.02	0.91	-0.11
230	Eastwood	Eastwood Middle	2529.21	106.7	7.62	7.15	-0.47	108.45	108.42	-0.03	0.80	0.77	-0.03
231	Eastwood	Eastwood Middle	2525.58	106.69	7.60	7.18	-0.42	108.44	108.41	-0.03	0.86	0.84	-0.02
232	Eastwood	Eastwood Middle	2500.57	106.64	7.28	6.38	-0.90	108.31	108.29	-0.02	1.42	1.28	-0.14
233	Eastwood	Eastwood Middle	2474.79	106.59	5.77	6.17	0.40	108.28	108.26	-0.02	0.71	0.77	0.06
234	Eastwood	Eastwood Middle	2444.89	106.54	5.55	5.89	0.34	108.26	108.23	-0.03	0.67	0.73	0.06
235	Eastwood	Eastwood Middle	2431.92	106.41	5.40	5.60	0.20	108.25	108.21	-0.04	0.66	0.72	0.06
236	Eastwood	Eastwood Middle	2389.44	106.31	3.58	4.23	0.65	108.24	108.20	-0.04	0.41	0.51	0.10
237	Eastwood	Eastwood Middle	2332.94	106.19	1.99	2.11	0.12	108.24	108.20	-0.04	0.27	0.30	0.03
238	Eastwood	Eastwood Middle	2326.43	106.33	2.00	2.21	0.21	108.23	108.19	-0.04	0.35	0.40	0.05
239	Eastwood	Eastwood Middle	2324.57		Bridge								
240	Eastwood	Eastwood Middle	2321.53	106.09	2.01	2.23	0.22	108.24	108.20	-0.04	0.29	0.33	0.04
241	Eastwood	Eastwood Middle	2320.14	106.07	2.04	2.27	0.23	108.24	108.20	-0.04	0.28	0.32	0.04
242	Eastwood	Eastwood Middle	2318.18	105.98	2.04	2.29	0.25	108.24	108.20	-0.04	0.26	0.30	0.04
243	Eastwood	Eastwood Middle	2307.97	106.03	2.02	2.25	0.23	108.24	108.20	-0.04	0.23	0.26	0.03
244	Eastwood	Eastwood Middle	2295.28	106.05	1.90	2.12	0.22	108.24	108.20	-0.04	0.19	0.22	0.03
245	Eastwood	Eastwood Middle	2290.92	105.88	1.79	1.99	0.20	108.24	108.20	-0.04	0.20	0.23	0.03
246	Eastwood	Eastwood Middle	2289		Bridge								
247	Eastwood	Eastwood Middle	2286.93	106.04	1.79	1.99	0.20	108.24	108.20	-0.04	0.21	0.24	0.03
248	Eastwood	Eastwood Middle	2282.8	106.37	1.66	1.85	0.19	108.24	108.20	-0.04	0.19	0.22	0.03
249	Eastwood	Eastwood Middle	2231.44	106.28	1.32	1.47	0.15	108.24	108.20	-0.04	0.11	0.13	0.02
250	Eastwood	Eastwood Middle	2115.69	105.96	1.12	1.27	0.15	108.24	108.19	-0.05	0.09	0.11	0.02
251	Eastwood	Eastwood Middle	2106.79	105.94	1.09	1.35	0.26	108.24	108.19	-0.05	0.08	0.11	0.03
252	Eastwood	Eastwood Middle	2089.83	105.91	1.33	1.56	0.23	108.24	108.19	-0.05	0.10	0.12	0.02
253	Eastwood	Eastwood Middle	1983.71	105.54	1.62	1.74	0.12	108.24	108.19	-0.05	0.12	0.13	0.01
254	Eastwood	Eastwood Middle	1975.34	105.53	1.48	1.67	0.19	108.23	108.19	-0.04	0.20	0.23	0.03
255	Eastwood	Eastwood Middle	1969.14	105.53	1.50	1.70	0.20	108.23	108.19	-0.04	0.18	0.20	0.02
256	Eastwood	Eastwood Middle	1903.54	105.5	1.51	1.90	0.39	108.23	108.19	-0.04	0.12	0.16	0.04
257	Eastwood	Eastwood Middle	1829.69	105.46	1.79	2.18	0.39	108.23	108.19	-0.04	0.12	0.15	0.03
258	Eastwood	Eastwood Middle	1784.35	105.44	2.01	2.41	0.40	108.23	108.18	-0.05	0.11	0.14	0.03
259	Eastwood	Eastwood Middle	1769.22	105.64	1.98	2.38	0.40	108.23	108.18	-0.05	0.10	0.13	0.03

260	Eastwood	Eastwood Middle	1752.91	105.86	1.96	2.31	0.35	108.23	108.18	-0.05	0.14	0.17	0.03
261	Eastwood	Eastwood Lower	1751.56	105.88	1.60	1.57	-0.03	108.23	108.18	-0.05	0.07	0.07	0.00
262	Eastwood	Eastwood Lower	1737.94	106.07	1.54	1.51	-0.03	108.23	108.18	-0.05	0.12	0.12	0.00
263	Eastwood	Eastwood Lower	1726.89	106.09	1.48	1.48	0.00	108.23	108.18	-0.05	0.17	0.17	0.00
264	Eastwood	Eastwood Lower	1688.34	106.16	1.29	1.33	0.04	108.22	108.18	-0.04	0.19	0.21	0.02
265	Eastwood	Eastwood Lower	1631.25	105.95	1.64	1.75	0.11	108.22	108.18	-0.04	0.12	0.14	0.02
266	Eastwood	Eastwood Lower	1611.42	105.92	1.87	2.02	0.15	108.22	108.17	-0.05	0.15	0.17	0.02
267	Eastwood	Eastwood Lower	1598.18	105.93	1.90	2.05	0.15	108.22	108.17	-0.05	0.12	0.13	0.01
268	Eastwood	Eastwood Lower	1558.08	106.93	2.00	3.02	1.02	108.22	108.17	-0.05	0.15	0.24	0.09
269	Eastwood	Eastwood Lower	1555		Culvert								
270	Eastwood	Eastwood Lower	1468.55	105.84	2.19	3.02	0.83	108.22	108.17	-0.05	0.14	0.19	0.05
271	Eastwood	Eastwood Lower	1425.68	105.82	1.45	1.93	0.48	108.22	108.17	-0.05	0.10	0.14	0.04
272	Eastwood	Eastwood Lower	1419.37	105.66	1.38	1.86	0.48	108.22	108.17	-0.05	0.13	0.18	0.05
273	Eastwood	Eastwood Lower	1416.83		Bridge								
274	Eastwood	Eastwood Lower	1414.13	105.84	1.38	1.86	0.48	108.22	108.17	-0.05	0.13	0.18	0.05
275	Eastwood	Eastwood Lower	1409.78	105.78	1.26	1.84	0.58	108.22	108.17	-0.05	0.13	0.19	0.06
276	Eastwood	Eastwood Lower	1385.87	105.73	1.16	1.80	0.64	108.22	108.17	-0.05	0.08	0.13	0.05
277	Eastwood	Eastwood Lower	1379.22	105.78	1.10	1.72	0.62	108.22	108.17	-0.05	0.07	0.11	0.04
278	Eastwood	Eastwood Lower	1373.79	105.81	1.03	1.69	0.66	108.22	108.17	-0.05	0.05	0.09	0.04
279	Eastwood	Eastwood Lower	1367.76	105.85	1.11	1.19	0.08	108.22	108.17	-0.05	0.05	0.05	0.00
280	Eastwood	Eastwood Lower	1347.46	105.75	0.65	0.68	0.03	108.22	108.17	-0.05	0.06	0.06	0.00
281	Eastwood	Eastwood Lower	1289.41	105.67	1.48	0.58	-0.90	108.22	108.17	-0.05	0.12	0.05	-0.07
282	Eastwood	Eastwood Lower	1279.02	105.76	0.32	0.54	0.22	108.23	108.17	-0.06	0.02	0.04	0.02
283	Eastwood	Eastwood Lower	1252	105.58	0.15	0.75	0.60	108.22	108.17	-0.05	0.01	0.05	0.04
284	Eastwood	Eastwood MidLow	1238.99	105.5	0.90	1.32	0.42	108.22	108.17	-0.05	0.07	0.11	0.04
285	Eastwood	Eastwood MidLow	1203.25	105.61	2.14	1.66	-0.48	108.21	108.17	-0.04	0.17	0.13	-0.04
286	Eastwood	Eastwood MidLow	1178.05	105.56	1.67	1.50	-0.17	108.21	108.17	-0.04	0.13	0.12	-0.01
287	Eastwood	Eastwood MidLow	1160.74	105.46	1.09	1.34	0.25	108.22	108.17	-0.05	0.08	0.10	0.02
288	Eastwood	Eastwood MidLow	1141.13	105.44	1.03	1.15	0.12	108.21	108.17	-0.04	0.07	0.08	0.01
289	Eastwood	Eastwood MidLow	1104.68	105.49	1.05	0.86	-0.19	108.21	108.17	-0.04	0.08	0.07	-0.01
290	Eastwood	Eastwood MidLow	1029.94	105.21	0.96	1.02	0.06	108.21	108.17	-0.04	0.06	0.07	0.01
291	Eastwood	Eastwood MidLow	1026.88		Bridge								
292	Eastwood	Eastwood MidLow	1023.66	105.35	0.96	1.02	0.06	108.21	108.17	-0.04	0.07	0.07	0.00
293	Eastwood	Eastwood MidLow	980.716	105.39	1.53	1.53	0.00	108.22	108.17	-0.05	0.10	0.10	0.00
294	Eastwood	Eastwood MidLow	973.443	105.44	0.88	1.97	1.09	108.21	108.17	-0.04	0.04	0.10	0.06
295	Eastwood	Eastwood DN	966.972	105.44	2.39	2.28	-0.11	108.21	108.17	-0.04	0.12	0.12	0.00
296	Eastwood	Eastwood DN	856.701	105.47	1.28	1.15	-0.13	108.21	108.16	-0.05	0.09	0.08	-0.01
297	Eastwood	Eastwood DN	753.091	105.39	1.13	0.97	-0.16	108.21	108.16	-0.05	0.07	0.06	-0.01
298	Eastwood	Eastwood DN	632.196	105.15	0.91	1.11	0.20	108.21	108.16	-0.05	0.06	0.07	0.01
299	Eastwood	Eastwood DN	532.555	105.37	0.74	1.02	0.28	108.21	108.16	-0.05	0.03	0.05	0.02
300	Eastwood	Eastwood DN	506.277	105.31	1.09	1.23	0.14	108.21	108.16	-0.05	0.06	0.07	0.01
301	Eastwood	Eastwood DN	459.994	105.33	0.95	1.22	0.27	108.21	108.16	-0.05	0.05	0.07	0.02
302	Eastwood	Eastwood DN	420.226	105.33	0.78	1.16	0.38	108.21	108.16	-0.05	0.04	0.07	0.03
303	Eastwood	Eastwood DN	387.011	105.33	0.59	0.81	0.22	108.21	108.16	-0.05	0.03	0.05	0.02
304	Eastwood	Eastwood DN	382.006	105.4	0.60	0.66	0.06	108.21	108.16	-0.05	0.04	0.04	0.00

305	Eastwood	Eastwood DN	377.969	105.28	0.57	0.58	0.01	108.21	108.16	-0.05	0.04	0.04	0.00
306	Eastwood	Eastwood DN	375.829		Bridge								
307	Eastwood	Eastwood DN	373.189	105.34	0.57	0.58	0.01	108.21	108.16	-0.05	0.04	0.04	0.00
308	Eastwood	Eastwood DN	367.945	105.32	0.72	0.63	-0.09	108.21	108.16	-0.05	0.04	0.04	0.00
309	Eastwood	Eastwood DN	333.348	105.25	0.95	0.78	-0.17	108.21	108.16	-0.05	0.05	0.04	-0.01
310	Eastwood	Eastwood DN	281.341	105.09	1.60	1.36	-0.24	108.21	108.16	-0.05	0.09	0.08	-0.01
311	Eastwood	Eastwood DN	269.683	105.07	1.68	1.58	-0.10	108.20	108.16	-0.04	0.09	0.09	0.00
312	Eastwood	Eastwood DN	223.169	105.17	2.51	2.03	-0.48	108.20	108.16	-0.04	0.15	0.12	-0.03
313	Eastwood	Eastwood DN	169.306	105.22	3.41	3.19	-0.22	108.20	108.15	-0.05	0.22	0.21	-0.01
314	Eastwood	Eastwood DN	105.13	105.54	5.33	6.10	0.77	108.19	108.13	-0.06	0.33	0.39	0.06
315	Eastwood	Eastwood DN	71.8761	105.22	6.51	6.78	0.27	108.18	108.13	-0.05	0.39	0.41	0.02
316	Eastwood	Eastwood DN	36.8629	104.84	7.78	7.16	-0.62	108.17	108.12	-0.05	0.44	0.41	-0.03
317	Eastwood	Eastwood DN	36.0798		Bridge								
318	Eastwood	Eastwood DN	35.1494	104.83	7.78	7.16	-0.62	108.17	108.12	-0.05	0.46	0.43	-0.03
319	Eastwood	Eastwood DN	26.5665	104.79	7.81	7.14	-0.67	108.17	108.11	-0.06	0.46	0.43	-0.03
320	Eastwood	Eastwood DN	20.6975	104.78	8.45	7.72	-0.73	108.16	108.11	-0.05	0.52	0.49	-0.03
321	Eastwood	Eastwood DN	13.253	104.75	11.01	10.38	-0.63	108.13	108.09	-0.04	0.69	0.67	-0.02

## 8.9 ANNEX I – MET EIREANN DDF TABLE

Met Eireann  
Return Period Rainfall Depths for sliding Durations  
Irish Grid: Easting: 213230, Northing: 174540,

DURATION	Interval		Years													
	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.7,	3.7,	4.2,	4.9,	5.4,	5.8,	7.1,	8.5,	9.5,	10.7,	11.9,	12.7,	14.1,	15.1,	15.9,	N/A ,
10 mins	3.7,	5.1,	5.8,	6.9,	7.6,	8.1,	9.9,	11.9,	13.2,	15.0,	16.5,	17.7,	19.6,	21.0,	22.2,	N/A ,
15 mins	4.4,	6.0,	6.8,	8.1,	8.9,	9.6,	11.7,	14.0,	15.5,	17.6,	19.5,	20.9,	23.1,	24.7,	26.1,	N/A ,
30 mins	5.8,	7.8,	8.9,	10.4,	11.4,	12.2,	14.7,	17.5,	19.3,	21.8,	23.9,	25.6,	28.1,	30.1,	31.6,	N/A ,
1 hours	7.7,	10.2,	11.5,	13.4,	14.6,	15.6,	18.6,	21.9,	24.0,	26.9,	29.4,	31.3,	34.3,	36.5,	38.3,	N/A ,
2 hours	10.2,	13.3,	14.9,	17.2,	18.7,	19.8,	23.4,	27.3,	29.8,	33.2,	36.2,	38.4,	41.8,	44.3,	46.4,	N/A ,
3 hours	12.1,	15.6,	17.4,	19.9,	21.6,	22.9,	26.9,	31.2,	33.9,	37.6,	40.8,	43.2,	46.9,	49.7,	51.9,	N/A ,
4 hours	13.6,	17.4,	19.3,	22.1,	23.9,	25.3,	29.6,	34.2,	37.1,	41.1,	44.5,	47.0,	50.9,	53.9,	56.2,	N/A ,
6 hours	16.0,	20.3,	22.5,	25.6,	27.6,	29.1,	33.9,	39.0,	42.1,	46.5,	50.2,	53.0,	57.2,	60.3,	62.9,	N/A ,
9 hours	18.9,	23.8,	26.2,	29.7,	31.9,	33.6,	38.8,	44.4,	47.9,	52.6,	56.6,	59.7,	64.2,	67.6,	70.4,	N/A ,
12 hours	21.2,	26.5,	29.2,	32.9,	35.3,	37.1,	42.8,	48.7,	52.4,	57.4,	61.7,	64.9,	69.7,	73.3,	76.2,	N/A ,
18 hours	25.0,	31.0,	34.0,	38.1,	40.8,	42.8,	49.0,	55.5,	59.6,	65.0,	69.6,	73.1,	78.3,	82.1,	85.2,	N/A ,
24 hours	28.1,	34.7,	37.8,	42.3,	45.2,	47.4,	54.0,	60.9,	65.2,	71.0,	75.9,	79.5,	85.0,	89.0,	92.3,	103.3,
2 days	35.4,	42.7,	46.2,	51.1,	54.2,	56.6,	63.7,	71.0,	75.5,	81.5,	86.6,	90.3,	95.9,	100.0,	103.3,	114.4,
3 days	41.6,	49.6,	53.4,	58.7,	62.1,	64.6,	72.2,	79.9,	84.7,	91.0,	96.2,	100.1,	105.9,	110.2,	113.6,	124.9,
4 days	47.3,	55.9,	60.0,	65.7,	69.2,	71.9,	79.9,	88.0,	93.0,	99.6,	105.1,	109.1,	115.1,	119.5,	123.1,	134.7,
6 days	57.7,	67.4,	72.0,	78.3,	82.2,	85.1,	93.9,	102.8,	108.2,	115.3,	121.2,	125.5,	131.9,	136.6,	140.3,	152.6,
8 days	67.2,	77.9,	82.9,	89.8,	94.1,	97.2,	106.7,	116.2,	122.0,	129.5,	135.8,	140.4,	147.1,	152.0,	156.0,	168.9,
10 days	76.3,	87.9,	93.3,	100.6,	105.2,	108.5,	118.6,	128.7,	134.8,	142.8,	149.4,	154.2,	161.3,	166.5,	170.6,	184.1,
12 days	85.0,	97.4,	103.1,	111.0,	115.8,	119.4,	130.0,	140.6,	147.1,	155.4,	162.3,	167.4,	174.7,	180.1,	184.4,	198.4,
16 days	101.8,	115.6,	122.0,	130.6,	136.0,	139.9,	151.5,	163.2,	170.1,	179.2,	186.6,	192.1,	200.0,	205.8,	210.4,	225.3,
20 days	117.8,	133.0,	139.9,	149.3,	155.1,	159.4,	171.9,	184.4,	191.9,	201.6,	209.5,	215.3,	223.7,	229.9,	234.7,	250.5,
25 days	137.3,	154.0,	161.6,	171.8,	178.1,	182.7,	196.4,	209.8,	217.8,	228.2,	236.7,	242.9,	251.9,	258.4,	263.6,	280.4,

NOTES:

N/A Data not available

These values are derived from a Depth Duration Frequency (DDF) Model

For details refer to:

'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',

Available for download at [www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies\\_TN61.pdf](http://www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf)

## 8.10 ANNEX J - FSU REPORT

# Flood Estimation Report #13792 (Borrisbeg02)



Generated 04-09-2023 16:15

## Subject site

### Attributes

Name	Unit	Value
Coordinate [X]		213075.003899283
Coordinate [Y]		171871.003164135
Distance	km	474.512142927321
Station Number		16_774_3
Location		
Water Body		
Catchment		
Hydrometric Area		
Organisation		
FSU Rating Classification		
Drainage works	year	
Contributing Catchment Area	km <sup>2</sup>	95.963
Center Northing	m	176070
Center Easting	m	213030
Northing	m	171871
Easting	m	213075
A-Max series gap in years	year	
A-Max series number of years	year	
A-Max series number of usable years	year	
A-Max series end year	year	
A-Max series start year	year	
FARL		1
ALLUV		0.0315
PEAT		0.033
FOREST		0.1039
PASTURE		0.8444
S1085	m/km	7.4615
MSL	km	15.546
DRAIND	km/km <sup>2</sup>	0.951
ALTBAR		147.5
NETLEN	km	91.266
T4		
T3		



SAAPE	mm	505.32
T2		
ARTDRAIN2		0
ARTDRAIN		0
TAYSLO		1.03684
STMFRQ		70
BFISOIL		0.553565334
SAAR	mm	935.05
RWSEG_CD		16_774
TOP_RWSEG		
Bankfull		
HGF	m <sup>3</sup> /s	
MAF	m <sup>3</sup> /s	
FAI		0.2788
FLATWET		0.59
URBEXT		0.0036
HGF/QMED		
centroidx3857		-867455.435310894
centroidy3857		6953037.4345641
x3857		-869059.301517697
y3857		6945728.21699044

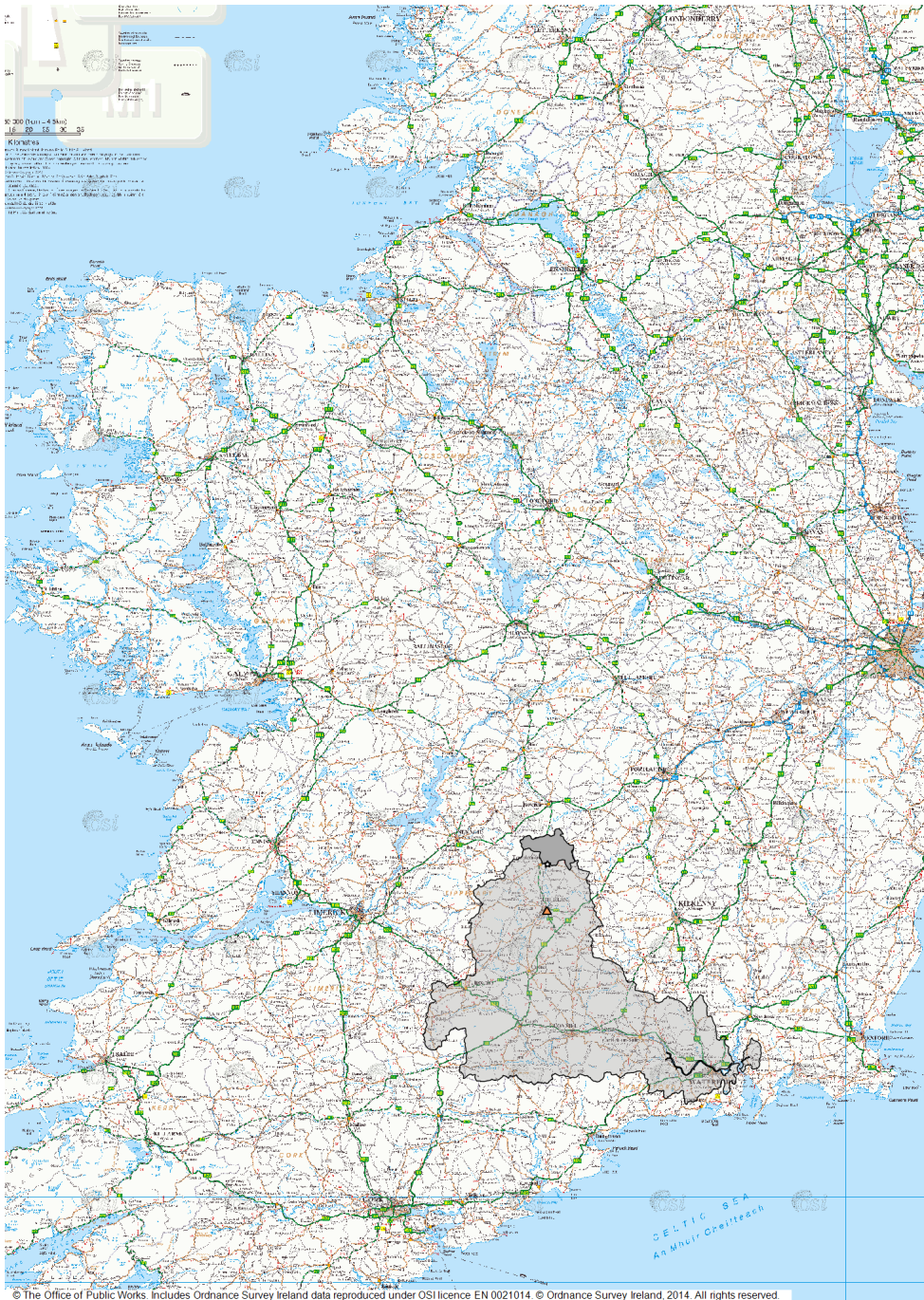
# Pivotal site

## Attributes

Name	Unit	Value
Coordinate [X]		212925.997457409
Coordinate [Y]		158630.00228838
Station Number		16004
Location		THURLES
Water Body		SUIR
Catchment		Suir
Hydrometric Area		16
Organisation		OPW
FSU Rating Classification		A2
Drainage works	year	No
Contributing Catchment Area	km <sup>2</sup>	228.7432
Center Northing	m	170380
Center Easting	m	214810
Northing	m	158630
Easting	m	212926
A-Max series gap in years	year	0
A-Max series number of years	year	49
A-Max series number of usable years	year	48
A-Max series end year	year	2002
A-Max series start year	year	1954
FARL		1
ALLUV		0.0393
PEAT		0.0428
FOREST		0.0783
PASTURE		0
S1085	m/km	1.79135
MSL	km	32.672
DRAIN	km/km <sup>2</sup>	0.915
ALTBAR		0
NETLEN	km	209.301
T4		0.13118039222063
T3		-0.002673240511085
SAAPE	mm	509.64
T2		0.14352188721759
ARTDRAIN2		0
ARTDRAIN		0
TAYSLO		0.397796
STMFRQ		156
BFISOIL		0.5786
SAAR	mm	941.36
RWSEG_CD		16_3997
TOP_RWSEG		16_931
Bankfull		1.46 from survey
HGF	m <sup>3</sup> /s	19.6
MAF	m <sup>3</sup> /s	22.24
FAI		0.31
FLATWET		0.59
URBEXT		0.0109
HGF/QMED		1.008749356665
x3857		-869363.116522814
y3857		6923852.68031561

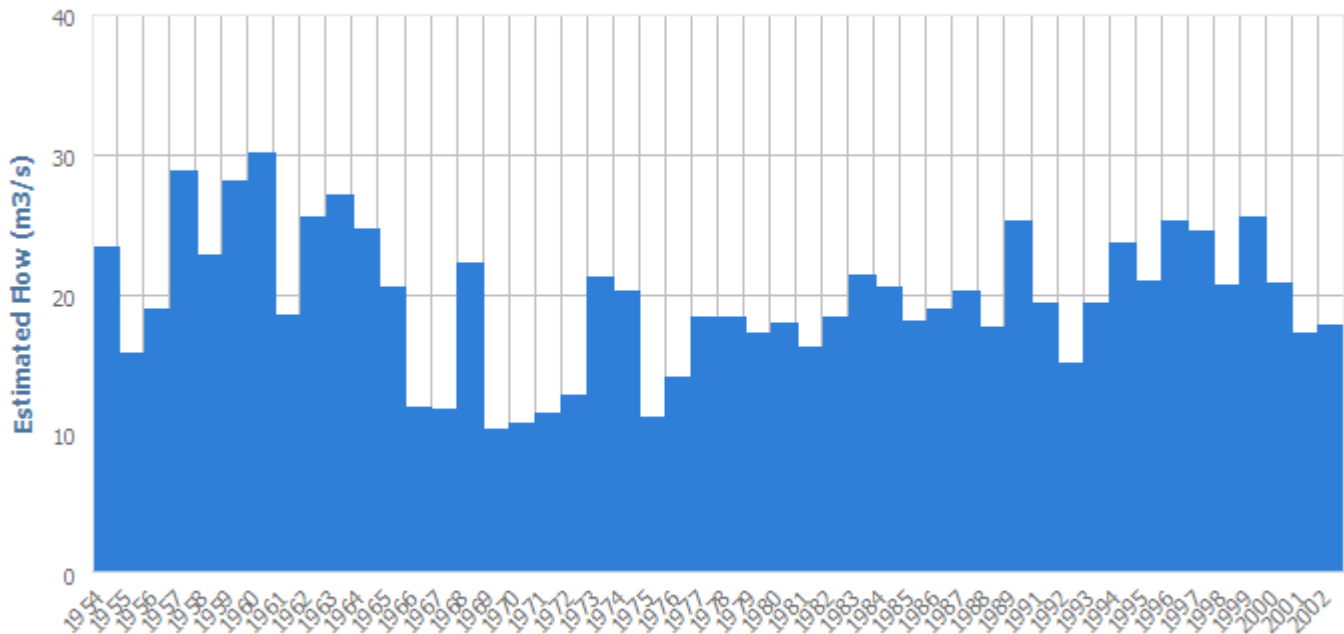
centroidx3857		-867837.845897677
centroidy3857		6945384.33952941
Distance	km	7.66264324282632

# Map



# Amax Series Chart

Amax series for station 16004  
HydroNET



## QMED Estimates

Subject rural QMED	16.61
Subject urban QMED	16.7
Pivotal gauged QMED	19.43
Pivotal adjustment factor QMED	0.69
Subject adjusted QMED	<b>11.6</b>

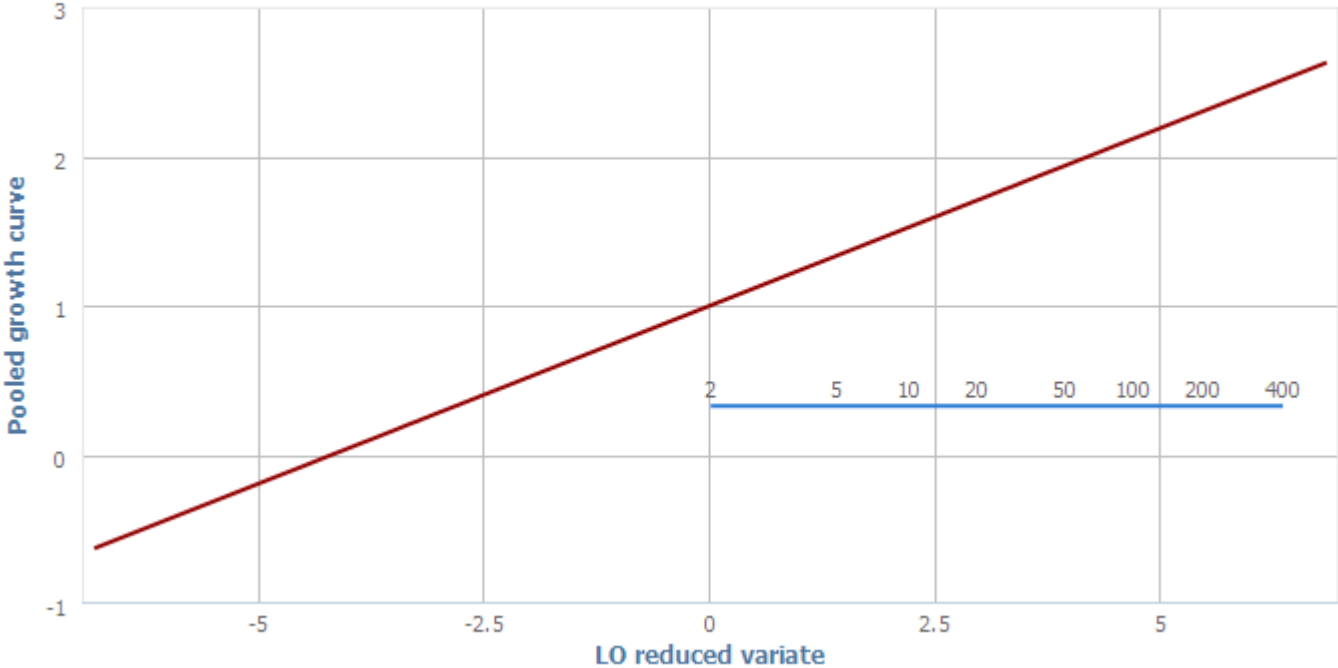
## Pooling Group

Station	Amax years
09010 WALDRONS BRIDGE	19
26022 KILMORE	33
26020 ARGAR	33
07006 FYANSTOWN	19
16001 ATHLUMMON	33
26009 BELLANTRA BR.	35
06031 CURRALHIR	18
11001 BOLEANY	33
24022 HOSPITAL	20
06025 BURLEY	30

16004 THURLES	48
36031 LISDARN	30
24002 GRAYS BR.	32
25022 SYNGEFIELD	22
26010 RIVERSTOWN	35
25023 MILLTOWN	33
26019 MULLAGH	51

# Selected Flood Growth Curve

Flood growth curve



Pooled growth curve	LO reduced variate
-0.63	-6.84
-0.38	-5.81
-0.27	-5.32
-0.19	-4.99
-0.13	-4.74
-0.08	-4.54
-0.04	-4.37
-0.01	-4.22
0.02	-4.1
0.05	-3.99
0.08	-3.88
0.1	-3.79
0.12	-3.71
0.14	-3.63
0.15	-3.56
0.17	-3.49
0.19	-3.42
0.2	-3.36
0.21	-3.3
0.23	-3.25
0.24	-3.2
0.25	-3.15
0.26	-3.1
0.27	-3.06
0.28	-3.01
0.29	-2.97
0.3	-2.93
0.31	-2.89
0.32	-2.85

0.33	-2.82
0.34	-2.78
0.35	-2.75
0.35	-2.71
0.36	-2.68
0.37	-2.65
0.38	-2.62
0.38	-2.59
0.39	-2.56
0.4	-2.53
0.4	-2.51
0.41	-2.48
0.42	-2.45
0.42	-2.43
0.43	-2.4
0.43	-2.38
0.44	-2.35
0.45	-2.33
0.45	-2.3
0.46	-2.28
0.46	-2.26
0.47	-2.24
0.47	-2.22
0.48	-2.19
0.48	-2.17
0.49	-2.15
0.49	-2.13
0.5	-2.11
0.5	-2.09
0.51	-2.07
0.51	-2.05
0.52	-2.04
0.52	-2.02
0.52	-2
0.53	-1.98
0.53	-1.96
0.54	-1.95
0.54	-1.93
0.55	-1.91
0.55	-1.89
0.55	-1.88
0.56	-1.86
0.56	-1.84
0.56	-1.83
0.57	-1.81
0.57	-1.8
0.58	-1.78
0.58	-1.77
0.58	-1.75
0.59	-1.74
0.59	-1.72
0.59	-1.71
0.6	-1.69
0.6	-1.68
0.6	-1.66
0.61	-1.65
0.61	-1.63



0.61	-1.62
0.62	-1.61
0.62	-1.59
0.62	-1.58
0.63	-1.57
0.63	-1.55
0.63	-1.54
0.64	-1.53
0.64	-1.51
0.64	-1.5
0.65	-1.49
0.65	-1.48
0.65	-1.46
0.65	-1.45
0.66	-1.44
0.66	-1.43
0.66	-1.41
0.67	-1.4
0.67	-1.39
0.67	-1.38
0.67	-1.37
0.68	-1.35
0.68	-1.34
0.68	-1.33
0.69	-1.32
0.69	-1.31
0.69	-1.3
0.69	-1.29
0.7	-1.27
0.7	-1.26
0.7	-1.25
0.7	-1.24
0.71	-1.23
0.71	-1.22
0.71	-1.21
0.71	-1.2
0.72	-1.19
0.72	-1.18
0.72	-1.17
0.72	-1.16
0.73	-1.14
0.73	-1.13
0.73	-1.12
0.73	-1.11
0.74	-1.1
0.74	-1.09
0.74	-1.08
0.74	-1.07
0.75	-1.06
0.75	-1.05
0.75	-1.04
0.75	-1.03
0.76	-1.02
0.76	-1.01
0.76	-1
0.76	-0.99
0.77	-0.98

0.77	-0.97
0.77	-0.97
0.77	-0.96
0.77	-0.95
0.78	-0.94
0.78	-0.93
0.78	-0.92
0.78	-0.91
0.79	-0.9
0.79	-0.89
0.79	-0.88
0.79	-0.87
0.79	-0.86
0.8	-0.85
0.8	-0.84
0.8	-0.84
0.8	-0.83
0.81	-0.82
0.81	-0.81
0.81	-0.8
0.81	-0.79
0.81	-0.78
0.82	-0.77
0.82	-0.76
0.82	-0.76
0.82	-0.75
0.82	-0.74
0.83	-0.73
0.83	-0.72
0.83	-0.71
0.83	-0.7
0.83	-0.69
0.84	-0.69
0.84	-0.68
0.84	-0.67
0.84	-0.66
0.84	-0.65
0.85	-0.64
0.85	-0.63
0.85	-0.63
0.85	-0.62
0.85	-0.61
0.86	-0.6
0.86	-0.59
0.86	-0.58
0.86	-0.58
0.86	-0.57
0.87	-0.56
0.87	-0.55
0.87	-0.54
0.87	-0.54
0.87	-0.53
0.88	-0.52
0.88	-0.51
0.88	-0.5
0.88	-0.49
0.88	-0.49

0.89	-0.48
0.89	-0.47
0.89	-0.46
0.89	-0.45
0.89	-0.45
0.9	-0.44
0.9	-0.43
0.9	-0.42
0.9	-0.41
0.9	-0.41
0.91	-0.4
0.91	-0.39
0.91	-0.38
0.91	-0.37
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0.91	-0.36
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0.92	-0.34
0.92	-0.34
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0.92	-0.32
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0.93	-0.3
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0.94	-0.26
0.94	-0.26
0.94	-0.25
0.94	-0.24
0.94	-0.23
0.95	-0.23
0.95	-0.22
0.95	-0.21
0.95	-0.2
0.95	-0.2
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0.96	-0.15
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0.98	-0.07
0.98	-0.06
0.99	-0.06
0.99	-0.05
0.99	-0.04

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0.99	-0.03
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1	0
1	0
1	0.01
1	0.02
1.01	0.03
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1.01	0.04
1.01	0.05
1.01	0.06
1.02	0.06
1.02	0.07
1.02	0.08
1.02	0.09
1.02	0.1
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1.18	0.74
1.18	0.75
1.18	0.76
1.18	0.76
1.18	0.77
1.19	0.78
1.19	0.79
1.19	0.8
1.19	0.81
1.19	0.82
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1.2	0.84
1.2	0.84
1.2	0.85
1.21	0.86
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1.7	2.93
1.71	2.97
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1.77	3.25
1.79	3.3
1.8	3.36
1.81	3.42
1.83	3.49
1.85	3.56
1.86	3.63
1.88	3.71
1.9	3.79
1.92	3.88
1.95	3.99
1.98	4.1
2.01	4.22
2.04	4.37
2.08	4.54
2.13	4.74
2.19	4.99
2.27	5.32
2.38	5.81
2.63	6.84



## Adopted Growth Factors

<b>Return Period</b>	<b>Growth Factor</b>	<b>Design Peak Flow (m<sup>3</sup>/s)</b>
1.3	0.71	11.86
2	1	16.7
5	1.33	22.21
10	1.52	25.38
20	1.7	28.39
30	1.8	30.06
50	1.93	32.23
100	2.09	34.9
200	2.26	37.74
500	2.48	41.41
1000	2.64	44.08

# Audit Trail Report #13792 (Borrisbeg02)



<b>User ID:</b>	igor.kerin@ucc.ie
<b>Name:</b>	Kerin, Igor
<b>Company:</b>	
<b>Address:</b>	
<b>Report date &amp; time:</b>	04-09-2023 16:15
<b>Start of Calculation:</b>	17-06-2022 20:10

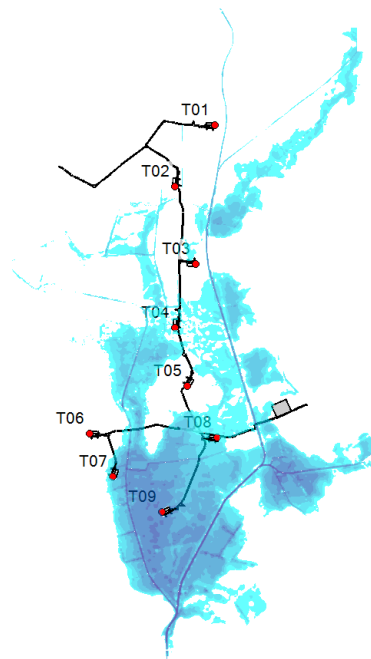
## Decisions made by the user:

<b>Decision</b>	<b>User comment</b>	<b>System information</b>	<b>Date</b>
2.1 Subject site accepted	N/A	Location 16_774_3	17-06-2022 21:19
2.4 Pivotal site accepted	Reason for accepting: Two sites belong to the same catchment Reason for ignoring warnings:	Station: 16004 THURLES The user has been notified that 10 candidates where either hydrologically or geographically closer to the subject site than the chosen pivotal site. The user has accepted to reject these sites in preference of the chosen pivotal site.	17-06-2022 21:24
2.8 QMED data transfer performed	To remain conservative	Warning: you are disallowing the pivotal site from playing a part in QMED estimation at the subject site. Please provide a reason for this choice.	17-06-2022 21:31

2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: EV1	17-06-2022 21:32
2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: LO	17-06-2022 21:35
2.8 QMED data transfer performed	More conservative	Warning: you are disallowing the pivotal site from playing a part in QMED estimation at the subject site. Please provide a reason for this choice.	04-09-2023 18:04
2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: EV1	04-09-2023 18:04
2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: GLO	04-09-2023 18:07
2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: GEV	04-09-2023 18:12
2.11 Pooling group accepted	N/A	Pooled group accepted with the following stations: [09010, 26022, 26020, 07006, 16001, 26009, 06031, 11001, 24022, 06025, 16004, 36031, 24002, 25022, 26010, 25023, 26019] and distribution: LO	04-09-2023 18:13





2.13 Module 2 finalized	N/A	Finished pooled analysis with the following distribution selected: LO.	04-09-2023 18:13
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# Hydraulic Assessment of Stream Restoration at Borrisbeg Wind Farm



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**November 2023**

Project:		Hydraulic Assessment of Stream Restoration at Borrisbeg Wind Farm		
Site:		Borrisbeg		
Client:		Buiríos Ltd. Lissarda Industrial Estate, Lissarda, Co. Cork Ireland		
Job title:		Borrisbeg Wind Farm		
Job ID:		IE-2023.03-BUI		
Document title:		IE-2023.03-BUI-BorrisbegWF-FRA.pdf		
Date:		16/05/2023		
Revision	Date			
Draft	30-Nov-23	Filename:	IE-2023.05-BUI-BorrisbegStreamRestoration-01.pdf	
			Prepared by	Checked / Approved by
		Name	IK, EMcK	EMcK
		Signature	 Dr. Igor Kerin, CEng. MIEI.	 Dr. Eamon McKeogh BSc. PhD. MBA. CEng. MIEI.
Final		Filename:	IE-2023.05-BUI-BorrisbegStreamRestoration.pdf	
			Prepared by	Checked / Approved by
		Name	IK, EMcK	EMcK
		Signature	 Dr. Igor Kerin, CEng. MIEI.	 Dr. Eamon McKeogh BSc. PhD. MBA. CEng. MIEI.



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## TABLE OF CONTENTS

1	INTRODUCTION .....	4
1.1	Background and site location .....	4
1.2	Re-meandering restoration proposal .....	5
1.2.1	Scope and objectives .....	8
2	EXISTING SITE CONDITIONS .....	9
2.1	Hydrological Features .....	9
3	HYDROLOGY .....	13
4	HYDRAULIC SIMULATIONS .....	16
4.1	Methodology .....	16
4.2	Model description.....	16
4.3	Model Input data .....	18
4.3.1	Geometry - Survey of river bed and flood plains.....	18
4.3.2	Upstream Boundary conditions .....	19
4.3.3	Downstream Boundary condition.....	19
4.3.4	Roughness.....	19
4.4	Simulation events in flood risk scoping .....	19
4.5	Computer model results .....	20
4.5.1	Water levels at control points.....	22
4.5.2	Flow rates at control Profiles “P” .....	26
4.5.3	Water levels and terrain at control profiles “P” .....	30
4.5.4	Longitudinal profile showing water levels at new meandering axis.....	38
5	CONCLUSIONS .....	41
6	REFERENCES .....	42
7	APPENDICES .....	7-43
7.1	Annex A - HEC-RAS output tables – Water Levels .....	7-44
7.2	Annex B - Flow velocity maps .....	7-110
7.2.1	Velocity distribution for $Q_{med}$ .....	7-111
7.2.2	Velocity distribution for $Q_{100cc}$ .....	7-112
7.2.3	Velocity distribution for $Q_{1000cc}$ .....	7-113
7.3	Annex C – Typical Riffle and Pool Cross Sections and Design Longitudinal profile ...	7-114

## LIST OF TABLES

Table 3.1.	Culvert details.....	10
Table 4.3.	Design flows [ $m^3/s$ ] and contributing catchment area [ $km^2$ ] for each HEP.....	13
Table 5.13.	Design Events used in flood risk scoping .....	19

## LIST OF FIGURES

Figure 1.1. Site location.....	4
Figure 1.2. Proposed wind farm development.....	6
Figure 1.3. Layout of proposed restoration works in Eastwood River.....	7
Figure 2.1. Bridge 17-Farm Access road concrete bridge single span c. 4m wide (u/s elevation).....	10
Figure 2.2. Hydrological Features.....	12
Figure 3.1. Relevant Hydrological Estimation Points (HEP's) for the new hydraulic model.....	13
Figure 3.2. Boundary conditions for $Q_{var}$ simulations (Existing and Design).....	14
Figure 3.3. Boundary conditions for $Q_{med}$ simulations (Existing and Design).....	14
Figure 3.4. Boundary conditions for $Q_{100cc}$ simulations (Existing and Design).....	15
Figure 3.5. Boundary conditions for $Q_{1000cc}$ simulations (Existing and Design).....	15
Figure 4.1. Layout of HEC-RAS model with DTM underlayer.....	17
Figure 4.2. Comparison of Existing and Design Digital Terrain Models of the model area.....	18
Figure 4.3. Existing digital terrain model with the location of control points CP's and cross sections "P".....	21
Figure 4.4. Design digital terrain model with the location of control points CP's.....	21
Figure 4.5. Comparison of water levels for range of flows at control point CP1.....	22
Figure 4.6. Comparison of water levels for range of flows at control point CP2.....	23
Figure 4.7. Comparison of water levels for range of flows at control point CP3.....	24
Figure 4.8. Comparison of water levels for range of flows at control point CP4.....	25
Figure 4.9. Comparison of Existing and design flow rates at cross section P1.....	26
Figure 4.10. Comparison of Existing and design flow rates at cross section P2.....	27
Figure 4.11. Comparison of Existing and design flow rates at cross section P3.....	28
Figure 4.12. Comparison of Existing and design flow rates at cross section P4.....	29
Figure 4.13. Comparison of Existing and design ground levels and water levels for $Q_{med}$ at CS1.....	30
Figure 4.14. Comparison of Existing and design ground levels and water levels for $Q_{100cc}$ at CS1.....	31
Figure 4.15. Comparison of Existing and design ground levels and water levels for $Q_{1000cc}$ at CS1.....	31
Figure 4.16. Comparison of Existing and design ground levels and water levels for $Q_{med}$ at CS2.....	32
Figure 4.17. Comparison of Existing and design ground levels and water levels for $Q_{100cc}$ at CS2.....	32
Figure 4.18. Comparison of Existing and design ground levels and water levels for $Q_{1000cc}$ at CS2.....	33
Figure 4.19. Comparison of Existing and design ground levels and water levels for $Q_{med}$ at CS3.....	34
Figure 4.20. Comparison of Existing and design ground levels and water levels for $Q_{100cc}$ at CS3.....	34
Figure 4.21. Comparison of Existing and design ground levels and water levels for $Q_{1000cc}$ at CS3.....	35
Figure 4.22. Comparison of Existing and design ground levels and water levels for $Q_{med}$ at CS4.....	36
Figure 4.23. Comparison of Existing and design ground levels and water levels for $Q_{100cc}$ at CS4.....	36
Figure 4.24. Comparison of Existing and design ground levels and water levels for $Q_{1000cc}$ at CS4.....	37
Figure 4.25. Longitudinal profile along the new re-meandered section showing Design water levels for flows ranging from 0.10 – 1.10 $m^3/s$ .....	38
Figure 4.26. Longitudinal profile along the new re-meandered section showing maximum Design water levels for $Q_{var}$ , $Q_{med}$ , $Q_{100cc}$ and $Q_{1000cc}$ flows.....	39
Figure 4.27. Longitudinal profile along the new re-meandered section showing maximum Design flow velocities for $Q_{var}$ , $Q_{med}$ , $Q_{100cc}$ and $Q_{1000cc}$ flows.....	40



# 1 Introduction

## 1.1 BACKGROUND AND SITE LOCATION

Fluvio R&D Ltd. was commissioned by Buirios Limited, to undertake a Hydraulic Assessment of stream restoration works (re-meandering) of 300m reach of the River Eastwood as an extension of Flood Risk Assessment (FRA) for a wind farm development at Borrisbeg, Co. Tipperary, Ireland.

This report will assess the flooding risk to the development, adjoining and downstream lands for low, medium and extreme flood flows in accordance with the guidelines published by the OPW and DHELG in November 2009 "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" [1].

In general, this FRA concludes that stream restoration works do not affect flood flows/runoff downstream of the works and locally improve/lower flood levels by enabling additional storage for medium and high flood flows.

The site is located east of the N62 and the townland of Borrisbeg, and north-east of Templemore in Co. Tipperary as shown in Figure 1.1.

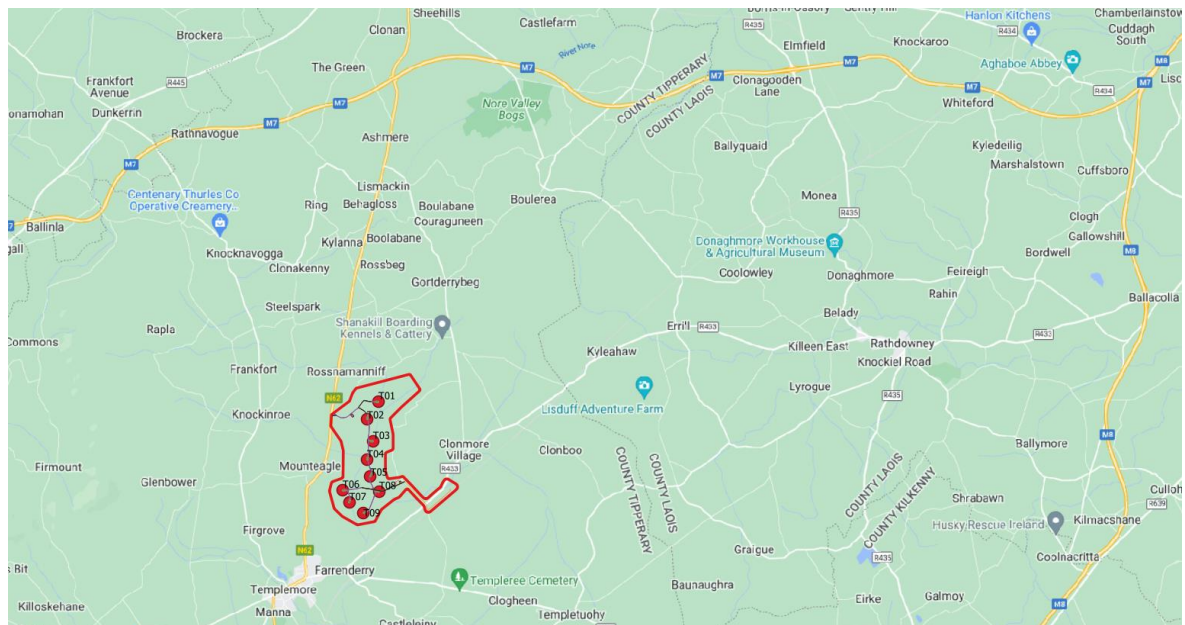


Figure 1.1. Site location.

## 1.2 RE-MEANDERING RESTORATION PROPOSAL

For the purposes of environmental/ecological enhancement within the wind farm site, it is proposed to restore a circa.240m segment of the Eastwood Rive. From an ecological perspective, the Eastwood River within the project site is currently in poor condition. It has been straightened and lacks good quality in-stream or riparian habitat. It is proposed to restore appropriate pattern, profile and dimension to the channel with a view to improving stability of the channel and restoring in stream habitat. It is also proposed to establish a natural wooded riparian buffer and to exclude livestock from accessing the restored channel.

The restoration reach is approximately 240 meters in length with no sinuosity. It is proposed to construct a new meandering channel with a length of approximately 299m. This will result in a channel sinuosity of approximately 1.32m/m. The new channel will have an average slope of 0.0026 m/m and a bankfull width of 4m.

The 240m of the existing Eastwood River reach within the proposed Borrisbeg Wind Farm (WF) shown in blue box Figure 1.2 is proposed for restoration to create a 299m meandering reach. Previous existing channel is canalised as a straight reach, while the restoration works will introduce a meandering pattern with additional riffle and pool sections as shown in Figure 1.3.

Typical sections of riffle and pool is shown in Annex C.

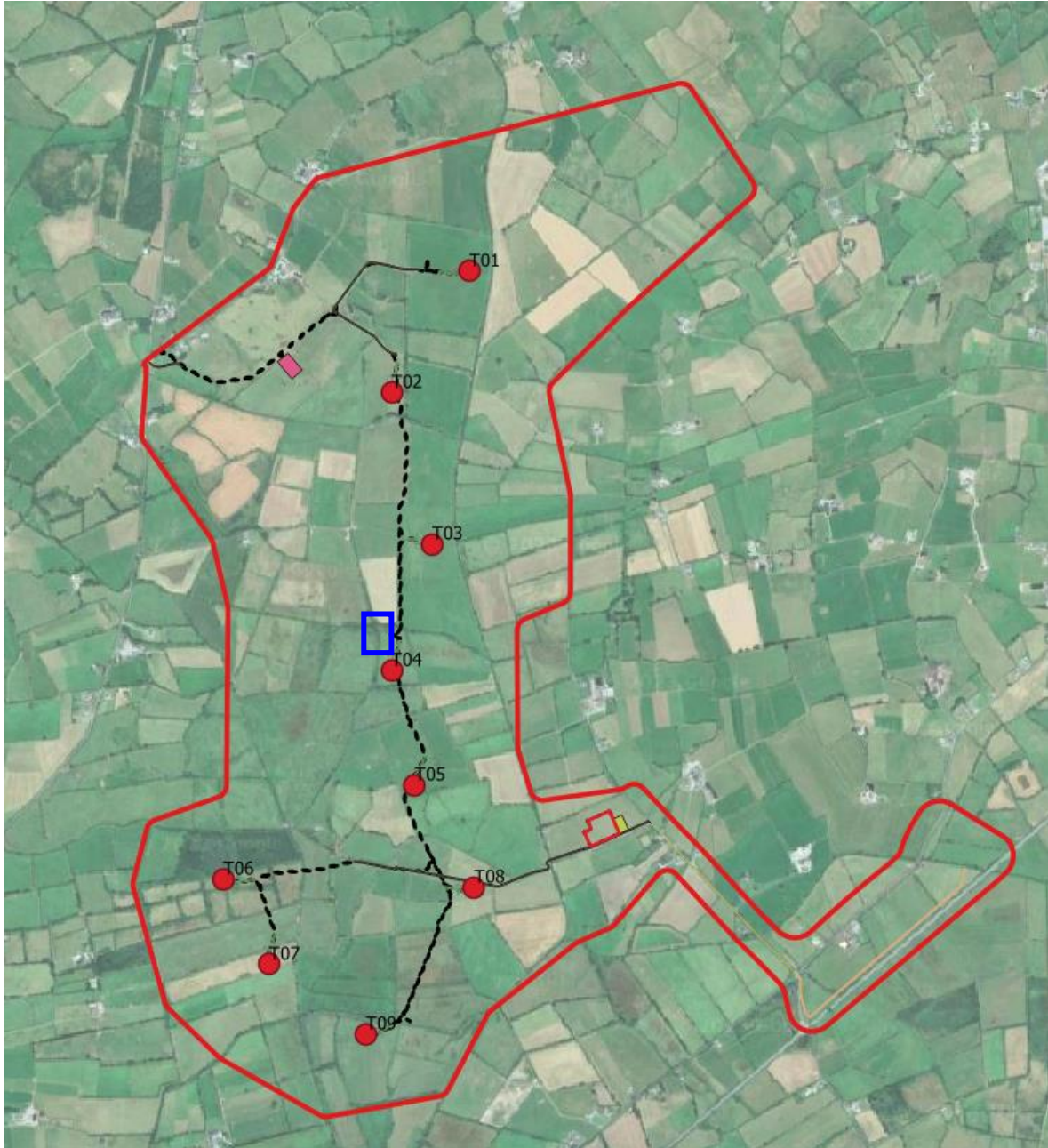


Figure 1.2. Proposed wind farm development.



Figure 1.3. Layout of proposed restoration works in Eastwood River.

### 1.2.1 Scope and objectives

The scope of this report is to provide the information necessary for a planning application by the wind farm (WF) developer, to discharge their responsibilities under the OPW Planning and Development Flood Policy with regard to flood risk constraints and to ensure that the development complies with the flood risk policies within Tipperary County Council's Development Plan [11]. This report has been prepared in accordance with "The Planning System and Flood Risk Management – Guidelines for Planning Authorities" published by OPW and the Department of the Environment, Heritage and Local Government in November 2009 [1]. The aim of the FRA is to:

- Identify the flooding issues associated with the re-meandering proposal (if any) at and adjacent to the site,
- Identify and carry out the studies required to assess the impact of these.
- Design mitigation and flood alleviation measures for the development should issues arise.

The risk assessment covers all sources of flooding, including the effects of run-off from the re-meandering development on flood risk to the vicinity, environs and downstream of the development site. The study involves the use of a previous hydrological assessment to estimate extreme river flows and examines the effect of the proposed development on these and assesses if this will have any significant impact on flooding elsewhere.

## 2 Existing site conditions

The subject site is located in Borrisbeg, Co. Tipperary, Ireland. The site is located east of the N62 road and the townland of Borrisbeg and north-east of Templemore in Co. Tipperary as shown in Figure 1.1.

### 2.1 HYDROLOGICAL FEATURES

A site walkover survey was carried out in April 2022 to establish the pattern of existing drainage and to record existing hydrology features. This was carried out to provide data for the Fluvio Borrisbeg FRA [2]

In summary, the site has a gentle slope in a north – south direction. The surface runoff percolates underground while the excess water is collected by the River Suir, Eastwood Stream and field drains along the site. Identified hydrological features are shown on Figure 2.2.

In total, 22 stream/river crossings have been identified within the site and adjacent to the site boundary and a single levee, these are marked on Figure 2.2 below. Property access culverts/bridges are marked from '1' to '22'. Culvert/Bridge characteristics are provided in Table 2.1. The highest ground level is at the northern part of the site, 113mOD, and the lowest point is in the south-western corner of the site, 107mOD. No local low points were identified during the site walkover. Some marsh areas with surface water ponding are located at the south side of the site where the two rivers become closer and eventually the Eastwood merges with river Suir.

An existing single span Bridge No 17 (Figure 2.1) c. 4m wide acting serving as farm access road from table below is incorporated in the Fluvio 2D hydraulic model [2] as it acts as a throttle on the downstream end of the re-meander reach, and acts as a control point during flood flows, see Figure 2.2 and Table 2.1.



Figure 2.1. Bridge 17-Farm Access road concrete bridge single span c. 4m wide (u/s elevation)

Table 2.1. Culvert details

No	Type	Detail
1	Culvert	12-Farm Access Culvert 600mm pipe
2	Culvert	13-N62 road bridge North 770x1000mm box old stone culvert
3	Culvert	14-Farm Access Culvert 600mm pipe
4	Culvert	15-Farm Access Culvert 600mm pipe
5	Culvert	16-Farm Access Partially collapsed old stone box culvert 850x500mm
6	Bridge	08-Single span 4m Arch Stone Road bridge L7039
7	Bridge	09-Fishing mobile metal bridge single span
8	Bridge	10-College Bridge - N62 road Two span (2m) arch stone bridge
9	Bridge	11-Farm wooden deck single span bridge
10	Bridge	17-Farm Access road concrete bridge single span c. 4m wide
11	Bridge	18-Farm Access road concrete bridge single span 2m wide
12	Bridge	19-Cattle Access metal bridge single span 3.2m wide
13	Bridge	20-Farm Access Bridge single span 2.2m wide
14	Bridge	21-Farm Access Bridge single span 3m wide
15	Bridge	22-Metal mobile bridge single span
16	Bridge	01-Knockanroe Bridge L3248 road – Three span Arch 2.3m, Beam 3m and 2.2m Arch

No	Type	Detail
17	Bridge	<b>02-Single span 6m concrete bridge Downstream of confluence with Shanakill Stream</b>
18	Bridge	03-Farmer Crossing Single Span beam 4m wide bridge
19	Bridge	04-Farmer Crossing Single Span beam 5m wide bridge
20	Bridge	05-Site Road at the bend Single Span beam 4m wide bridge
21	Bridge	06-Metal bridge with stone abutments single span 5m wide
22	Bridge	07-Knocknageragh Bridge R433 road arch stone 7m wide span
23	Levee	Levee 0.5m high and 0.5m width



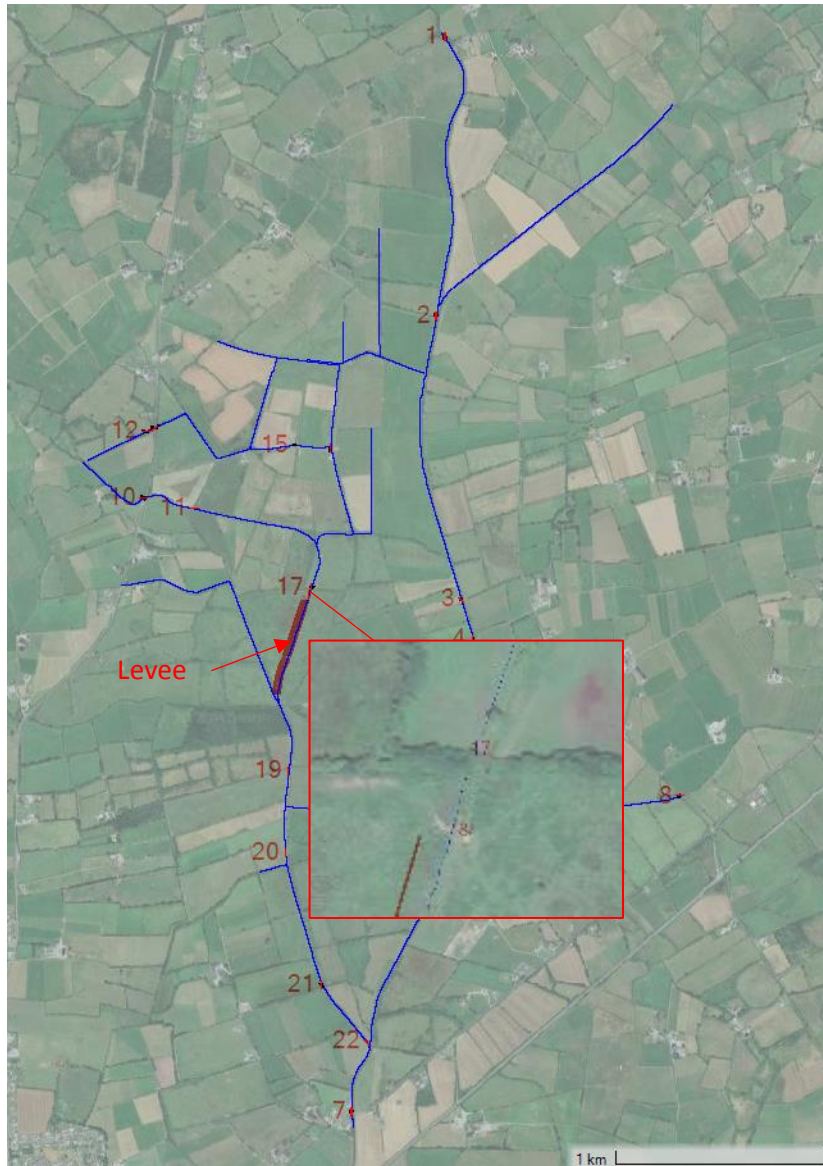


Figure 2.2. Hydrological Features

## 3 Hydrology

The hydrology calculations for this study are taken from the Fluvio Borrisbeg FRA Report [2] using  $Q_{med}$ ,  $Q_{100}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  flood flows. Flows for  $Q_{100cc}$  and  $Q_{1000cc}$  have included climate change factor with increase of 20%. The upstream section of the River Eastwood is explained by Hydrological Estimation points (HEPs) H11 and H14 as described in the Borrisbeg FRA report. The new HEP, H11<sub>L</sub> is introduced in order to provide more detailed input data for the left (east) branch of the stream in the new hydraulic model. The input flows for the left stream branch H11<sub>L</sub> are calculated based on the difference  $H11_L = H14 - H11$ , see figure below.

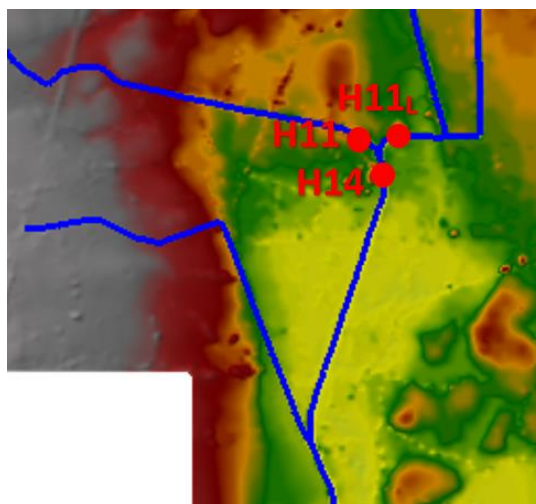


Figure 3.1. Relevant Hydrological Estimation Points (HEP's) for the new hydraulic model.

Each of the tributaries is hydrologically assessed separately and the runoff is calculated for a set of HEPs. The locations of the HEPs are shown in Figure 3-1 above. The breakdown of the contributing catchment areas and design flow rates for each HEP is given in the Table 1 below.

Table 3.1. Design flows [ $m^3/s$ ] and contributing catchment area [ $km^2$ ] for each HEP.

HEP ID	HEC RAS node	Catchment area [ $km^2$ ]	$Q_{med}$ [ $m^3/s$ ]	$Q_{100cc}$ [ $m^3/s$ ]	$Q_{1000cc}$ [ $m^3/s$ ]
H11	UBC-Right	8.439	1.26	4.32	5.45
H11 <sub>L</sub>	UBC-Left	2.791	0.39	1.36	1.71
H14	n/a	11.230	1.65	5.67	7.16

In addition, variable flow simulation is defined  $Q_{var}$  for flows ranging from 0.10 to 1.10  $m^3/s$  in order to access low to medium flows below  $Q_{med}$ . Input flow hydrographs used as upstream boundary condition for H11 (Eastwood right branch) and H11<sub>L</sub> (tributary left branch) and water levels used as downstream boundary condition for simulations  $Q_{var}$ ,  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  are shown in Figure 3.2-Figure 3.5 respectively.

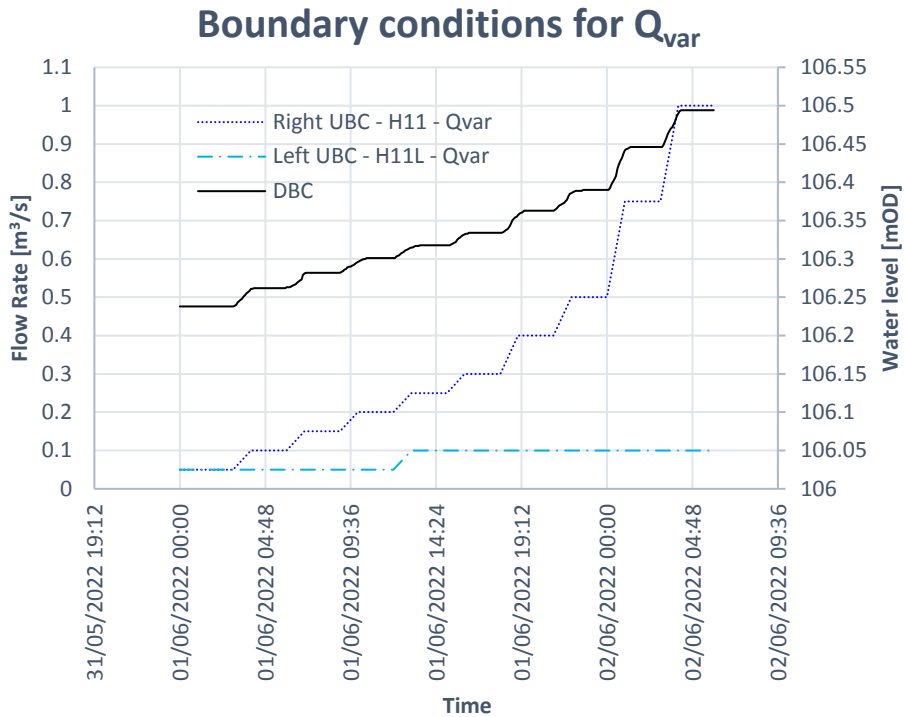


Figure 3.2. Boundary conditions for  $Q_{var}$  simulations (Existing and Design).

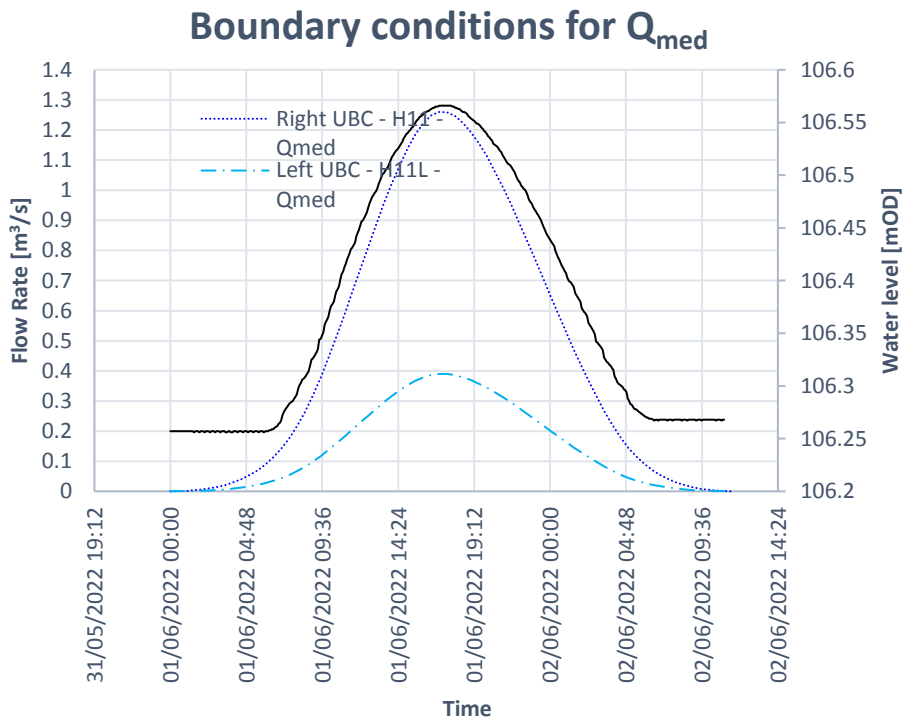


Figure 3.3. Boundary conditions for  $Q_{med}$  simulations (Existing and Design).

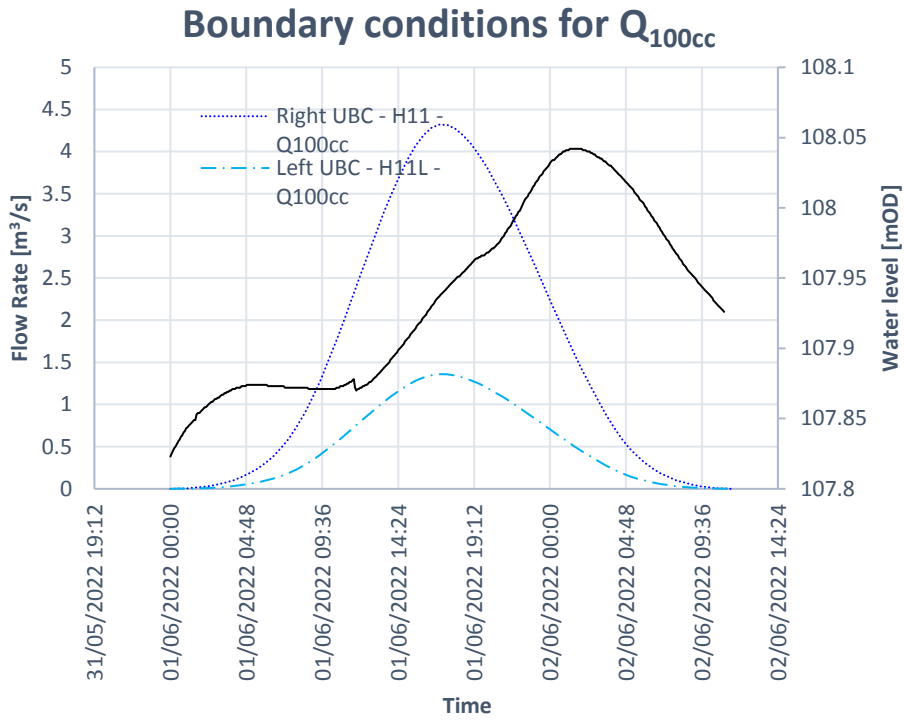


Figure 3.4. Boundary conditions for  $Q_{100cc}$  simulations (Existing and Design).

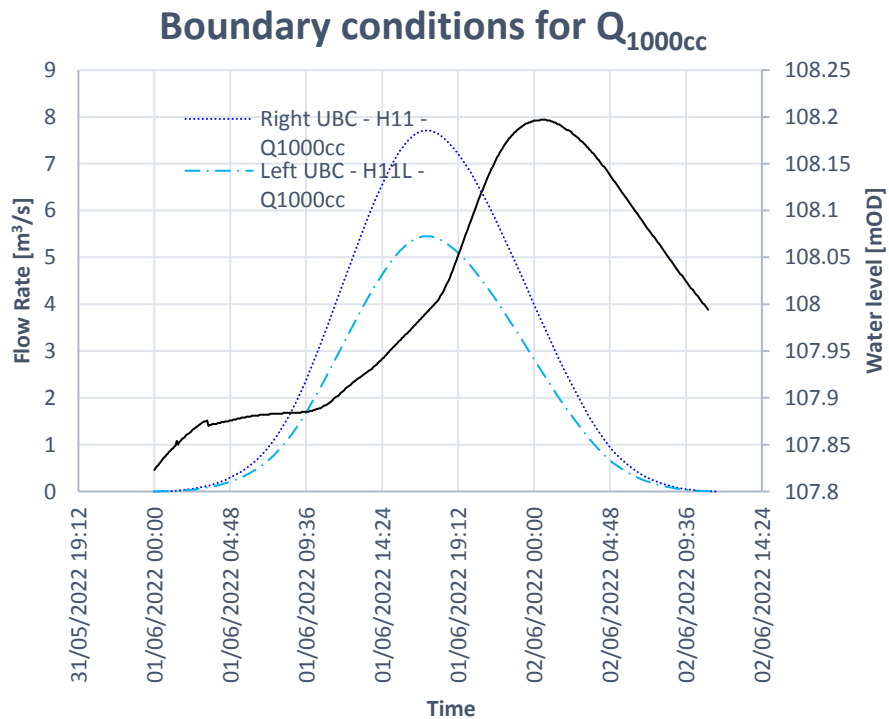


Figure 3.5. Boundary conditions for  $Q_{1000cc}$  simulations (Existing and Design).

## 4 Hydraulic simulations

### 4.1 METHODOLOGY

A full 2-D HEC-RAS computer model for varying flood flows is set-up to provide:

1. Hydrological/hydraulic simulations for the existing pre-development on the River Suir and flood plain site which give a benchmark for post re-meandering impacts.
2. Hydrological/hydraulic simulations to determine if there are any hydrological/hydraulic impacts adjacent to or downstream of the site.
3. Hydrological/Hydraulic simulations of the initial proposed stream and iterations leading to the final design.
4. Hydrological/hydraulic simulations of the final re-meandered reach to obtain all relevant data relating to the overall wind farm design and planning application.

### 4.2 MODEL DESCRIPTION

A 300m long and c. 30m width full 2D Hec-Ras hydraulic model was developed for Existing and Design river system. The grid consists of maximum width of cell of 1m x 1m on the floodplain and 0.5m x 0.5m in the main channel (Figure 4.1). The Existing system includes the proposed windfarm road and culvert design and existing channels. The Design system includes re-alignment of the channel, involving re-meandering and construction of riffle-pool sections. In addition to this, estimates of the river channel and flood plain roughness (Manning's-n values) are estimated as they are required as input parameters and these were determined during a site inspection.

Models were developed for two River Systems:

- Existing River System which uses the geometry of the natural river channel and flood plains, including the final geometry of the proposed windfarm.
- Design River System that includes the final geometry of the re-meandered river reach and the geometry of the proposed windfarm.

The 2D model covers an area of 9000m<sup>2</sup>. At the downstream end of the model, the 1D Bridge structure (Bridge No. 17) was modelled and incorporated within 2D model domain. The layout of the HEC-RAS cross-section locations and DTM are shown in Figure 4.1.

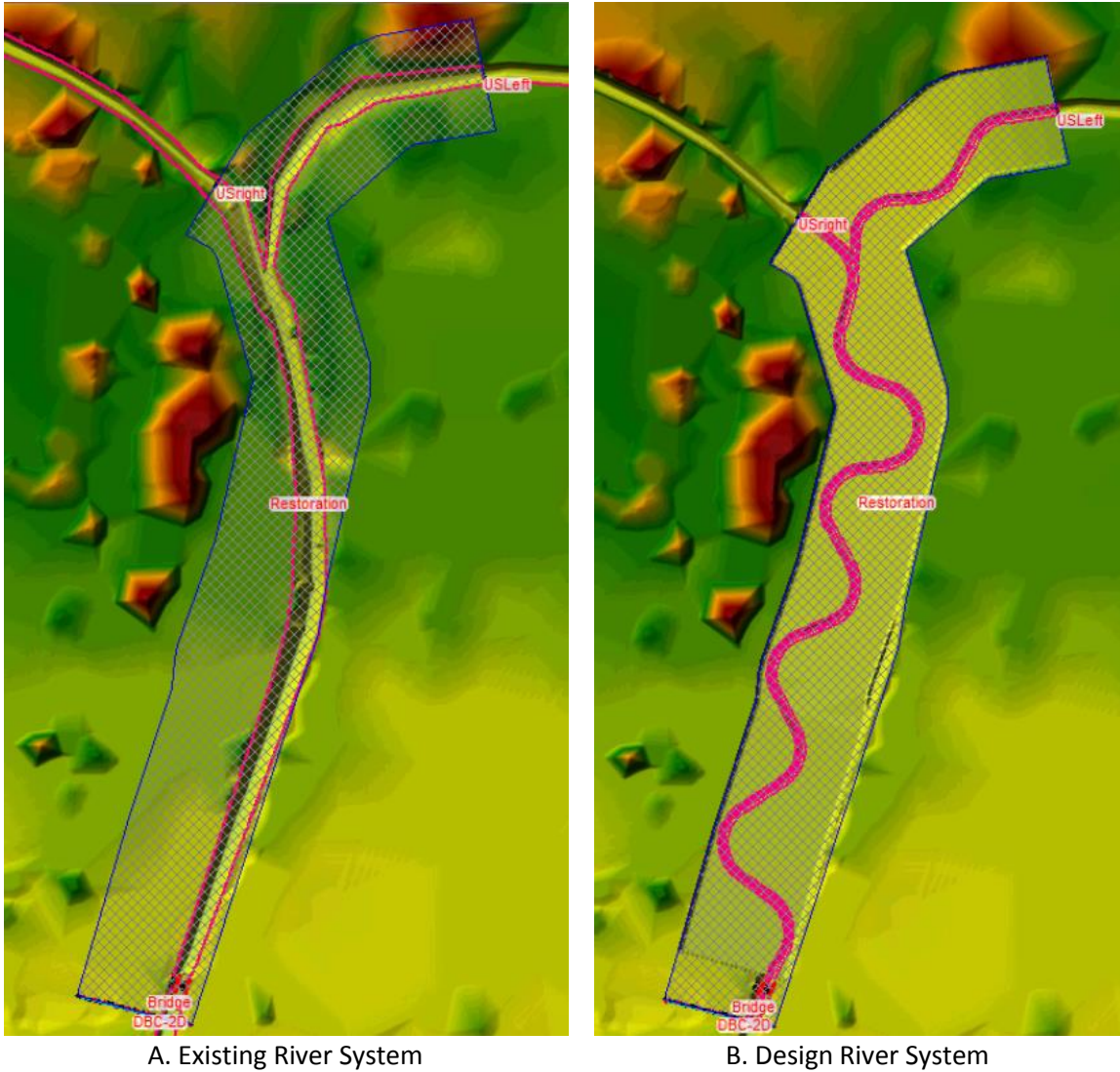
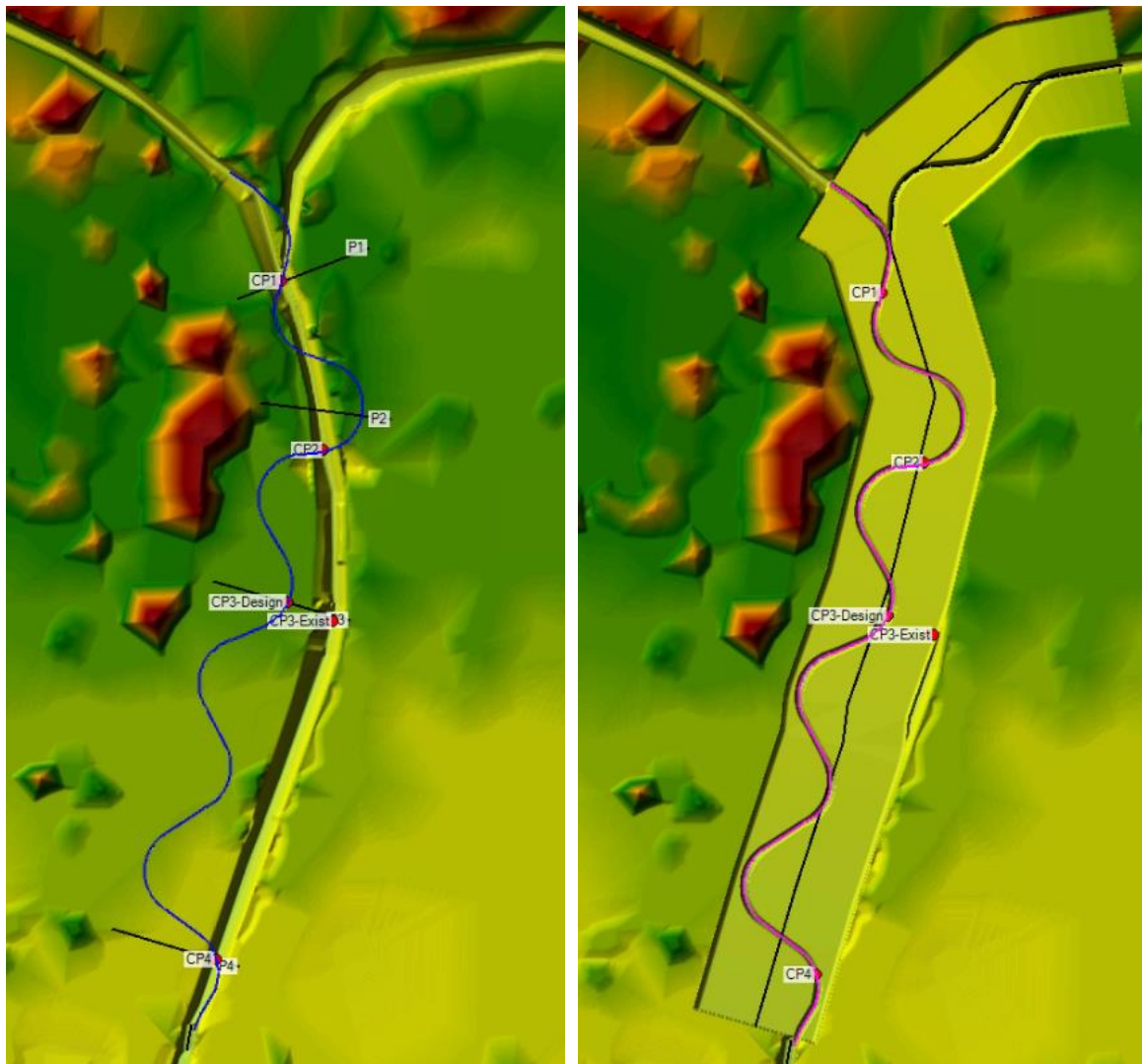


Figure 4.1. Layout of HEC-RAS model with DTM underlayer.

## 4.3 MODEL INPUT DATA

### 4.3.1 Geometry - Survey of river bed and flood plains

The first DTM describes the Existing River System<sup>1</sup> that includes wind turbine road network and new proposed culverts and flood plains (Figure 4.22A from FRA study [2]) and the second one describes the Design River System with an added meandering section with a 1m deep compound channel and nine riffles and pool sections (see (Figure 4.22B and Figure 1.3). Figure 4.22 also shows proposed enhancement work axis with control points and control cross sections.



A. Existing

B. Design

Figure 4.2. Comparison of Existing and Design Digital Terrain Models of the model area.

<sup>1</sup> Design River System from FRA Study [2]

### 4.3.2 Upstream Boundary conditions

The upstream boundary conditions are defined as input flow hydrographs for simulations  $Q_{var}$ ,  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  are shown in Figure 3.2-Figure 3.5 respectively.

### 4.3.3 Downstream Boundary condition

The downstream boundary conditions are defined as water levels that were obtained in the following way:

- for  $Q_{var}$  and  $Q_{med}$  were obtained iteratively, e.g. calculated based on normal depth,  $d_n$ , with a defined energy slope of 0.008m/m and then obtained water level was used for both Existing and Design River system
- For  $Q_{100cc}$  and  $Q_{1000cc}$  were obtained from existing hydraulic model results [2] at the location of downstream boundary condition of the new hydraulic model

### 4.3.4 Roughness

Since previous model was 1D-2D model and the new model is a full 2D model, **roughness values for river channel and compound channel and floodplains have a Manning coefficient of  $n=0.030$ .**

## 4.4 SIMULATION EVENTS IN FLOOD RISK SCOPING

Using the HEC-RAS computer model, computer simulations were carried out for unsteady flow conditions using a flood flow value corresponding to the peak of the flood hydrograph. In summary the flood risk at the development site was analysed for four hydrological scenarios that cover the full range of flows from low flows to extreme flows, as shown in Table 4.1.

**Table 4.1. Design Events used in flood risk scoping**

Design event	Flow ID - Geometry	Downstream boundary condition – Water levels	Description
1	$Q_{var}$ -Existing	Varying WL	<b>Varying flows from 0.1-1.1 m<sup>3</sup>/s Existing</b>
1	$Q_{var}$ -Design	Varying WL	<b>Varying flows from 0.1-1.1 m<sup>3</sup>/s Design</b>
2	$Q_{med}$ -Existing	Varying WL	<b>Q<sub>2</sub> c. 2-year flood Existing System</b>
2	$Q_{med}$ -Design	Varying WL	<b>Q<sub>2</sub> c. 2-year flood Existing System</b>
3	$Q_{100cc}$ -Existing (20% climate change)	Varying WL	<b>Flood zone A - <math>Q_{100cc}</math>-Existing System</b>
3	$Q_{100cc}$ -Design (20% climate change)	Varying WL	<b>Flood zone A - <math>Q_{100cc}</math>-Design System</b>
4	$Q_{1000cc}$ -Existing (20% climate change)	Varying WL	<b>Flood zone B - <math>Q_{1000cc}</math>-Existing System</b>
4	$Q_{1000cc}$ -Design (20% climate change)	Varying WL	<b>Flood zone B - <math>Q_{1000cc}</math>-Design System</b>



## 4.5 COMPUTER MODEL RESULTS

The results are shown for Existing and Design River System for  $Q_{var}$ ,  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  year flow rates with included 20% increase of flows due to climate change (MRFS) as follows:

- Water levels at Control points CP1-CP4 (Figure 4.5-Figure 4.8)
- Flow rates at control cross sections P1-P4 (Figure 4.9-Figure 4.12)
- Water levels and terrain geometry at control cross sections P1-P4 (Figure 4.13-Figure 4.24)
- Longitudinal profile showing water levels at new meandering axis (Figure 4.25-Figure 4.26)
- Longitudinal profile showing flow velocities at new meandering axis (Figure 4.27)

The output locations, e.g. control points “CP’s”, Cross Sections “P” and longitudinal profile of a new meandering section are shown in Figure 4.3 and Figure 4.4.

Table output model results for  $Q_{med}$ ,  $Q_{100cc}$  (MRFS) and  $Q_{1000cc}$  (HEFS) is shown in Annex A. The Flow velocity distribution maps for  $Q_{med}$ ,  $Q_{100cc}$  (MRFS) and  $Q_{1000cc}$  (HEFS) are shown in Annex B.



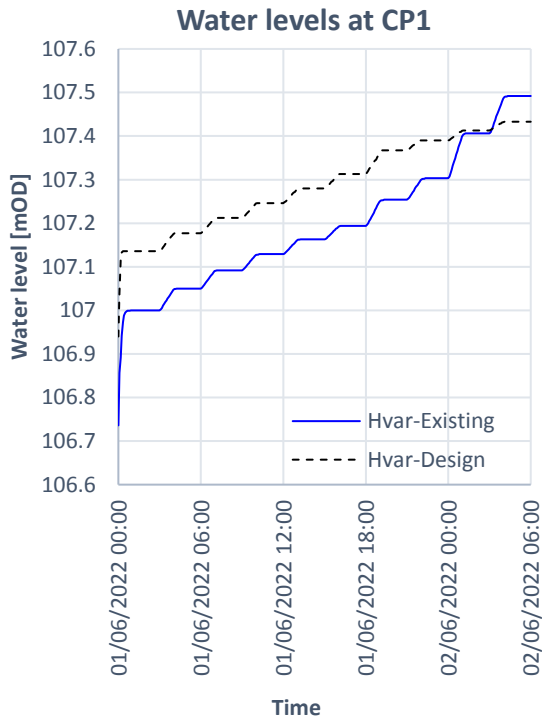
Figure 4.3. Existing digital terrain model with the location of control points CP's and cross sections "P".



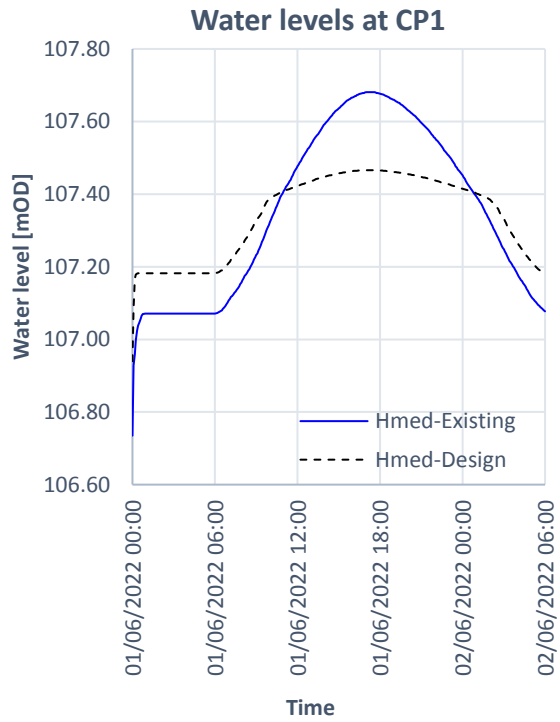
Figure 4.4. Design digital terrain model with the location of control points CP's.

### 4.5.1 Water levels at control points

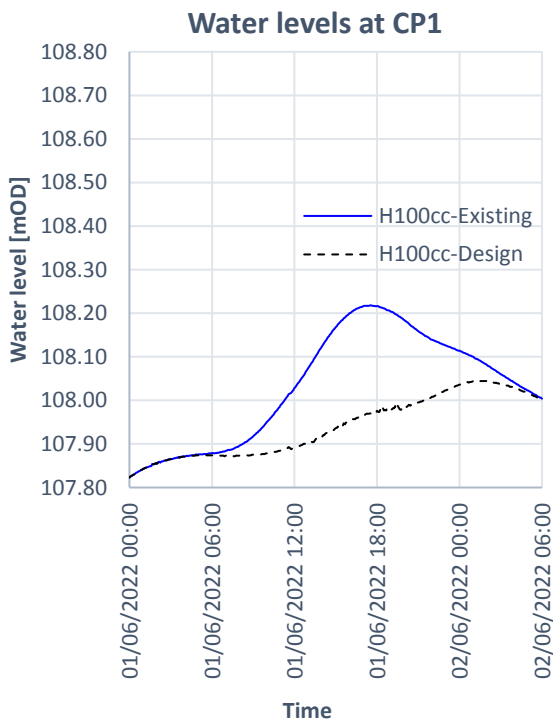
Q<sub>var</sub>



Q<sub>med</sub>



Q<sub>100cc</sub>



Q<sub>1000cc</sub>

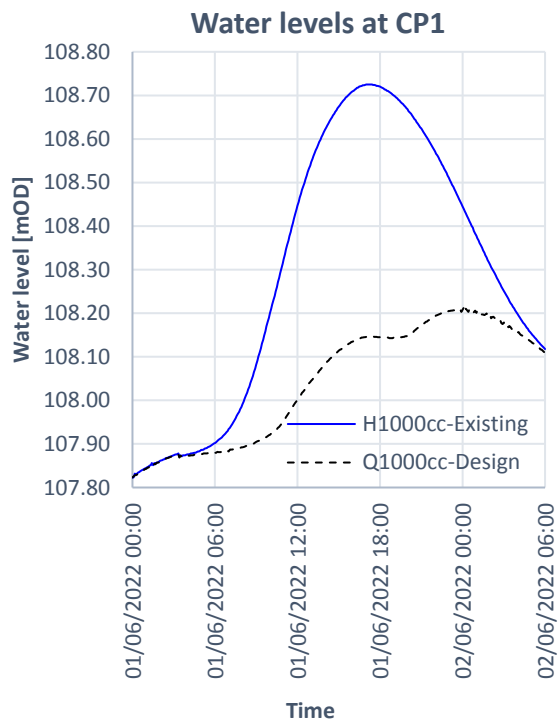
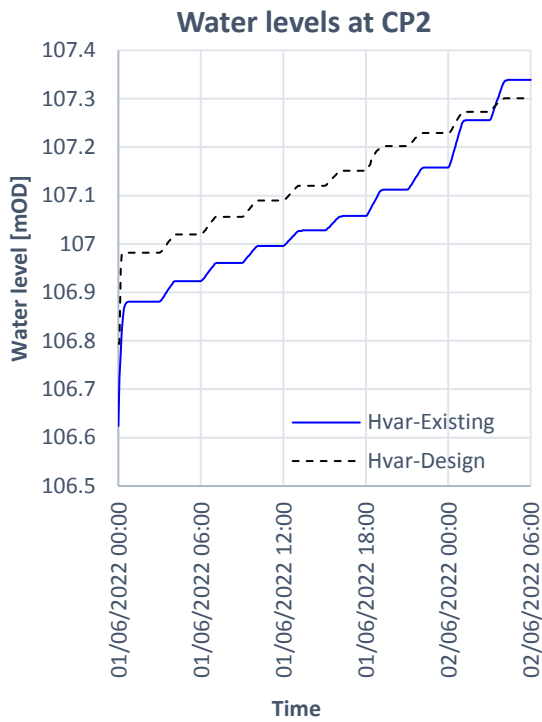
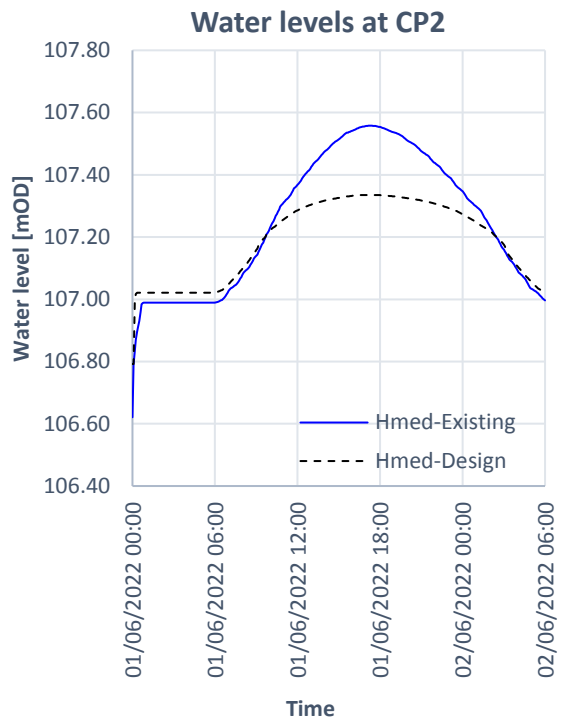


Figure 4.5. Comparison of water levels for range of flows at control point CP1.

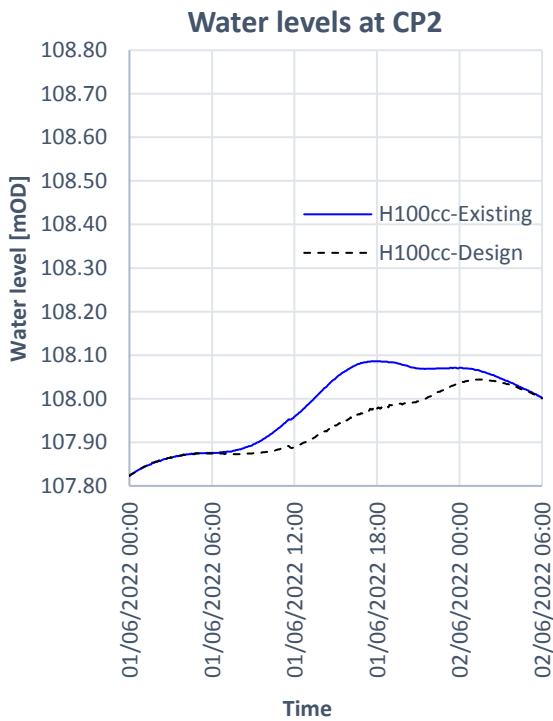
Q<sub>var</sub>



Q<sub>med</sub>



Q<sub>100cc</sub>



Q<sub>1000cc</sub>

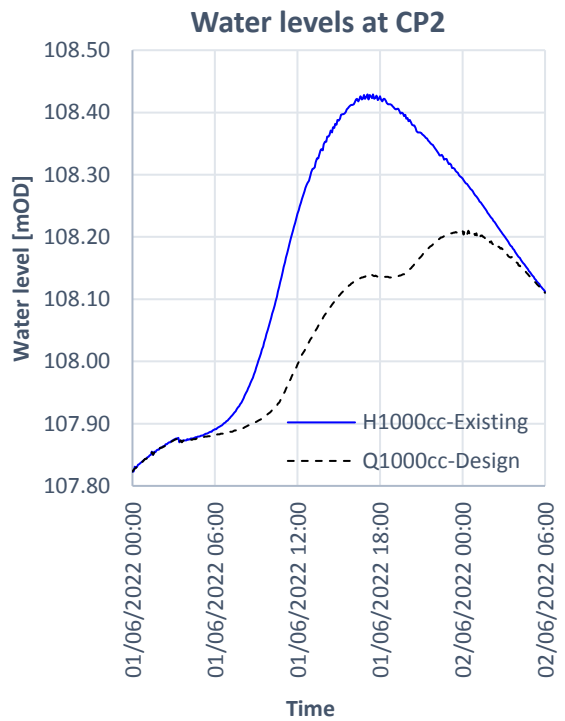
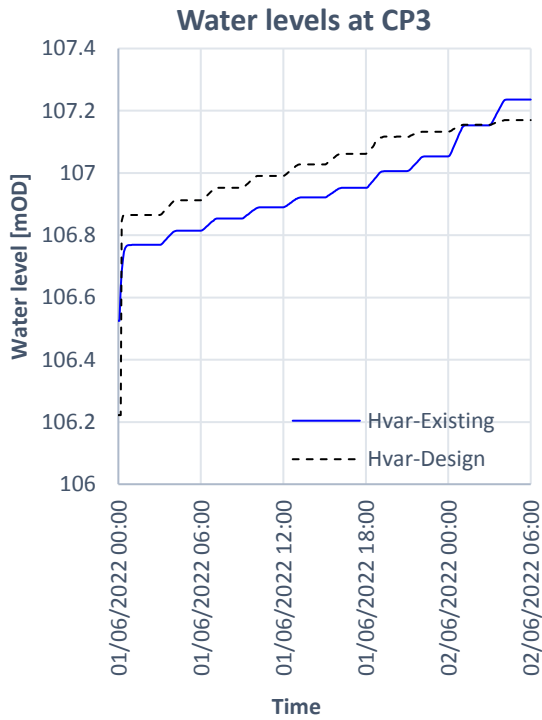
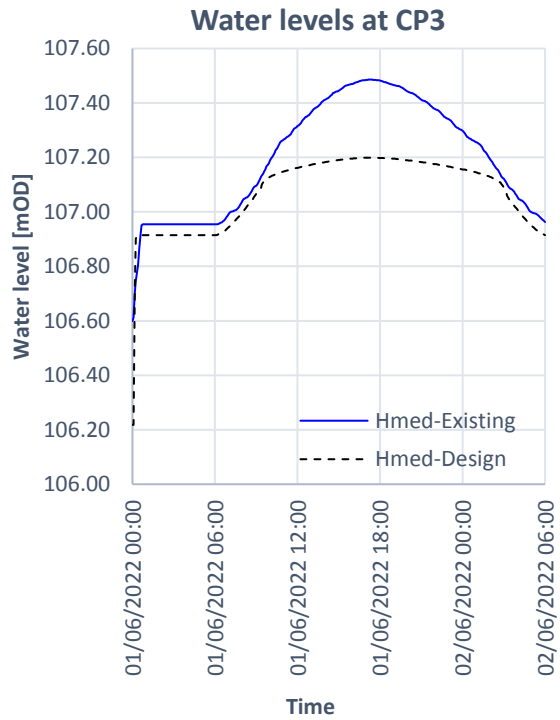


Figure 4.6. Comparison of water levels for range of flows at control point CP2.

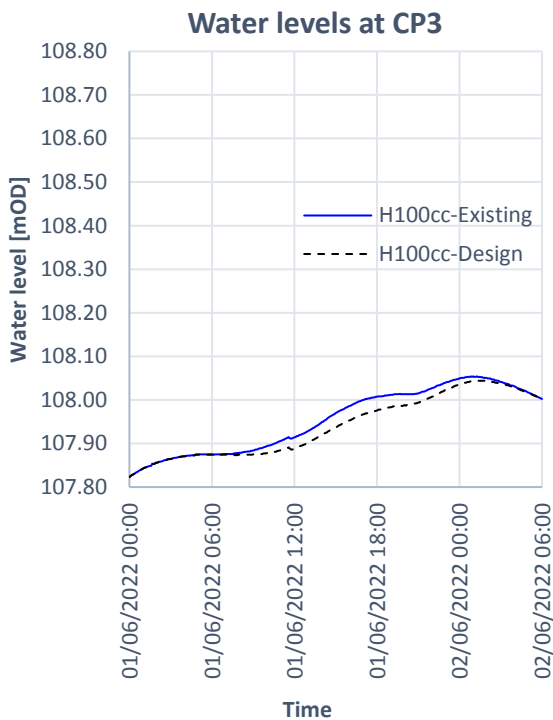
**Q<sub>var</sub>**



**Q<sub>med</sub>**



**Q<sub>100cc</sub>**



**Q<sub>1000cc</sub>**

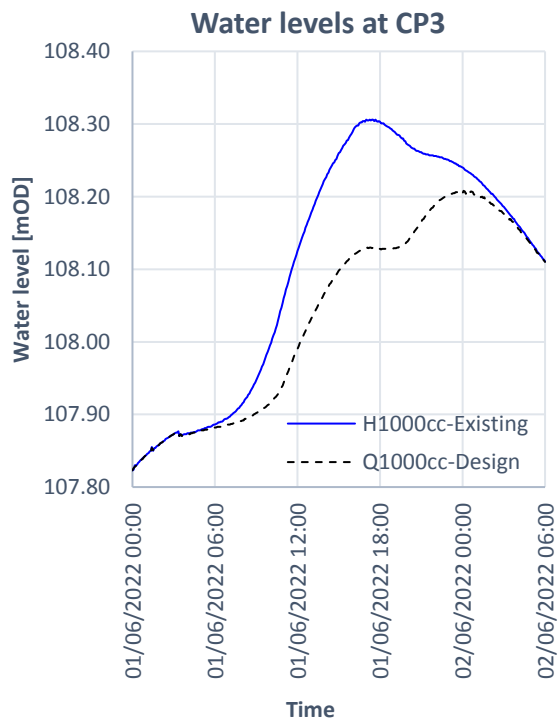
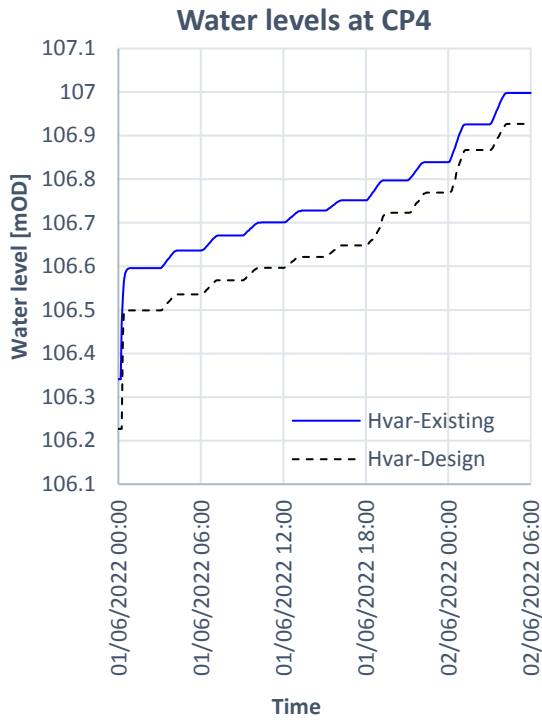
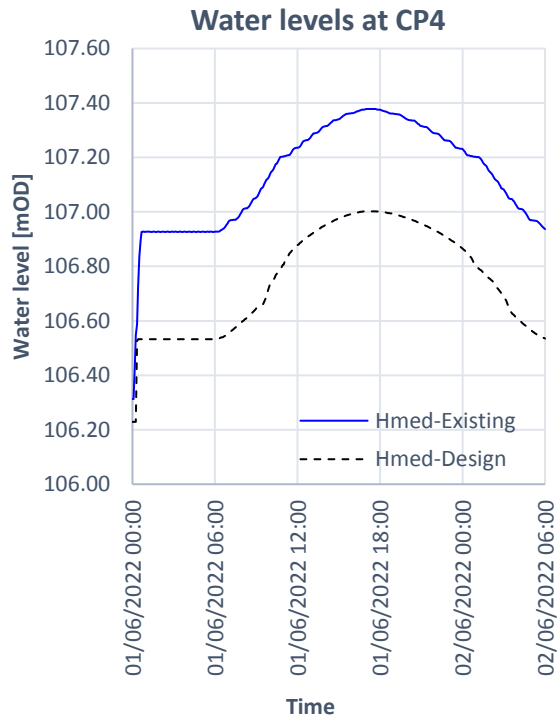


Figure 4.7. Comparison of water levels for range of flows at control point CP3.

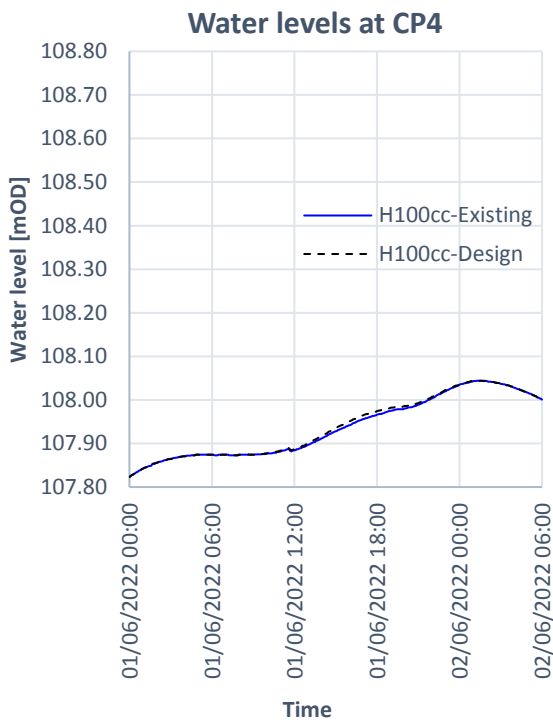
Q<sub>var</sub>



Q<sub>med</sub>



Q<sub>100cc</sub>



Q<sub>1000cc</sub>

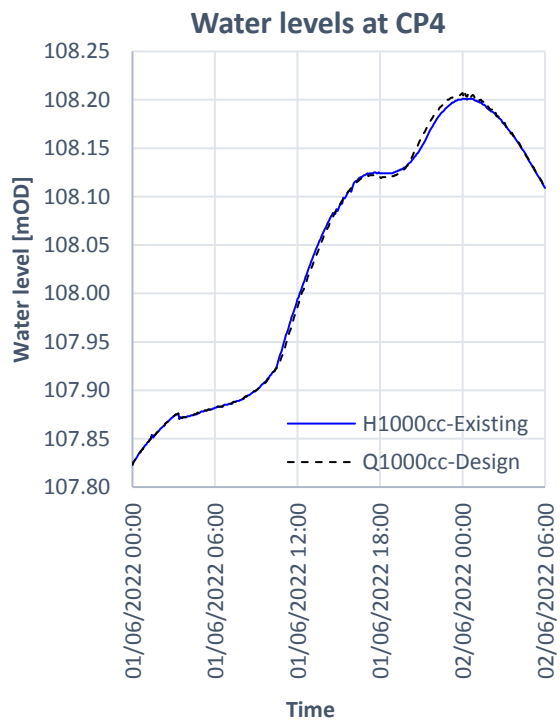
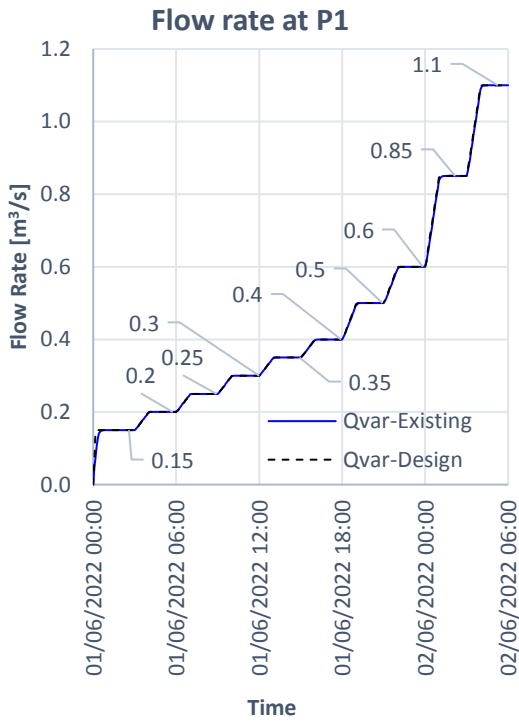


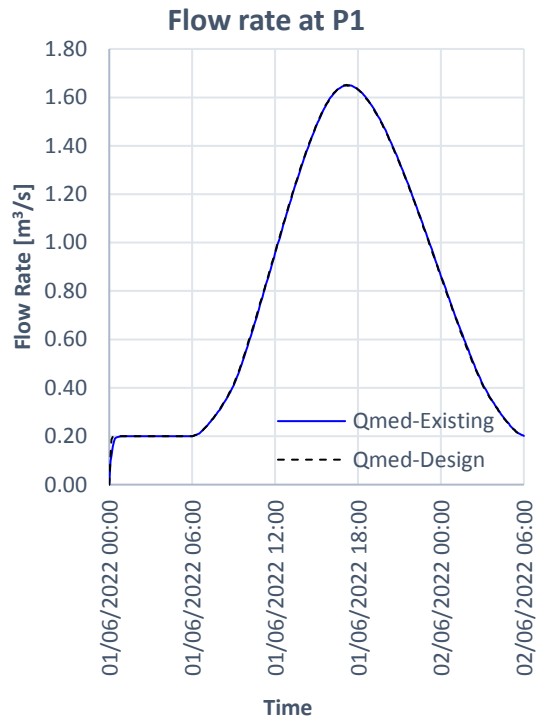
Figure 4.8. Comparison of water levels for range of flows at control point CP4.

**4.5.2 Flow rates at control Profiles “P”**

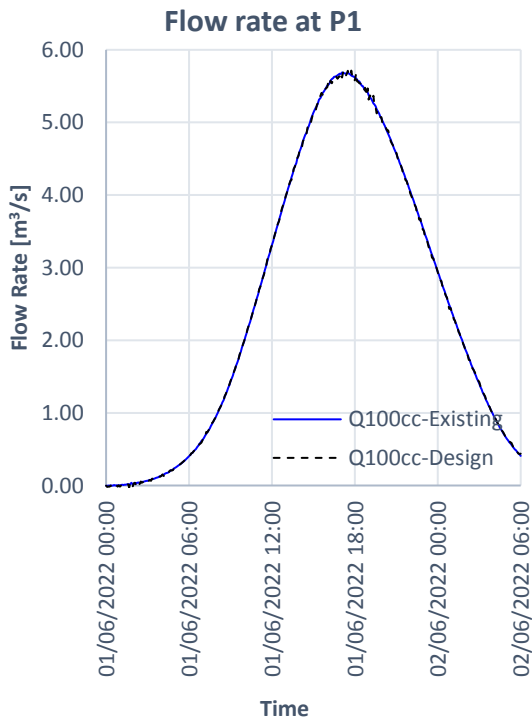
**Q<sub>var</sub>**



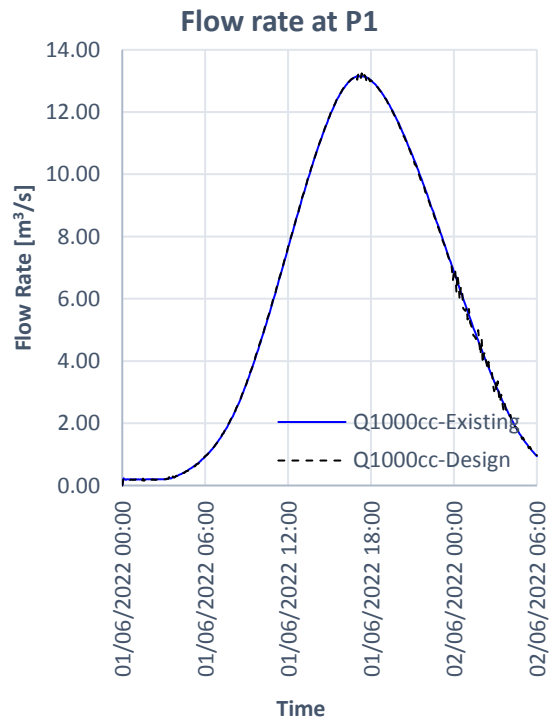
**Q<sub>med</sub>**



**Q<sub>100cc</sub>**

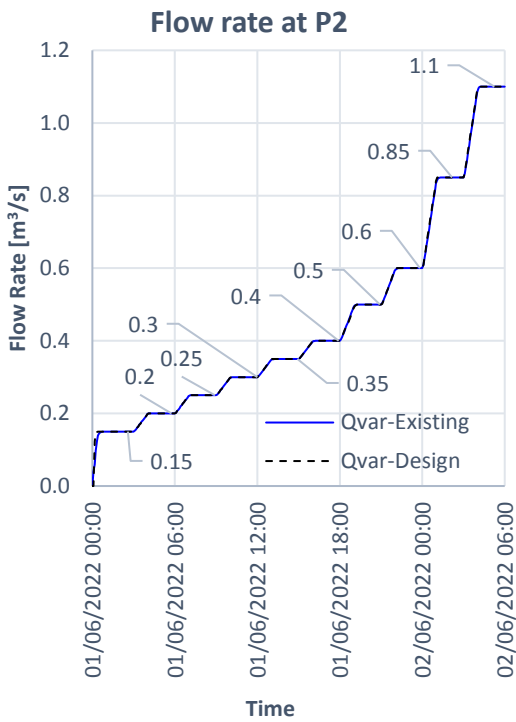


**Q<sub>1000cc</sub>**

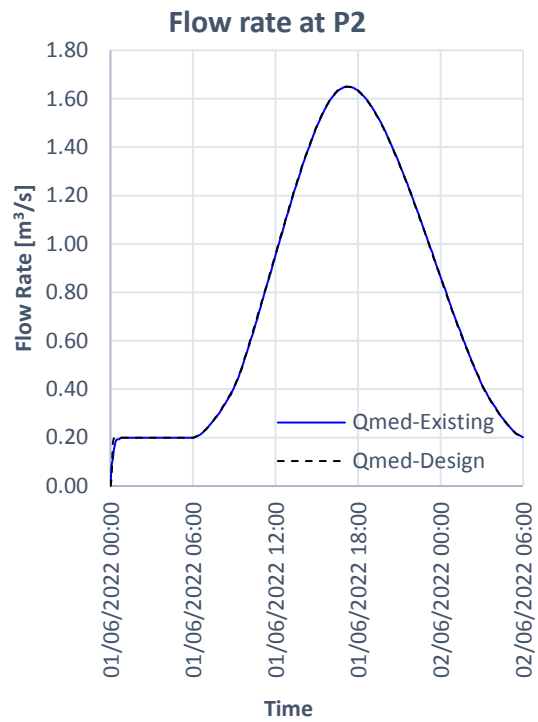


**Figure 4.9. Comparison of Existing and design flow rates at cross section P1.**

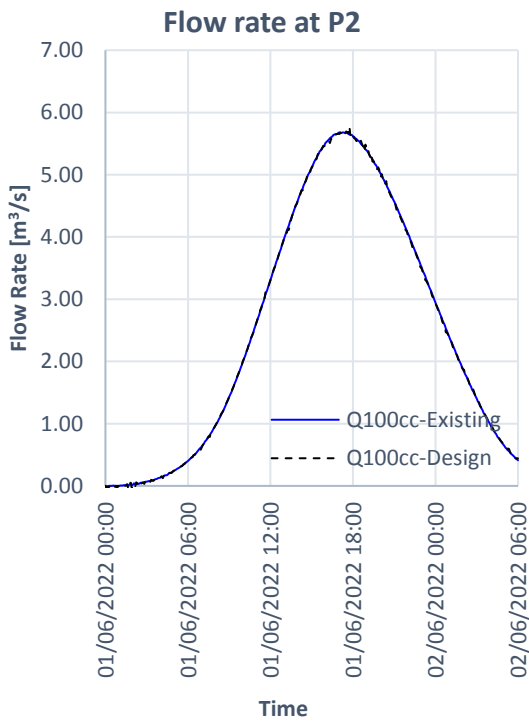
$Q_{var}$



$Q_{med}$



$Q_{100cc}$



$Q_{1000cc}$

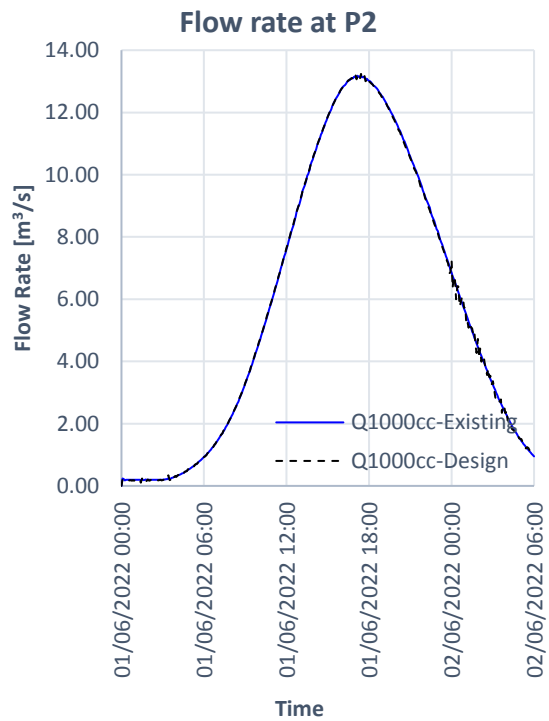
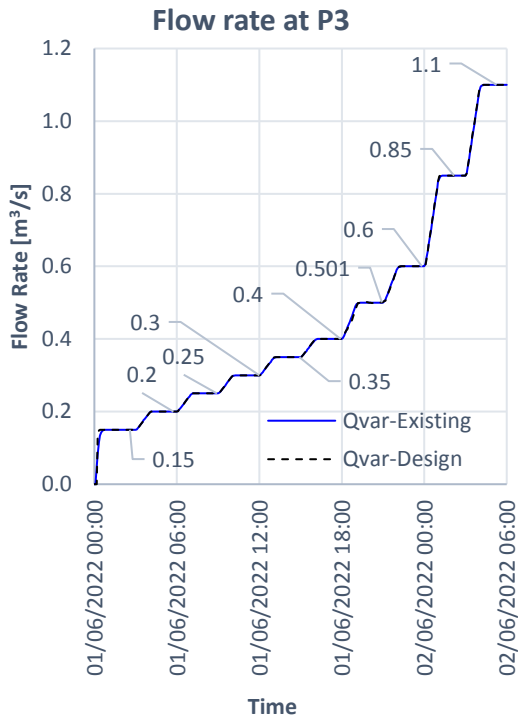


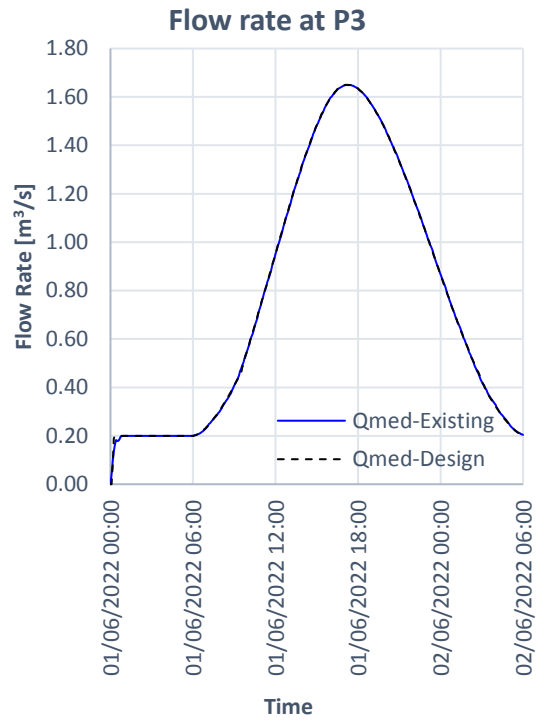
Figure 4.10. Comparison of Existing and design flow rates at cross section P2.



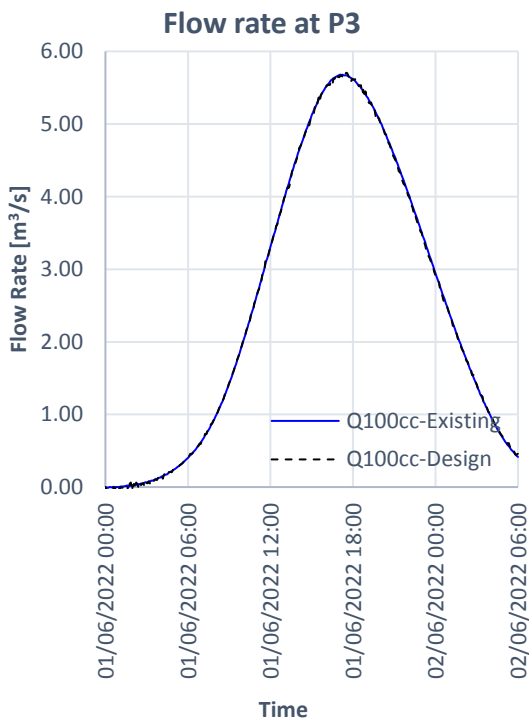
**Q<sub>var</sub>**



**Q<sub>med</sub>**



**Q<sub>100cc</sub>**



**Q<sub>1000cc</sub>**

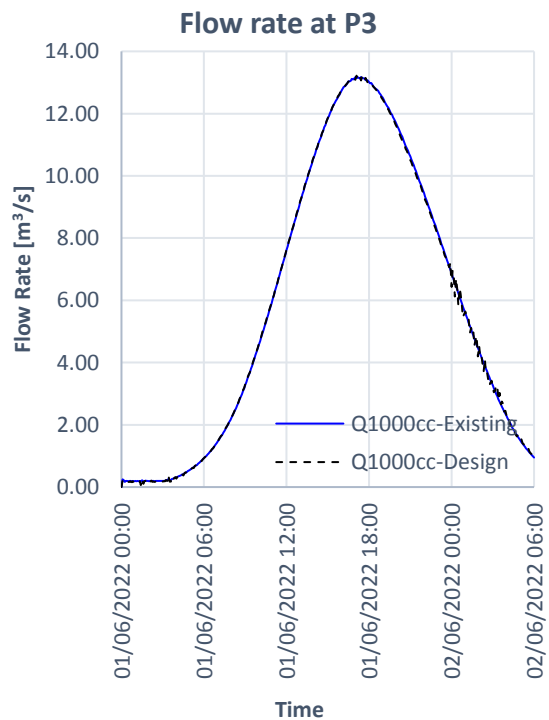
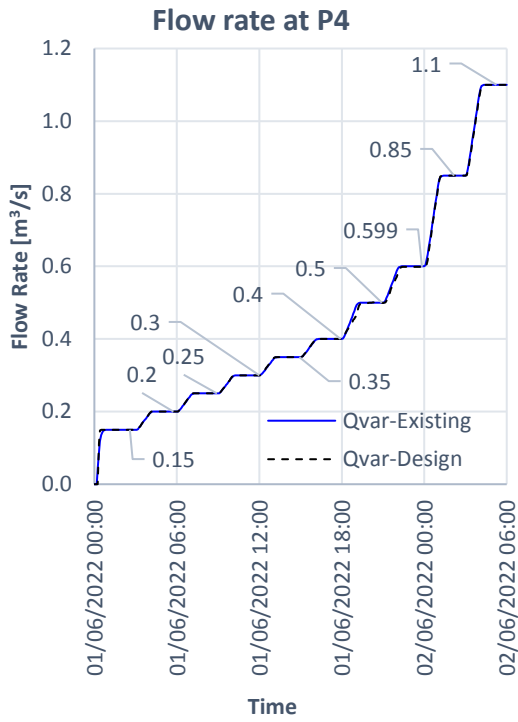
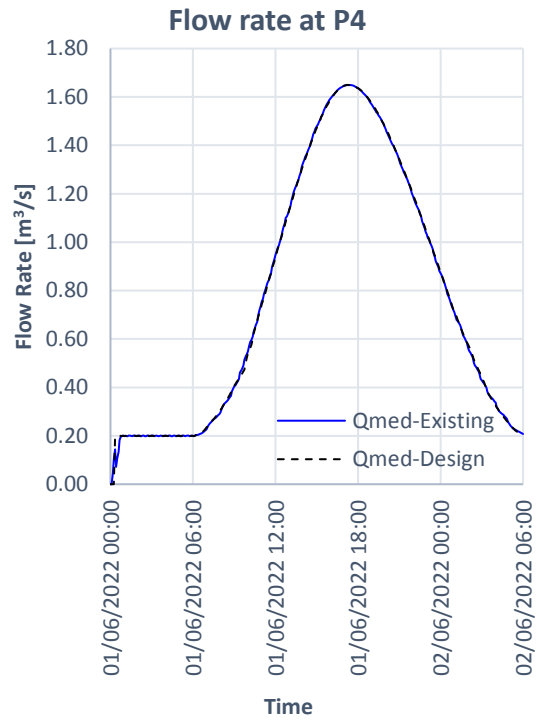


Figure 4.11. Comparison of Existing and design flow rates at cross section P3.

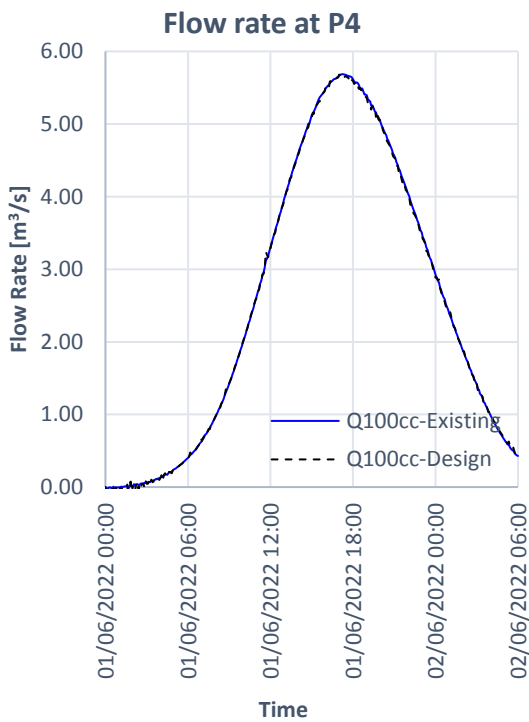
**Q<sub>var</sub>**



**Q<sub>med</sub>**



**Q<sub>100cc</sub>**



**Q<sub>1000cc</sub>**

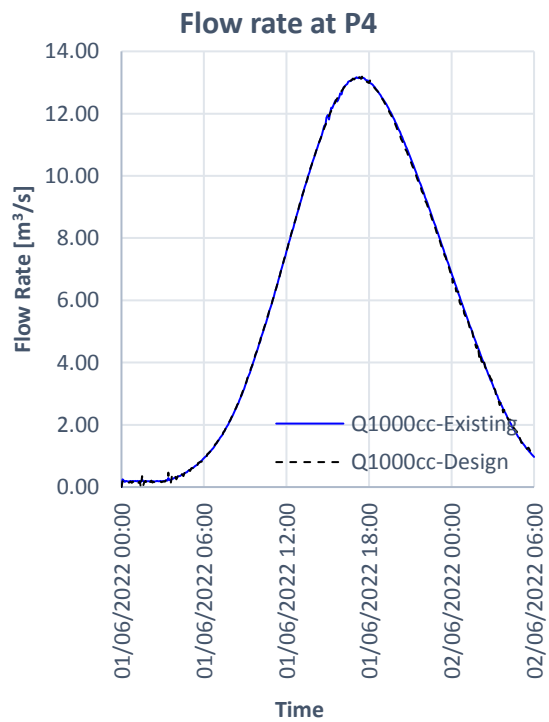


Figure 4.12. Comparison of Existing and design flow rates at cross section P4.

### 4.5.3 Water levels and terrain at control profiles “P”

#### 4.5.3.1 Cross section P1

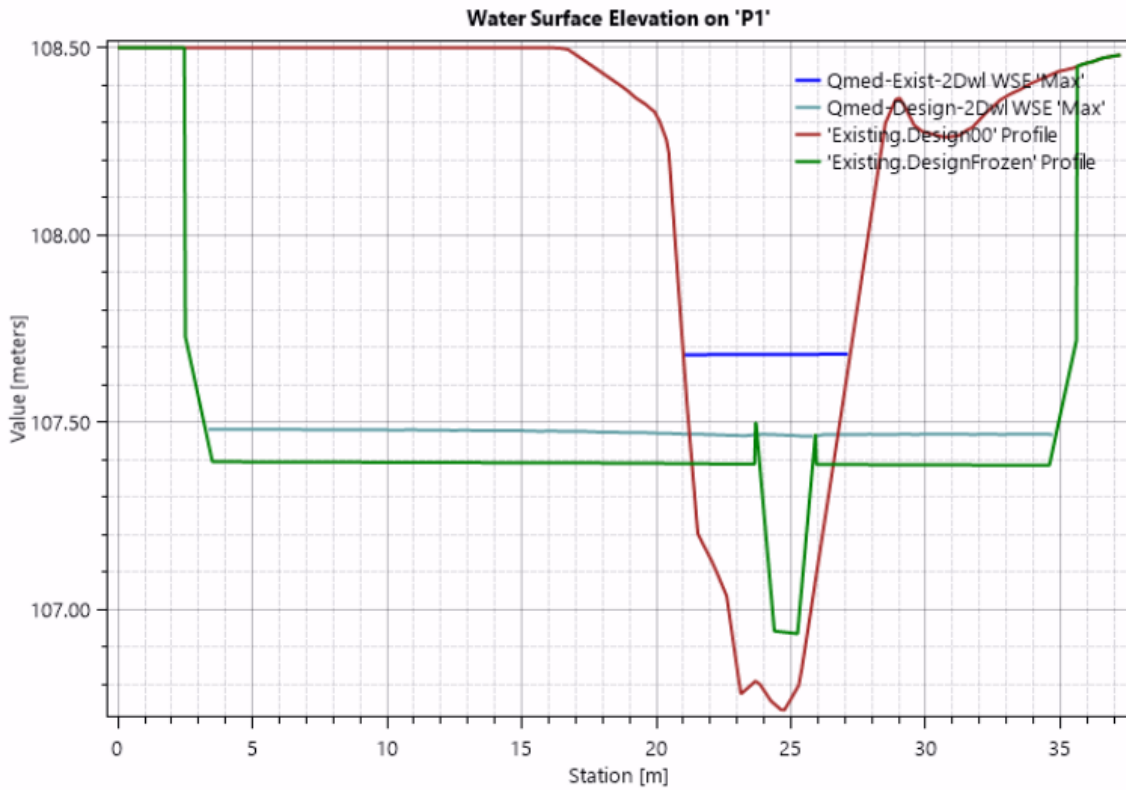


Figure 4.13. Comparison of Existing and design ground levels and water levels for  $Q_{med}$  at CS1.

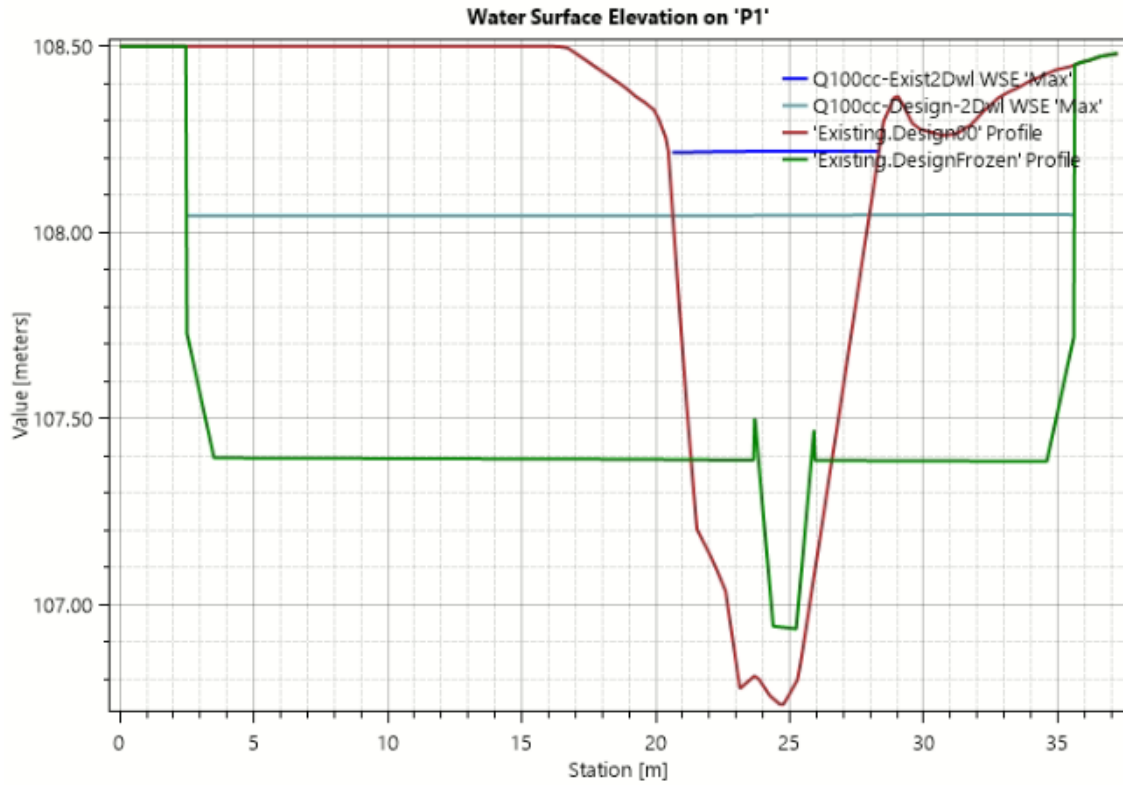


Figure 4.14. Comparison of Existing and design ground levels and water levels for Q100cc at CS1.

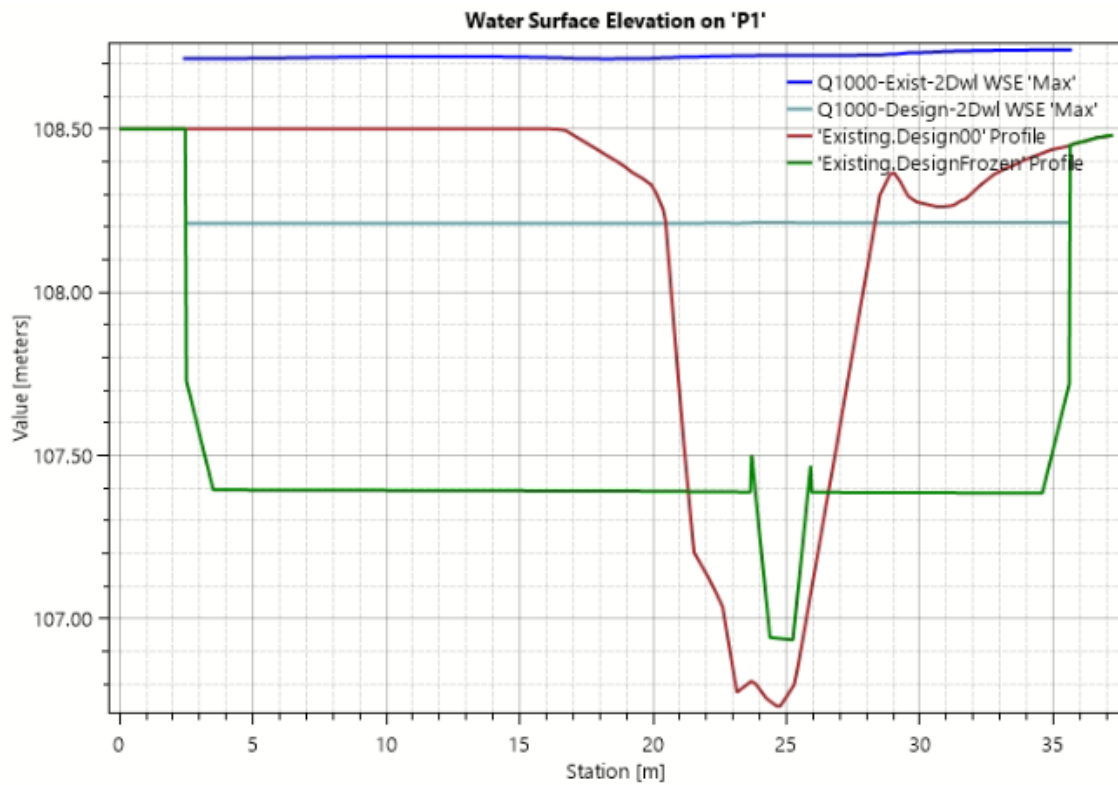


Figure 4.15. Comparison of Existing and design ground levels and water levels for Q1000cc at CS1.

4.5.3.2 Cross section P2

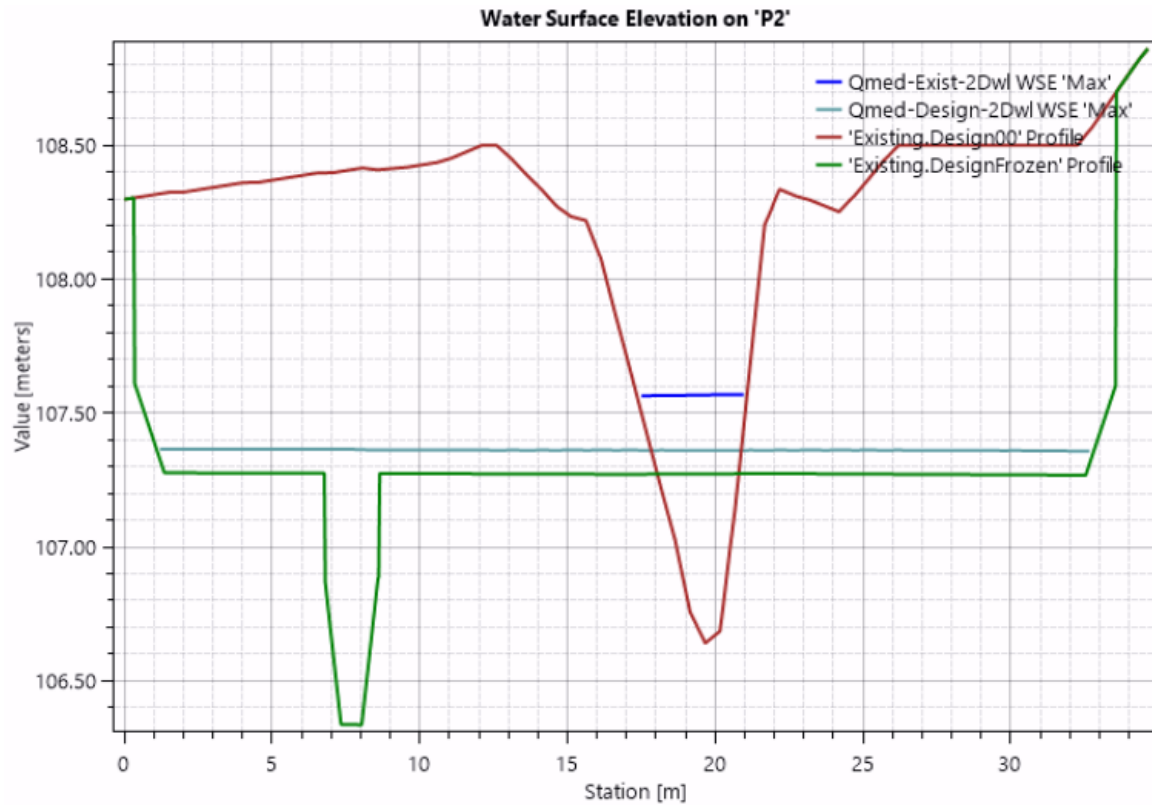


Figure 4.16. Comparison of Existing and design ground levels and water levels for  $Q_{med}$  at CS2.

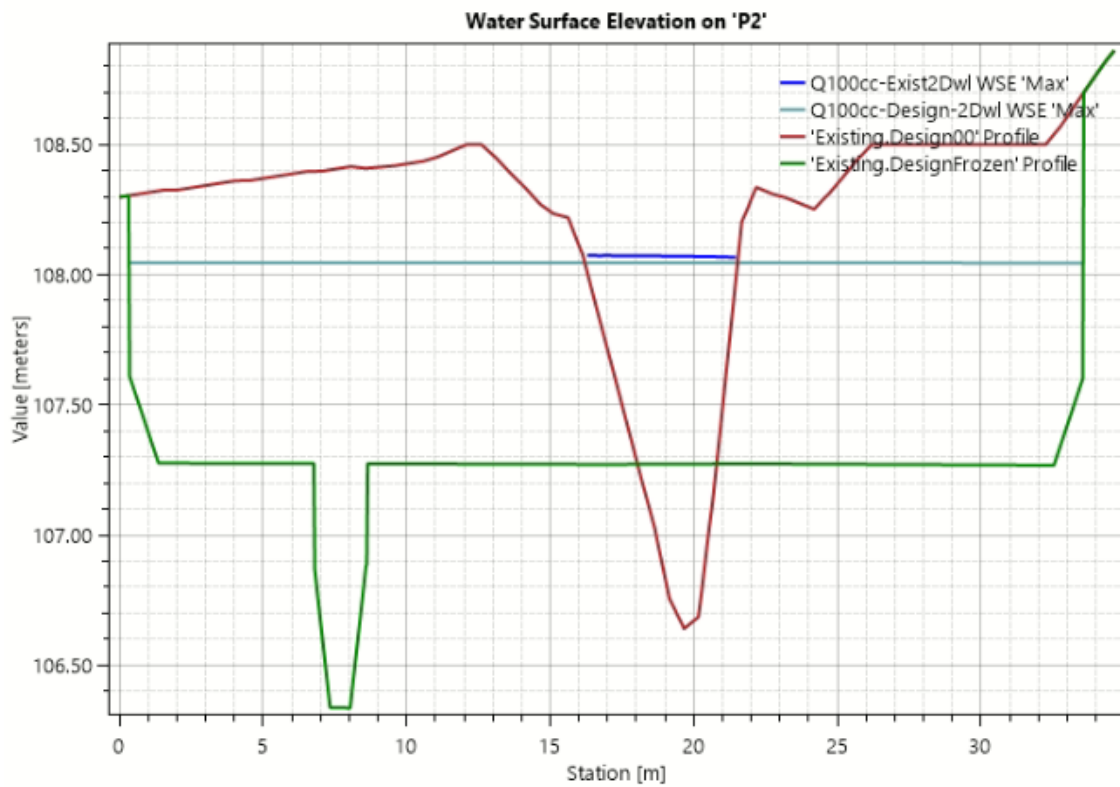


Figure 4.17. Comparison of Existing and design ground levels and water levels for  $Q_{100cc}$  at CS2.

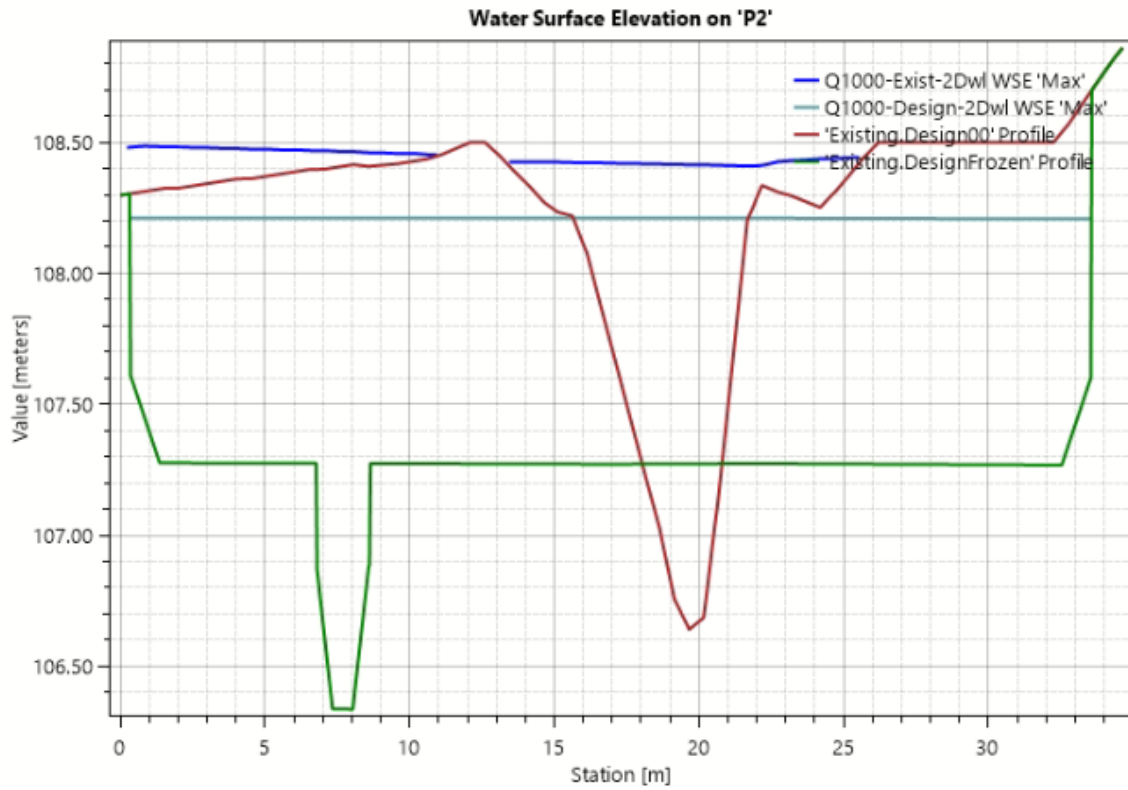


Figure 4.18. Comparison of Existing and design ground levels and water levels for Q<sub>1000cc</sub> at CS2.

4.5.3.3 Cross section P3

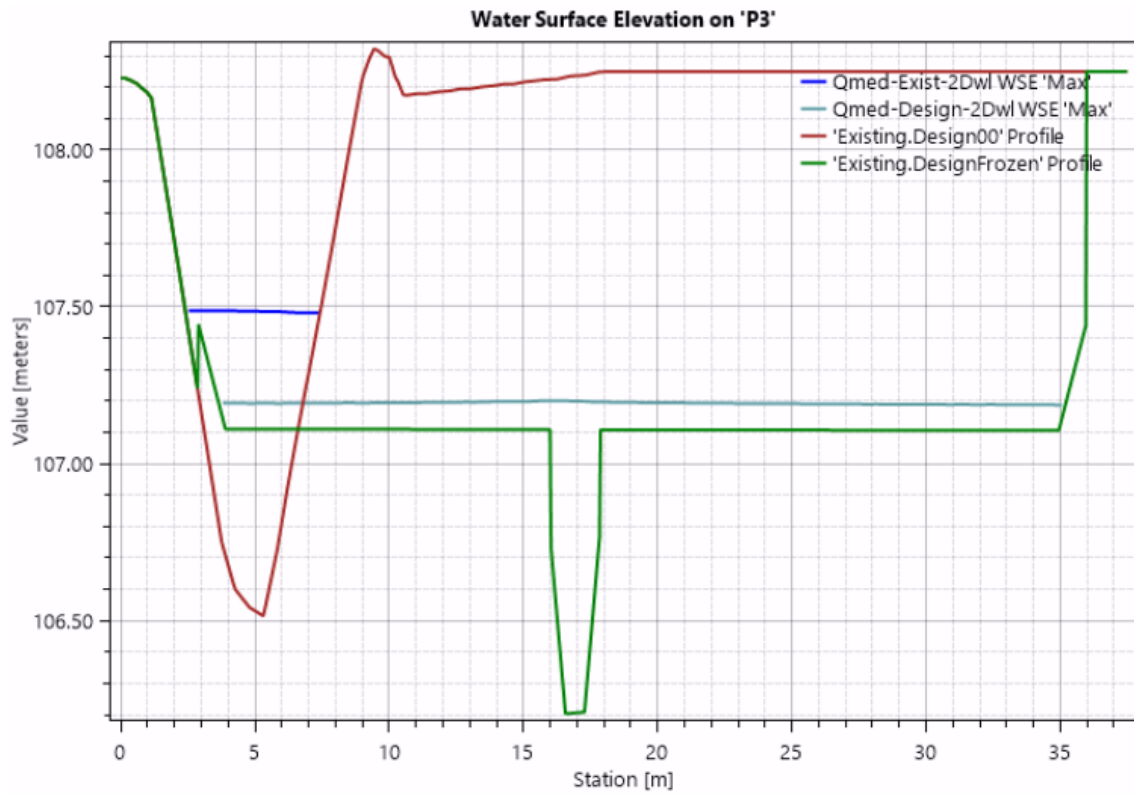


Figure 4.19. Comparison of Existing and design ground levels and water levels for  $Q_{med}$  at CS3.

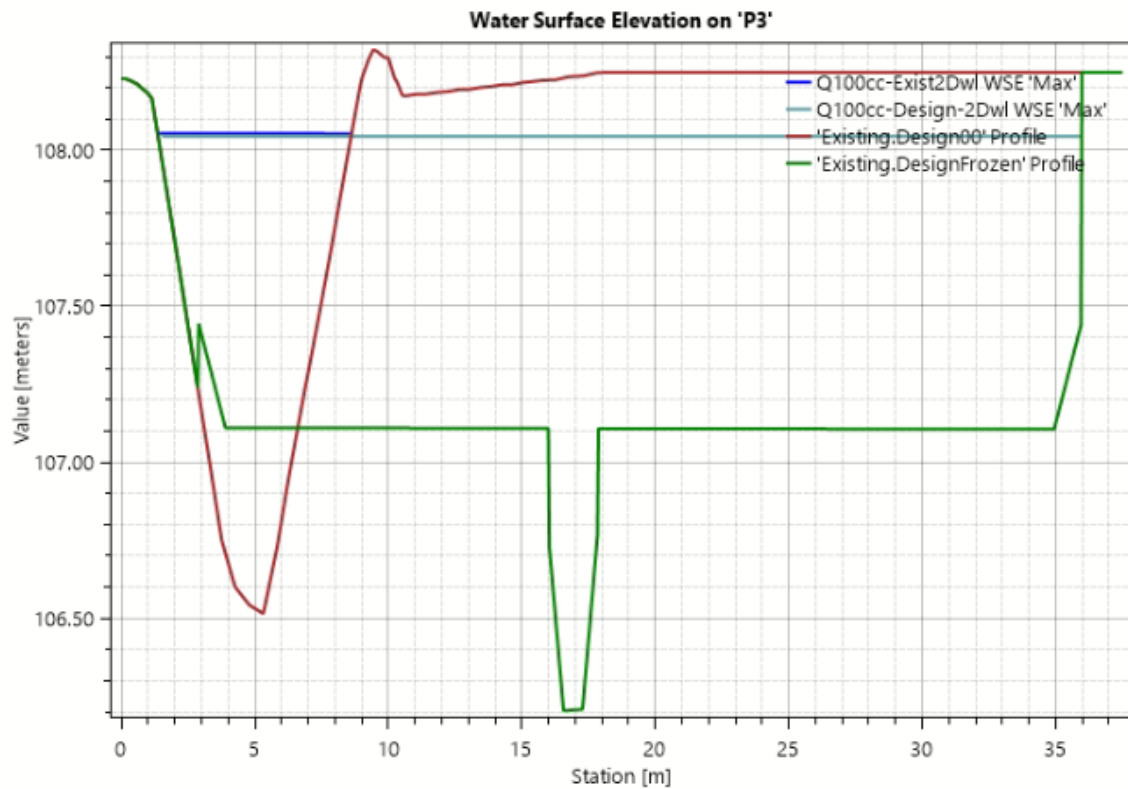


Figure 4.20. Comparison of Existing and design ground levels and water levels for  $Q_{100cc}$  at CS3.

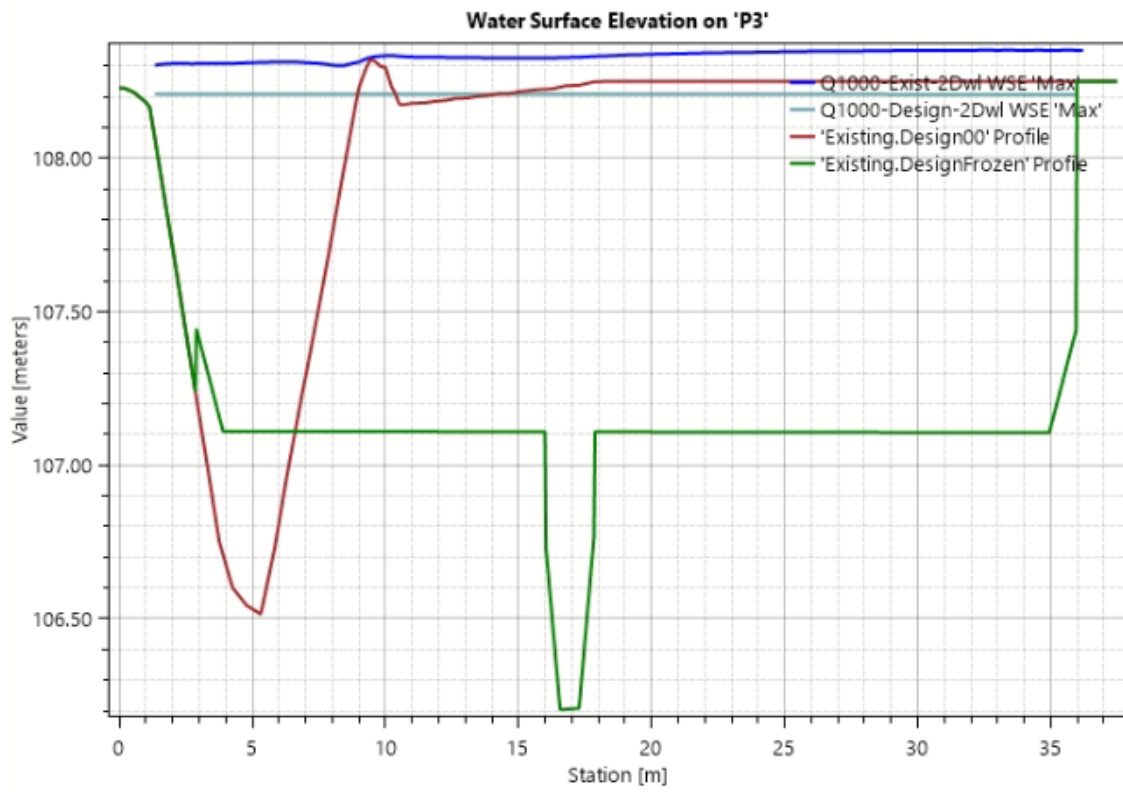


Figure 4.21. Comparison of Existing and design ground levels and water levels for Q<sub>1000cc</sub> at CS3.



4.5.3.4 Cross section P4

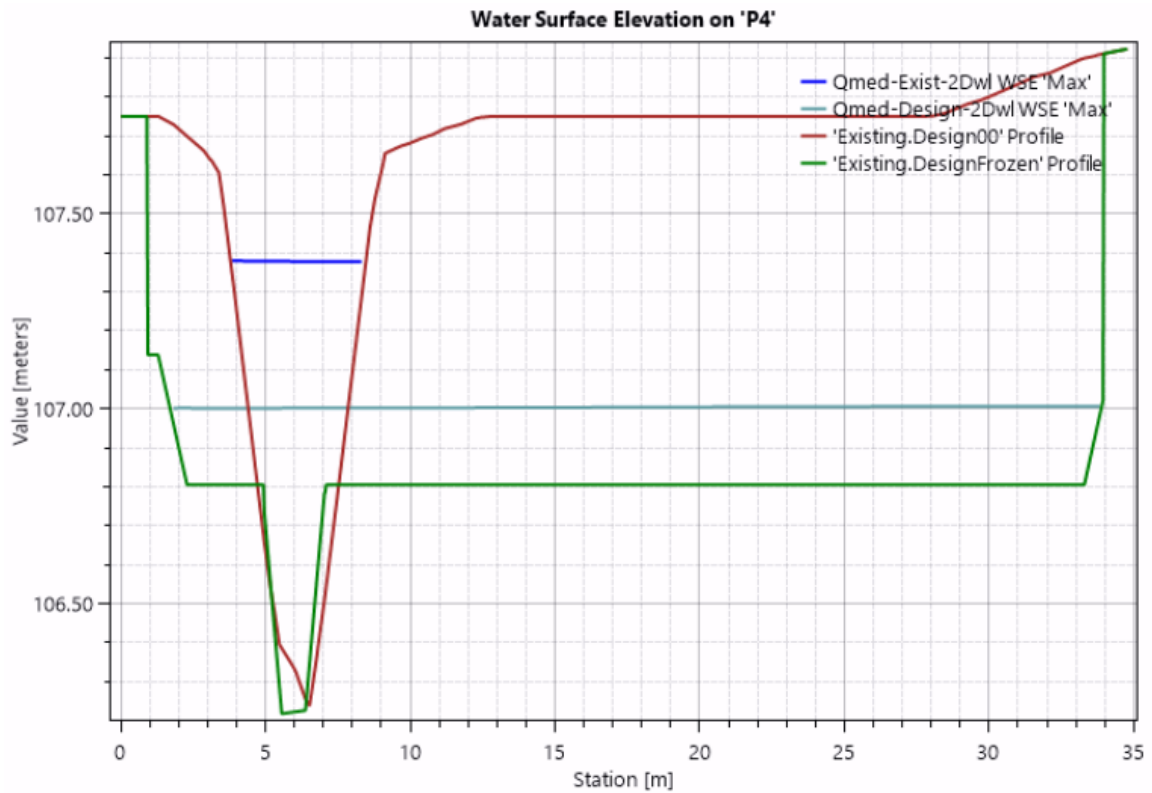


Figure 4.22. Comparison of Existing and design ground levels and water levels for  $Q_{med}$  at CS4.

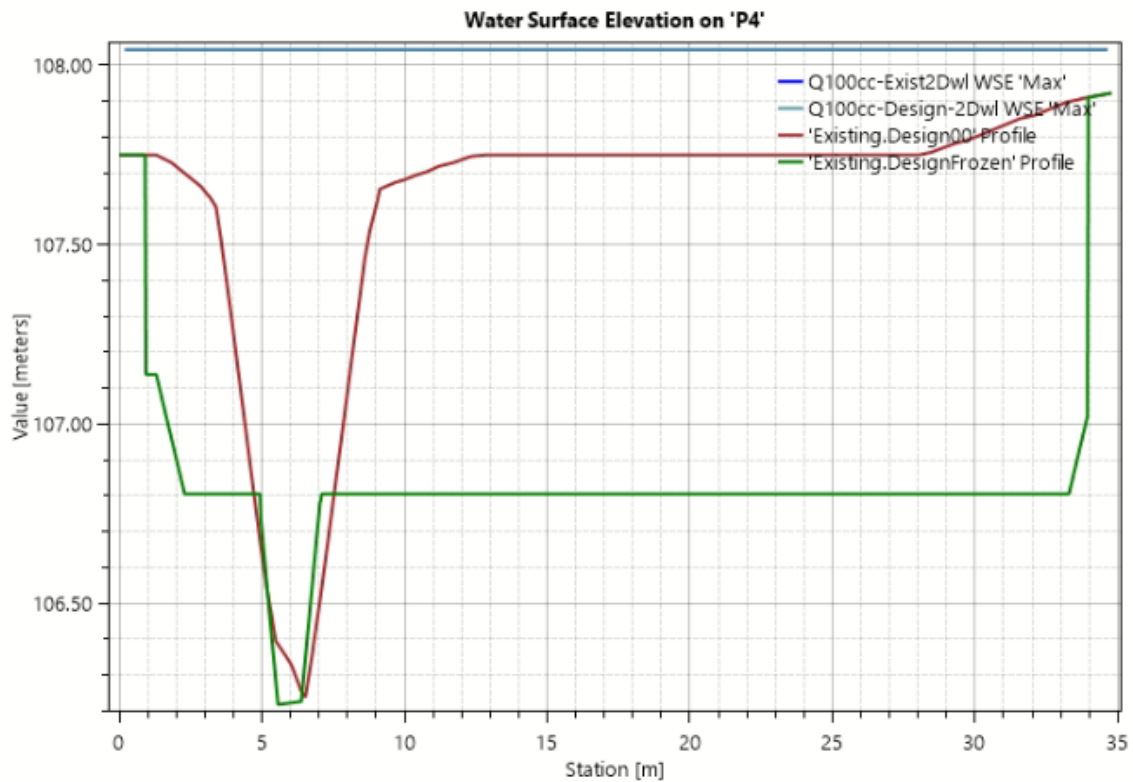


Figure 4.23. Comparison of Existing and design ground levels and water levels for  $Q_{100cc}$  at CS4.

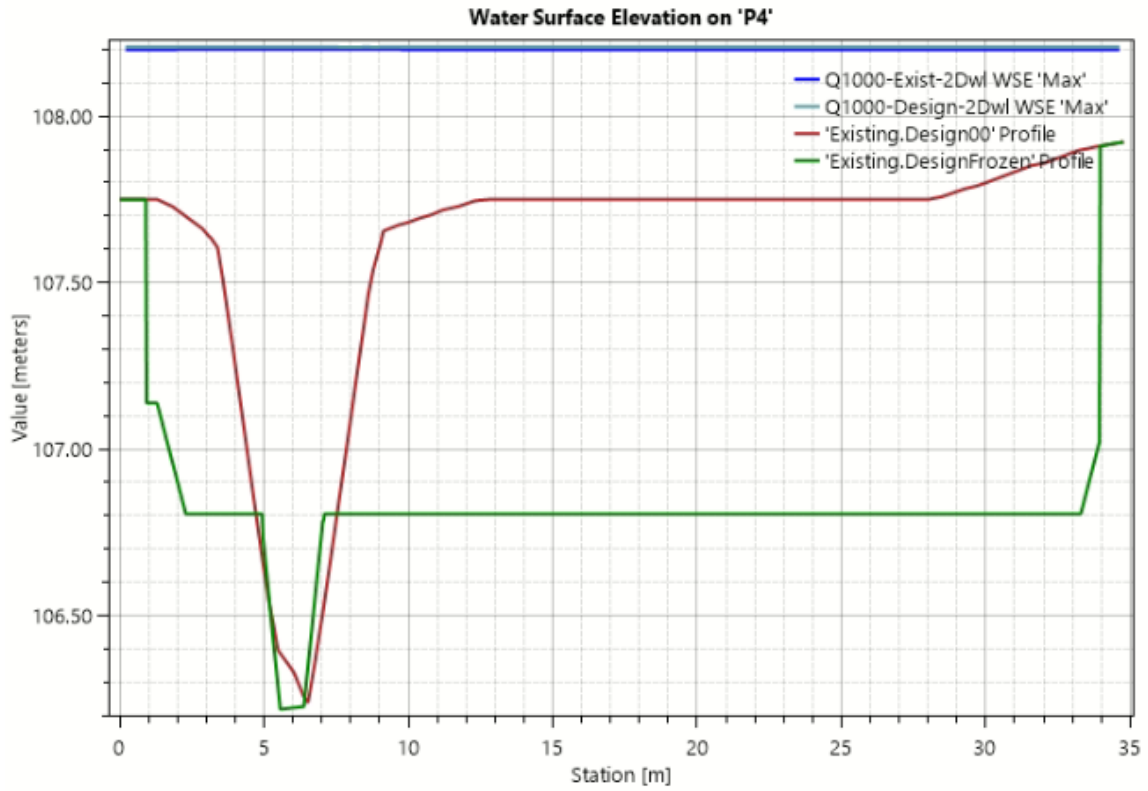


Figure 4.24. Comparison of Existing and design ground levels and water levels for Q<sub>1000cc</sub> at CS4.

**4.5.4 Longitudinal profile showing water levels at new meandering axis**

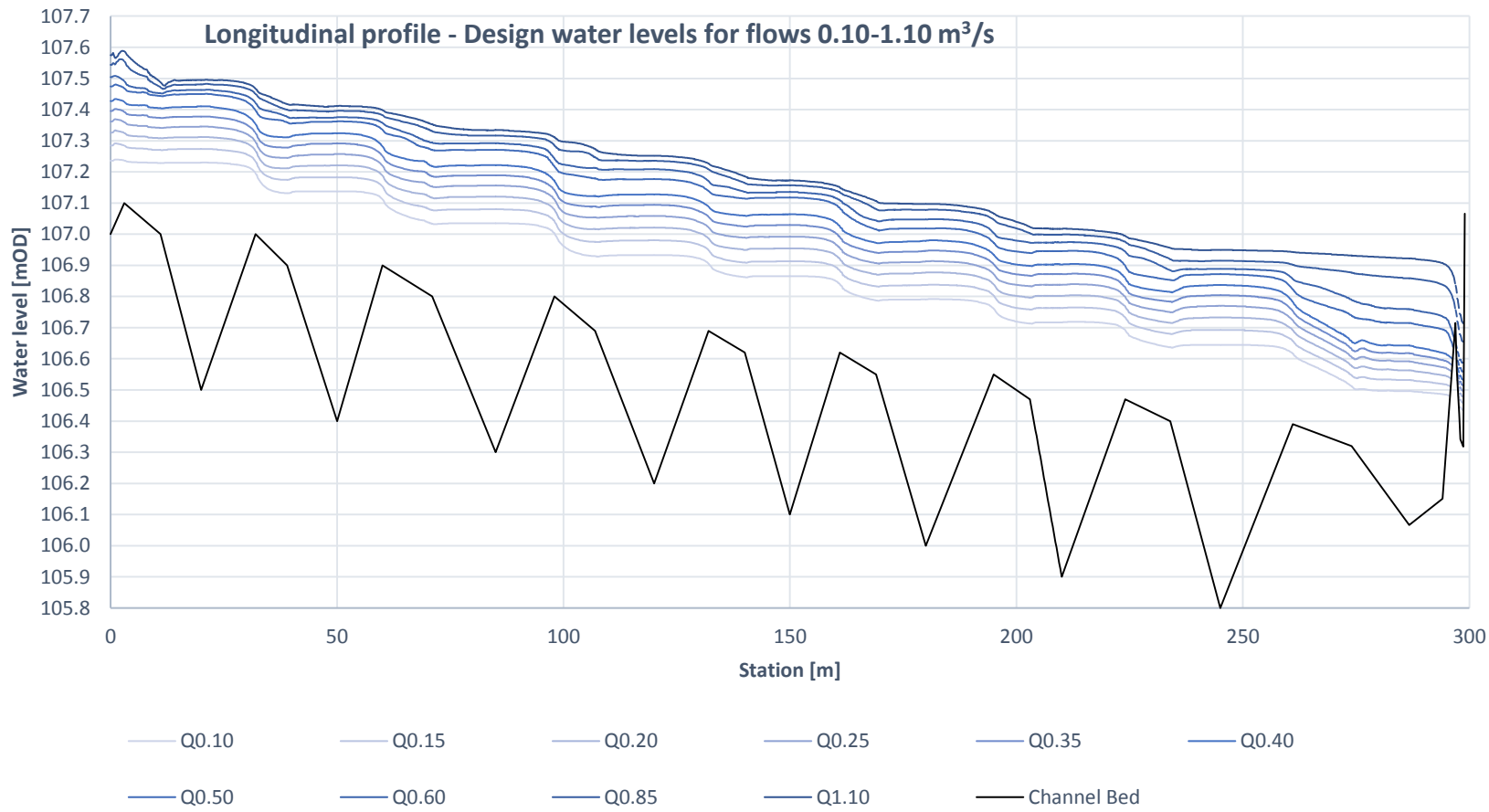


Figure 4.25. Longitudinal profile along the new re-meandered section showing Design water levels for flows ranging from 0.10 – 1.10 m<sup>3</sup>/s.

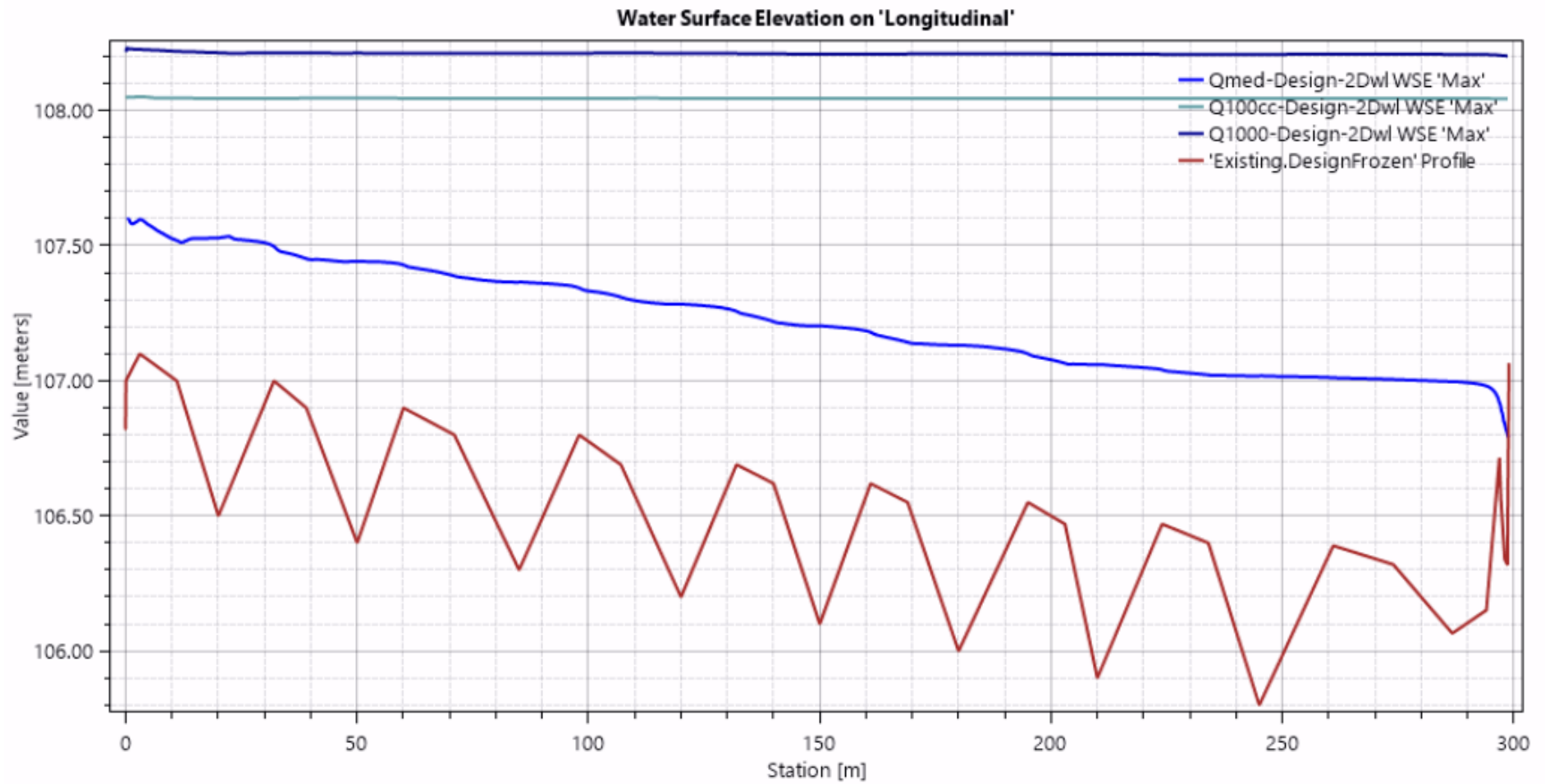


Figure 4.26. Longitudinal profile along the new re-meandered section showing maximum Design water levels for  $Q_{var}$ ,  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  flows.

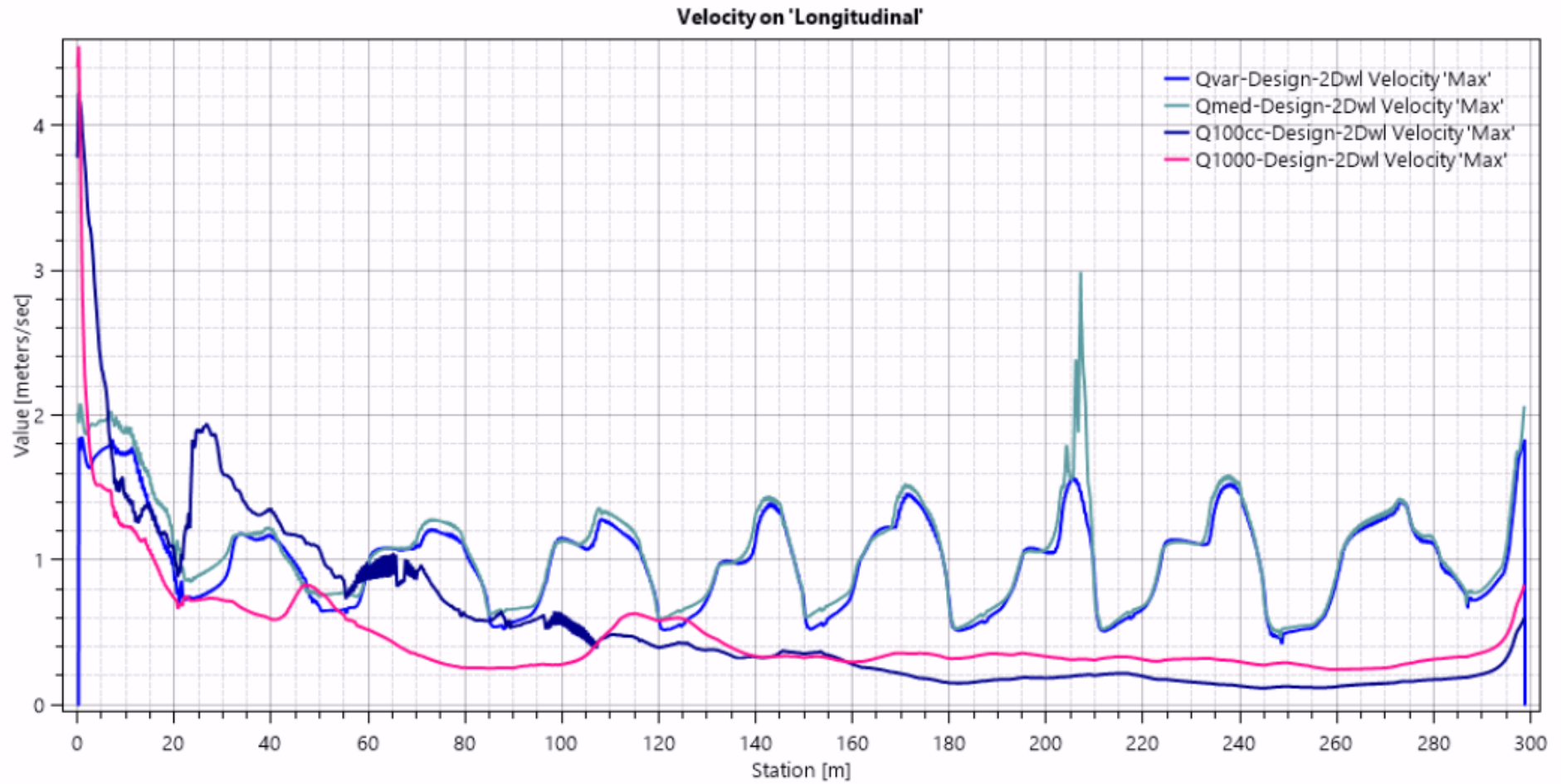


Figure 4.27. Longitudinal profile along the new re-meandered section showing maximum Design flow velocities for  $Q_{var}$ ,  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  flows.

## 5 Conclusions

1. Comparison of water levels shows that the Design River System gives lower water levels when compared to Existing River System for  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  flows (see  $Q_{med}$ ,  $Q_{100cc}$  and  $Q_{1000cc}$  results in Figures 4.5,4.6,4.7,4.8). This is due to additional storage provided by the newly formed compound channel incorporating the meandering main channel and the raised berm on either side that is on average 1m deeper than existing floodplain.
2. A slight increase of water levels for the Design River System is evident for very low flows below  $0.40 \text{ m}^3/\text{s}$  (see  $Q_{var}$  results in Figures 4.5,4.6,4.7,4.8). This is due to the riffle sections and lower slope ( $0.0026 \text{ m/m}$ ) of the new proposed design channel when compared to the existing (straight) channel.
3. Comparisons of water levels were made at selected cross-sections and the results are given in Figures 4.13,4.14 and 4.15. These results confirm water levels reductions from Existing to Design scenarios.
4. The Design channel capacity is around  $0.40 \text{ m}^3/\text{s}$ . This means that any flow greater than  $0.4 \text{ m}^3/\text{s}$  will spill out onto the compound channel berm but will have no effect on surrounding lands since the newly formed compound channel incorporating the meandering main channel and the raised berm on either side is on average 1m deeper than existing floodplain.
5. The model clearly showed that there are no increase of runoff i.e. flow rate, downstream of the re-meandered river reach (see Figures 4.9,4.10,4.11,4.12). Flow rate comparison showed that the difference between flow rates between Existing and Design River System is near zero for the full range of flows.
6. The flow velocities are noted to be the highest for  $Q_{med}$  simulations (near bank full flow) and are around  $2.0 \text{ m/s}$ , with some localised areas up to  $3.0 \text{ m/s}$ . It is recommended that these areas are armoured to provide long term stability.

## 6 References

- [1] The Planning System and Flood Risk Management - Guidelines for Planning Authorities, OPW and the Department of the Environment, Heritage and Local Government, November 2009.
- [2] Fluvio R&D Ltd., Borrisbeg Wind Farm Flood Risk Assessment, November 2023.
- [3] OPW Planning and Development Flood Policy, published on [www.flooding.ie](http://www.flooding.ie).
- [4] Arterial Drainage Act, 1945.
- [5] Arterial Drainage (Amendment) Act, 1995.
- [6] OPW Flood Hazard Mapping, [www.floodmaps.ie](http://www.floodmaps.ie)
- [7] IPCC 4th Assessment report, 2007.
- [8] Irish Committee on Climate Change – Ireland and the IPCC 4th Assessment Report, 2007.
- [9] IPCC 4th Assessment report, 2007.
- [10] OPW, Flood Risk Management Plan, River Basin (16) Suir, 2018.
- [11] Tipperary Co.Co. & CAAS Ltd., Strategic Flood Risk Assessment – Draft Tipperary County Development Plan 2022-2028, July 2021.
- [12] Tipperary Co.Co, Renewable Energy Strategy - Draft Tipperary County Development Plan 2022-2028, July 2021.
- [13] OPW, The National Preliminary Flood Risk Assessment, March 2012.
- [14] OPW, Suir CFRAM Study - UoM16 Preliminary Options Report, 2016.
- [15] Office of Public Works, Flood Studies Update, Technical Research Report, Volume I, 2014.
- [16] Office of Public Works, Flood Studies Update, Technical Research Report, Volume II, 2014.
- [17] Office of Public Works, Flood Studies Update, Technical Research Report, Volume III, 2014.
- [18] Office of Public Works, Flood Studies Update, Technical Research Report, Volume IV, 2014.

# 7 Appendices

7.1	Annex A - HEC-RAS output tables – Water Levels .....	7-44
7.2	Annex B - Flow velocity maps .....	7-110



## 7.1 ANNEX A - HEC-RAS OUTPUT TABLES – WATER LEVELS

No	Station [m]	Thalweg [mOD]	No	Station [m]	Qmed [mOD]	No	Station [m]	Q <sub>100cc</sub> [mOD]	No	Station [m]	Q <sub>1000cc</sub> [mOD]
1	-0.299	106.82	1	0	NaN	1	0	108.05	1	0	108.22
2	-0.086	106.82	2	0.213	NaN	2	0.125	108.05	2	0.125	108.23
3	0	107.00	3	0.299	107.58	3	0.25	108.05	3	0.25	108.23
4	3	107.10	4	0.424	107.59	4	0.375	108.05	4	0.375	108.23
5	11	107.00	5	0.549	107.59	5	0.5	108.05	5	0.5	108.23
6	20	106.50	6	0.674	107.58	6	0.666	108.05	6	0.666	108.23
7	32	107.00	7	0.799	107.58	7	0.833	108.05	7	0.833	108.23
8	39	106.90	8	0.965	107.58	8	0.999	108.05	8	0.999	108.23
9	50	106.40	9	1.132	107.57	9	1.166	108.05	9	1.166	108.23
10	60	106.90	10	1.298	107.57	10	1.332	108.05	10	1.332	108.23
11	71	106.80	11	1.465	107.57	11	1.499	108.05	11	1.499	108.23
12	85	106.30	12	1.631	107.58	12	1.665	108.05	12	1.665	108.23
13	98	106.80	13	1.798	107.58	13	1.832	108.05	13	1.832	108.23
14	107	106.69	14	1.964	107.58	14	1.998	108.05	14	1.998	108.23
15	120	106.20	15	2.131	107.58	15	2.165	108.05	15	2.165	108.23
16	132	106.69	16	2.297	107.59	16	2.331	108.05	16	2.331	108.23
17	140	106.62	17	2.464	107.59	17	2.498	108.05	17	2.498	108.23
18	150	106.10	18	2.63	107.59	18	2.664	108.05	18	2.664	108.23
19	161	106.62	19	2.797	107.59	19	2.831	108.05	19	2.831	108.23
20	169	106.55	20	2.963	107.59	20	2.997	108.05	20	2.997	108.23
21	180	106.00	21	3.13	107.59	21	3.166	108.05	21	3.166	108.23
22	195	106.55	22	3.296	107.59	22	3.331	108.05	22	3.331	108.23
23	203	106.47	23	3.465	107.59	23	3.497	108.05	23	3.497	108.23
24	203	106.47	24	3.63	107.59	24	3.663	108.05	24	3.663	108.23
25	203	106.47	25	3.796	107.59	25	3.83	108.05	25	3.83	108.23
26	203	106.47	26	3.962	107.58	26	3.996	108.05	26	3.996	108.23
27	203	106.47	27	4.129	107.58	27	4.163	108.05	27	4.163	108.23
28	203	106.47	28	4.296	107.58	28	4.329	108.05	28	4.329	108.23
29	203	106.47	29	4.462	107.58	29	4.496	108.05	29	4.496	108.23
30	203	106.47	30	4.629	107.58	30	4.662	108.05	30	4.662	108.23
31	203	106.47	31	4.795	107.57	31	4.829	108.05	31	4.829	108.23
32	203	106.47	32	4.962	107.57	32	4.995	108.05	32	4.995	108.23
33	203	106.47	33	5.128	107.57	33	5.162	108.05	33	5.162	108.22
34	203	106.47	34	5.295	107.57	34	5.328	108.05	34	5.328	108.22
35	203	106.47	35	5.461	107.57	35	5.495	108.05	35	5.495	108.22
36	203	106.47	36	5.628	107.56	36	5.661	108.05	36	5.661	108.22

37	203	106.47	37	5.794	107.56	37	5.828	108.05	37	5.828	108.22
38	203	106.47	38	5.961	107.56	38	5.994	108.05	38	5.994	108.22
39	203	106.47	39	6.127	107.56	39	6.161	108.05	39	6.161	108.22
40	203	106.47	40	6.294	107.56	40	6.327	108.05	40	6.327	108.22
41	203	106.47	41	6.46	107.55	41	6.494	108.05	41	6.494	108.22
42	203	106.47	42	6.627	107.55	42	6.659	108.05	42	6.659	108.22
43	203	106.47	43	6.793	107.55	43	6.824	108.05	43	6.824	108.22
44	203	106.47	44	6.958	107.55	44	6.988	108.05	44	6.988	108.22
45	203	106.47	45	7.123	107.55	45	7.14	108.05	45	7.14	108.22
46	203	106.47	46	7.288	107.54	46	7.291	108.05	46	7.291	108.22
47	203	106.47	47	7.439	107.54	47	7.442	108.05	47	7.442	108.22
48	203	106.47	48	7.59	107.54	48	7.463	108.05	48	7.463	108.22
49	203	106.47	49	7.742	107.54	49	7.601	108.05	49	7.601	108.22
50	203	106.47	50	7.762	107.54	50	7.738	108.05	50	7.738	108.22
51	203	106.47	51	7.9	107.54	51	7.863	108.05	51	7.863	108.22
52	203	106.47	52	8.037	107.54	52	7.988	108.05	52	7.988	108.22
53	203	106.47	53	8.162	107.54	53	8.113	108.05	53	8.113	108.22
54	203	106.47	54	8.287	107.53	54	8.237	108.05	54	8.237	108.22
55	203	106.47	55	8.412	107.53	55	8.362	108.05	55	8.362	108.22
56	203	106.47	56	8.537	107.53	56	8.487	108.05	56	8.487	108.22
57	203	106.47	57	8.661	107.53	57	8.612	108.05	57	8.612	108.22
58	203	106.47	58	8.786	107.53	58	8.737	108.05	58	8.737	108.22
59	203	106.47	59	8.911	107.53	59	8.861	108.05	59	8.861	108.22
60	203	106.47	60	9.036	107.53	60	8.986	108.05	60	8.986	108.22
61	203	106.47	61	9.161	107.53	61	9.111	108.05	61	9.111	108.22
62	203	106.47	62	9.285	107.52	62	9.236	108.05	62	9.236	108.22
63	203	106.47	63	9.41	107.52	63	9.361	108.05	63	9.361	108.22
64	203	106.47	64	9.535	107.52	64	9.485	108.05	64	9.485	108.22
65	203	106.47	65	9.66	107.52	65	9.61	108.05	65	9.61	108.22
66	204.229	106.37	66	9.785	107.52	66	9.735	108.05	66	9.735	108.22
67	204.438	106.35	67	9.91	107.52	67	9.86	108.05	67	9.86	108.22
68	204.857	106.32	68	10.034	107.52	68	9.985	108.05	68	9.985	108.22
69	205.067	106.30	69	10.159	107.52	69	10.109	108.05	69	10.109	108.22
70	205.067	106.30	70	10.284	107.52	70	10.234	108.05	70	10.234	108.22
71	205.067	106.30	71	10.409	107.52	71	10.359	108.05	71	10.359	108.22
72	205.067	106.30	72	10.534	107.52	72	10.484	108.05	72	10.484	108.22
73	205.067	106.30	73	10.658	107.51	73	10.609	108.05	73	10.609	108.22
74	205.067	106.30	74	10.783	107.51	74	10.734	108.05	74	10.734	108.22
75	205.067	106.30	75	10.908	107.51	75	10.858	108.05	75	10.858	108.22
76	205.067	106.30	76	11.033	107.51	76	10.983	108.05	76	10.983	108.22
77	205.067	106.30	77	11.158	107.51	77	11	108.05	77	11	108.22
78	205.067	106.30	78	11.282	107.51	78	11.116	108.05	78	11.116	108.22
79	205.067	106.30	79	11.299	107.51	79	11.233	108.05	79	11.233	108.22
80	205.067	106.30	80	11.416	107.51	80	11.358	108.05	80	11.358	108.22
81	205.067	106.30	81	11.532	107.51	81	11.482	108.05	81	11.482	108.22

82	205.067	106.30	82	11.657	107.51	82	11.607	108.05	82	11.607	108.22
83	205.067	106.30	83	11.782	107.51	83	11.732	108.05	83	11.732	108.22
84	205.067	106.30	84	11.906	107.51	84	11.857	108.05	84	11.857	108.22
85	205.067	106.30	85	12.031	107.51	85	11.982	108.05	85	11.982	108.22
86	205.067	106.30	86	12.156	107.51	86	12.106	108.05	86	12.106	108.22
87	205.067	106.30	87	12.281	107.51	87	12.231	108.05	87	12.231	108.22
88	205.067	106.30	88	12.406	107.51	88	12.356	108.05	88	12.356	108.22
89	205.067	106.30	89	12.531	107.51	89	12.481	108.05	89	12.481	108.22
90	205.067	106.30	90	12.655	107.51	90	12.606	108.05	90	12.606	108.22
91	205.067	106.30	91	12.78	107.51	91	12.731	108.05	91	12.731	108.22
92	205.067	106.30	92	12.905	107.51	92	12.855	108.05	92	12.855	108.22
93	205.067	106.30	93	13.03	107.51	93	12.98	108.05	93	12.98	108.22
94	205.067	106.30	94	13.155	107.51	94	13.105	108.05	94	13.105	108.22
95	205.276	106.29	95	13.279	107.51	95	13.23	108.05	95	13.23	108.22
96	205.276	106.29	96	13.404	107.51	96	13.367	108.05	96	13.367	108.22
97	205.276	106.29	97	13.529	107.51	97	13.505	108.05	97	13.505	108.22
98	205.276	106.29	98	13.667	107.51	98	13.528	108.05	98	13.528	108.22
99	205.276	106.29	99	13.804	107.52	99	13.688	108.05	99	13.688	108.22
100	205.276	106.29	100	13.827	107.52	100	13.711	108.05	100	13.711	108.22
101	205.276	106.29	101	13.988	107.52	101	13.804	108.05	101	13.804	108.22
102	205.276	106.29	102	14.01	107.52	102	13.898	108.05	102	13.898	108.22
103	205.276	106.29	103	14.104	107.52	103	13.973	108.05	103	13.973	108.22
104	205.276	106.29	104	14.197	107.52	104	14.107	108.05	104	14.107	108.22
105	205.276	106.29	105	14.272	107.52	105	14.24	108.05	105	14.24	108.22
106	205.276	106.29	106	14.407	107.52	106	14.317	108.05	106	14.317	108.22
107	205.276	106.29	107	14.54	107.52	107	14.471	108.05	107	14.471	108.22
108	205.276	106.29	108	14.616	107.52	108	14.526	108.05	108	14.526	108.22
109	205.276	106.29	109	14.77	107.52	109	14.631	108.05	109	14.631	108.22
110	205.276	106.29	110	14.826	107.52	110	14.736	108.05	110	14.736	108.22
111	205.276	106.29	111	14.93	107.52	111	14.841	108.05	111	14.841	108.22
112	205.276	106.29	112	15.035	107.52	112	14.945	108.05	112	14.945	108.22
113	205.276	106.29	113	15.14	107.52	113	14.971	108.05	113	14.971	108.22
114	205.276	106.29	114	15.244	107.52	114	15.063	108.05	114	15.063	108.22
115	205.276	106.29	115	15.27	107.52	115	15.155	108.05	115	15.155	108.22
116	205.276	106.29	116	15.362	107.52	116	15.233	108.05	116	15.233	108.22
117	205.276	106.29	117	15.454	107.52	117	15.364	108.05	117	15.364	108.22
118	205.276	106.29	118	15.532	107.52	118	15.47	108.05	118	15.47	108.22
119	205.276	106.29	119	15.663	107.52	119	15.573	108.05	119	15.573	108.22
120	205.276	106.29	120	15.769	107.52	120	15.732	108.05	120	15.732	108.22
121	205.276	106.29	121	15.873	107.52	121	15.783	108.05	121	15.783	108.22
122	205.276	106.29	122	16.031	107.52	122	15.876	108.05	122	15.876	108.22
123	205.276	106.29	123	16.082	107.52	123	15.97	108.05	123	15.97	108.22
124	205.276	106.29	124	16.175	107.52	124	15.992	108.05	124	15.992	108.22
125	205.276	106.29	125	16.269	107.52	125	16.097	108.05	125	16.097	108.22
126	205.276	106.29	126	16.292	107.52	126	16.202	108.05	126	16.202	108.22

127	205.485	106.27	127	16.396	107.52	127	16.231	108.05	127	16.231	108.22
128	205.485	106.27	128	16.501	107.52	128	16.321	108.05	128	16.321	108.22
129	205.485	106.27	129	16.53	107.52	129	16.411	108.05	129	16.411	108.22
130	205.485	106.27	130	16.62	107.52	130	16.469	108.05	130	16.469	108.22
131	205.485	106.27	131	16.71	107.52	131	16.621	108.05	131	16.621	108.22
132	205.485	106.27	132	16.768	107.52	132	16.729	108.05	132	16.729	108.22
133	205.485	106.27	133	16.92	107.52	133	16.83	108.05	133	16.83	108.22
134	205.485	106.27	134	17.029	107.52	134	16.968	108.05	134	16.968	108.22
135	205.485	106.27	135	17.129	107.52	135	17.039	108.05	135	17.039	108.22
136	205.485	106.27	136	17.268	107.52	136	17.134	108.05	136	17.134	108.22
137	205.485	106.27	137	17.339	107.52	137	17.229	108.05	137	17.229	108.22
138	205.485	106.27	138	17.433	107.52	138	17.249	108.05	138	17.249	108.22
139	205.485	106.27	139	17.528	107.52	139	17.354	108.05	139	17.354	108.22
140	205.485	106.27	140	17.548	107.52	140	17.458	108.05	140	17.458	108.22
141	205.485	106.27	141	17.653	107.52	141	17.568	108.05	141	17.568	108.22
142	205.485	106.27	142	17.758	107.52	142	17.668	108.05	142	17.668	108.22
143	205.485	106.27	143	17.867	107.52	143	17.728	108.05	143	17.728	108.22
144	205.485	106.27	144	17.967	107.52	144	17.877	108.05	144	17.877	108.22
145	205.485	106.27	145	18.027	107.52	145	17.967	108.05	145	17.967	108.22
146	205.485	106.27	146	18.177	107.52	146	18.087	108.05	146	18.087	108.22
147	205.485	106.27	147	18.267	107.52	147	18.227	108.05	147	18.227	108.22
148	205.485	106.27	148	18.386	107.52	148	18.296	108.05	148	18.296	108.22
149	205.485	106.27	149	18.527	107.52	149	18.381	108.05	149	18.381	108.22
150	205.485	106.27	150	18.595	107.52	150	18.466	108.05	150	18.466	108.22
151	205.485	106.27	151	18.681	107.52	151	18.506	108.05	151	18.506	108.22
152	205.485	106.27	152	18.766	107.52	152	18.61	108.05	152	18.61	108.22
153	205.485	106.27	153	18.805	107.52	153	18.715	108.05	153	18.715	108.21
154	205.485	106.27	154	18.91	107.52	154	18.727	108.05	154	18.727	108.21
155	205.485	106.27	155	19.014	107.52	155	18.826	108.05	155	18.826	108.21
156	205.485	106.27	156	19.026	107.52	156	18.924	108.05	156	18.924	108.21
157	205.485	106.27	157	19.125	107.52	157	18.966	108.05	157	18.966	108.21
158	205.485	106.27	158	19.224	107.52	158	19.05	108.05	158	19.05	108.21
159	205.485	106.27	159	19.265	107.52	159	19.134	108.05	159	19.134	108.21
160	205.485	106.27	160	19.349	107.52	160	19.226	108.05	160	19.226	108.21
161	205.485	106.27	161	19.433	107.52	161	19.343	108.05	161	19.343	108.21
162	205.485	106.27	162	19.526	107.52	162	19.465	108.05	162	19.465	108.21
163	205.485	106.27	163	19.643	107.52	163	19.553	108.05	163	19.553	108.21
164	205.485	106.27	164	19.764	107.52	164	19.639	108.05	164	19.639	108.21
165	205.695	106.25	165	19.852	107.52	165	19.726	108.05	165	19.726	108.21
166	205.904	106.23	166	19.939	107.52	166	19.762	108.05	166	19.762	108.21
167	205.904	106.23	167	20.025	107.52	167	19.862	108.05	167	19.862	108.21
168	205.904	106.23	168	20.061	107.52	168	19.963	108.05	168	19.963	108.21
169	205.904	106.23	169	20.162	107.52	169	20	108.05	169	20	108.21
170	205.904	106.23	170	20.262	107.52	170	20.091	108.05	170	20.091	108.21
171	205.904	106.23	171	20.299	107.52	171	20.181	108.05	171	20.181	108.21

172	205.904	106.23	172	20.39	107.52	172	20.225	108.05	172	20.225	108.21
173	205.904	106.23	173	20.48	107.52	173	20.39	108.05	173	20.39	108.21
174	205.904	106.23	174	20.525	107.52	174	20.462	108.05	174	20.462	108.21
175	205.904	106.23	175	20.69	107.52	175	20.6	108.05	175	20.6	108.21
176	205.904	106.23	176	20.761	107.52	176	20.725	108.05	176	20.725	108.21
177	205.904	106.23	177	20.899	107.52	177	20.809	108.05	177	20.809	108.21
178	205.904	106.23	178	21.024	107.52	178	20.914	108.05	178	20.914	108.21
179	205.904	106.23	179	21.109	107.52	179	21.019	108.05	179	21.019	108.21
180	205.904	106.23	180	21.213	107.52	180	21.108	108.05	180	21.108	108.21
181	205.904	106.23	181	21.318	107.52	181	21.197	108.05	181	21.197	108.21
182	205.904	106.23	182	21.407	107.52	182	21.228	108.05	182	21.228	108.21
183	205.904	106.23	183	21.496	107.52	183	21.333	108.05	183	21.333	108.21
184	205.904	106.23	184	21.528	107.52	184	21.438	108.05	184	21.438	108.21
185	205.904	106.23	185	21.632	107.52	185	21.542	108.05	185	21.542	108.21
186	205.904	106.23	186	21.737	107.52	186	21.647	108.05	186	21.647	108.21
187	205.904	106.23	187	21.842	107.52	187	21.711	108.05	187	21.711	108.21
188	205.904	106.23	188	21.946	107.52	188	21.857	108.05	188	21.857	108.21
189	205.904	106.23	189	22.011	107.52	189	21.961	108.05	189	21.961	108.21
190	205.904	106.23	190	22.156	107.52	190	22.066	108.05	190	22.066	108.21
191	205.904	106.23	191	22.261	107.52	191	22.226	108.05	191	22.226	108.21
192	205.904	106.23	192	22.365	107.52	192	22.275	108.05	192	22.275	108.21
193	205.904	106.23	193	22.525	107.52	193	22.38	108.05	193	22.38	108.21
194	205.904	106.23	194	22.575	107.52	194	22.485	108.05	194	22.485	108.21
195	205.904	106.23	195	22.679	107.52	195	22.59	108.05	195	22.59	108.21
196	205.904	106.23	196	22.784	107.52	196	22.694	108.05	196	22.694	108.21
197	205.904	106.23	197	22.889	107.52	197	22.722	108.05	197	22.722	108.21
198	205.904	106.23	198	22.994	107.52	198	22.846	108.05	198	22.846	108.21
199	205.904	106.23	199	23.022	107.52	199	22.904	108.05	199	22.904	108.21
200	205.904	106.23	200	23.145	107.52	200	23.008	108.05	200	23.008	108.21
201	205.904	106.23	201	23.203	107.52	201	23.113	108.05	201	23.113	108.21
202	205.904	106.23	202	23.308	107.52	202	23.228	108.05	202	23.228	108.21
203	205.904	106.23	203	23.412	107.52	203	23.323	108.05	203	23.323	108.21
204	205.904	106.23	204	23.527	107.52	204	23.409	108.05	204	23.409	108.21
205	205.904	106.23	205	23.622	107.52	205	23.495	108.05	205	23.495	108.21
206	205.904	106.23	206	23.708	107.52	206	23.532	108.05	206	23.532	108.21
207	205.904	106.23	207	23.794	107.51	207	23.63	108.05	207	23.63	108.21
208	206.114	106.22	208	23.831	107.51	208	23.727	108.05	208	23.727	108.21
209	206.114	106.22	209	23.929	107.51	209	23.741	108.05	209	23.741	108.21
210	206.114	106.22	210	24.027	107.51	210	23.846	108.05	210	23.846	108.21
211	206.114	106.22	211	24.041	107.51	211	23.951	108.05	211	23.951	108.21
212	206.114	106.22	212	24.145	107.51	212	23.991	108.05	212	23.991	108.21
213	206.114	106.22	213	24.25	107.51	213	24.076	108.05	213	24.076	108.21
214	206.114	106.22	214	24.29	107.51	214	24.16	108.05	214	24.16	108.21
215	206.114	106.22	215	24.375	107.51	215	24.227	108.05	215	24.227	108.21
216	206.114	106.22	216	24.46	107.51	216	24.37	108.05	216	24.37	108.21

217	206.114	106.22	217	24.527	107.51	217	24.489	108.05	217	24.489	108.21
218	206.114	106.22	218	24.669	107.51	218	24.579	108.05	218	24.579	108.21
219	206.114	106.22	219	24.788	107.51	219	24.727	108.05	219	24.727	108.21
220	206.114	106.22	220	24.879	107.51	220	24.789	108.05	220	24.789	108.21
221	206.114	106.22	221	25.027	107.51	221	24.889	108.05	221	24.889	108.21
222	206.114	106.22	222	25.088	107.51	222	24.989	108.05	222	24.989	108.21
223	206.114	106.22	223	25.188	107.51	223	25.103	108.05	223	25.103	108.21
224	206.114	106.22	224	25.288	107.51	224	25.208	108.05	224	25.208	108.21
225	206.114	106.22	225	25.402	107.51	225	25.227	108.05	225	25.227	108.21
226	206.114	106.22	226	25.507	107.51	226	25.322	108.05	226	25.322	108.21
227	206.114	106.22	227	25.527	107.51	227	25.417	108.05	227	25.417	108.21
228	206.114	106.22	228	25.621	107.51	228	25.488	108.05	228	25.488	108.21
229	206.114	106.22	229	25.716	107.51	229	25.626	108.05	229	25.626	108.21
230	206.114	106.22	230	25.787	107.51	230	25.727	108.05	230	25.727	108.21
231	206.114	106.22	231	25.926	107.51	231	25.836	108.05	231	25.836	108.21
232	206.114	106.22	232	26.026	107.51	232	25.987	108.05	232	25.987	108.21
233	206.114	106.22	233	26.135	107.51	233	26.045	108.05	233	26.045	108.21
234	206.114	106.22	234	26.287	107.51	234	26.136	108.05	234	26.136	108.21
235	206.114	106.22	235	26.345	107.51	235	26.227	108.05	235	26.227	108.21
236	206.114	106.22	236	26.435	107.51	236	26.255	108.05	236	26.255	108.21
237	206.114	106.22	237	26.526	107.51	237	26.359	108.05	237	26.359	108.21
238	206.114	106.22	238	26.554	107.51	238	26.464	108.05	238	26.464	108.21
239	206.114	106.22	239	26.659	107.51	239	26.487	108.05	239	26.487	108.21
240	206.114	106.22	240	26.763	107.51	240	26.58	108.05	240	26.58	108.21
241	206.114	106.22	241	26.787	107.51	241	26.674	108.05	241	26.674	108.21
242	206.114	106.22	242	26.88	107.51	242	26.727	108.05	242	26.727	108.21
243	206.114	106.22	243	26.973	107.51	243	26.883	108.05	243	26.883	108.21
244	206.114	106.22	244	27.026	107.51	244	26.987	108.05	244	26.987	108.21
245	206.114	106.22	245	27.182	107.51	245	27.092	108.05	245	27.092	108.21
246	206.114	106.22	246	27.286	107.51	246	27.227	108.05	246	27.227	108.21
247	206.114	106.22	247	27.392	107.51	247	27.302	108.05	247	27.302	108.21
248	206.114	106.22	248	27.526	107.51	248	27.394	108.05	248	27.394	108.21
249	206.114	106.22	249	27.601	107.51	249	27.487	108.05	249	27.487	108.21
250	206.323	106.20	250	27.694	107.51	250	27.511	108.05	250	27.511	108.21
251	206.323	106.20	251	27.786	107.51	251	27.616	108.05	251	27.616	108.21
252	206.323	106.20	252	27.811	107.51	252	27.721	108.05	252	27.721	108.21
253	206.323	106.20	253	27.915	107.51	253	27.828	108.05	253	27.828	108.21
254	206.323	106.20	254	28.02	107.51	254	27.93	108.05	254	27.93	108.21
255	206.323	106.20	255	28.127	107.51	255	27.987	108.05	255	27.987	108.21
256	206.323	106.20	256	28.229	107.51	256	28.14	108.05	256	28.14	108.21
257	206.323	106.20	257	28.286	107.51	257	28.226	108.05	257	28.226	108.21
258	206.323	106.20	258	28.439	107.51	258	28.349	108.05	258	28.349	108.21
259	206.323	106.20	259	28.525	107.51	259	28.487	108.05	259	28.487	108.21
260	206.323	106.20	260	28.648	107.51	260	28.559	108.05	260	28.559	108.21
261	206.323	106.20	261	28.786	107.51	261	28.725	108.05	261	28.725	108.21

262	206.323	106.20	262	28.858	107.51	262	28.768	108.05	262	28.768	108.21
263	206.323	106.20	263	29.024	107.51	263	28.873	108.05	263	28.873	108.21
264	206.323	106.20	264	29.067	107.51	264	28.977	108.05	264	28.977	108.21
265	206.323	106.20	265	29.172	107.51	265	29.087	108.05	265	29.087	108.21
266	206.323	106.20	266	29.277	107.51	266	29.187	108.05	266	29.187	108.21
267	206.323	106.20	267	29.386	107.51	267	29.224	108.05	267	29.224	108.21
268	206.323	106.20	268	29.486	107.51	268	29.31	108.05	268	29.31	108.21
269	206.323	106.20	269	29.523	107.50	269	29.396	108.05	269	29.396	108.21
270	206.323	106.20	270	29.61	107.50	270	29.472	108.05	270	29.472	108.21
271	206.323	106.20	271	29.696	107.50	271	29.569	108.05	271	29.569	108.21
272	206.323	106.20	272	29.772	107.50	272	29.653	108.05	272	29.653	108.21
273	206.323	106.20	273	29.868	107.50	273	29.737	108.05	273	29.737	108.21
274	206.323	106.20	274	29.952	107.50	274	29.858	108.05	274	29.858	108.21
275	206.323	106.20	275	30.037	107.50	275	29.979	108.05	275	29.979	108.21
276	206.533	106.18	276	30.157	107.50	276	30.104	108.05	276	30.104	108.21
277	206.533	106.18	277	30.278	107.50	277	30.23	108.05	277	30.23	108.21
278	206.533	106.18	278	30.404	107.50	278	30.354	108.05	278	30.354	108.21
279	206.533	106.18	279	30.529	107.50	279	30.479	108.05	279	30.479	108.21
280	206.533	106.18	280	30.654	107.50	280	30.604	108.05	280	30.604	108.21
281	206.533	106.18	281	30.779	107.50	281	30.729	108.05	281	30.729	108.21
282	206.533	106.18	282	30.904	107.50	282	30.854	108.05	282	30.854	108.21
283	206.533	106.18	283	31.029	107.50	283	30.979	108.05	283	30.979	108.21
284	206.533	106.18	284	31.153	107.50	284	31.104	108.05	284	31.104	108.21
285	206.533	106.18	285	31.278	107.50	285	31.229	108.05	285	31.229	108.21
286	206.533	106.18	286	31.403	107.50	286	31.354	108.05	286	31.354	108.21
287	206.533	106.18	287	31.528	107.49	287	31.479	108.05	287	31.479	108.21
288	206.533	106.18	288	31.653	107.49	288	31.604	108.05	288	31.604	108.21
289	206.533	106.18	289	31.778	107.49	289	31.729	108.05	289	31.729	108.21
290	206.533	106.18	290	31.903	107.49	290	31.853	108.05	290	31.853	108.21
291	206.533	106.18	291	32.028	107.49	291	31.978	108.05	291	31.978	108.21
292	206.533	106.18	292	32.153	107.49	292	32	108.05	292	32	108.21
293	206.533	106.18	293	32.278	107.49	293	32.114	108.05	293	32.114	108.21
294	206.533	106.18	294	32.299	107.49	294	32.228	108.05	294	32.228	108.21
295	206.533	106.18	295	32.413	107.48	295	32.353	108.05	295	32.353	108.21
296	206.533	106.18	296	32.527	107.48	296	32.478	108.05	296	32.478	108.21
297	206.533	106.18	297	32.652	107.48	297	32.603	108.05	297	32.603	108.21
298	206.533	106.18	298	32.777	107.48	298	32.728	108.05	298	32.728	108.21
299	206.533	106.18	299	32.902	107.48	299	32.853	108.05	299	32.853	108.21
300	206.533	106.18	300	33.027	107.47	300	32.978	108.05	300	32.978	108.21
301	206.533	106.18	301	33.152	107.47	301	33.103	108.05	301	33.103	108.21
302	206.533	106.18	302	33.277	107.47	302	33.228	108.05	302	33.228	108.21
303	206.533	106.18	303	33.402	107.47	303	33.352	108.05	303	33.352	108.21
304	206.533	106.18	304	33.527	107.47	304	33.477	108.05	304	33.477	108.21
305	206.533	106.18	305	33.652	107.47	305	33.602	108.05	305	33.602	108.21
306	206.533	106.18	306	33.777	107.47	306	33.727	108.05	306	33.727	108.21

307	206.533	106.18	307	33.902	107.47	307	33.852	108.05	307	33.852	108.21
308	206.742	106.17	308	34.026	107.47	308	33.977	108.05	308	33.977	108.21
309	206.742	106.17	309	34.151	107.47	309	34.102	108.05	309	34.102	108.21
310	206.742	106.17	310	34.276	107.47	310	34.227	108.05	310	34.227	108.21
311	206.742	106.17	311	34.401	107.47	311	34.352	108.05	311	34.352	108.21
312	206.742	106.17	312	34.526	107.47	312	34.477	108.05	312	34.477	108.21
313	206.742	106.17	313	34.651	107.47	313	34.602	108.05	313	34.602	108.21
314	206.742	106.17	314	34.776	107.47	314	34.727	108.05	314	34.727	108.21
315	206.742	106.17	315	34.901	107.47	315	34.851	108.05	315	34.851	108.21
316	206.742	106.17	316	35.026	107.46	316	34.976	108.05	316	34.976	108.21
317	206.742	106.17	317	35.151	107.46	317	35.101	108.05	317	35.101	108.21
318	206.742	106.17	318	35.276	107.46	318	35.226	108.05	318	35.226	108.21
319	206.742	106.17	319	35.401	107.46	319	35.351	108.05	319	35.351	108.21
320	206.742	106.17	320	35.525	107.46	320	35.476	108.05	320	35.476	108.21
321	206.742	106.17	321	35.65	107.46	321	35.601	108.05	321	35.601	108.21
322	206.742	106.17	322	35.775	107.46	322	35.726	108.05	322	35.726	108.21
323	206.742	106.17	323	35.9	107.46	323	35.851	108.05	323	35.851	108.21
324	206.742	106.17	324	36.025	107.46	324	35.976	108.05	324	35.976	108.21
325	206.742	106.17	325	36.15	107.46	325	36.101	108.05	325	36.101	108.21
326	206.742	106.17	326	36.275	107.46	326	36.226	108.05	326	36.226	108.21
327	206.742	106.17	327	36.4	107.46	327	36.35	108.05	327	36.35	108.21
328	206.742	106.17	328	36.525	107.46	328	36.475	108.05	328	36.475	108.21
329	206.742	106.17	329	36.65	107.46	329	36.6	108.05	329	36.6	108.21
330	206.742	106.17	330	36.775	107.46	330	36.725	108.05	330	36.725	108.21
331	206.742	106.17	331	36.9	107.45	331	36.85	108.05	331	36.85	108.21
332	206.742	106.17	332	37.024	107.45	332	36.975	108.05	332	36.975	108.21
333	206.742	106.17	333	37.149	107.45	333	37.1	108.05	333	37.1	108.21
334	206.742	106.17	334	37.274	107.45	334	37.225	108.05	334	37.225	108.21
335	206.742	106.17	335	37.399	107.45	335	37.35	108.05	335	37.35	108.21
336	206.742	106.17	336	37.524	107.45	336	37.475	108.05	336	37.475	108.21
337	206.742	106.17	337	37.649	107.45	337	37.6	108.05	337	37.6	108.21
338	206.742	106.17	338	37.774	107.45	338	37.725	108.05	338	37.725	108.21
339	206.742	106.17	339	37.899	107.45	339	37.849	108.05	339	37.849	108.21
340	206.742	106.17	340	38.024	107.45	340	37.974	108.05	340	37.974	108.21
341	206.742	106.17	341	38.149	107.45	341	38.099	108.05	341	38.099	108.21
342	206.742	106.17	342	38.274	107.45	342	38.224	108.05	342	38.224	108.21
343	206.742	106.17	343	38.399	107.45	343	38.349	108.05	343	38.349	108.21
344	206.742	106.17	344	38.523	107.44	344	38.474	108.05	344	38.474	108.21
345	206.742	106.17	345	38.648	107.44	345	38.599	108.05	345	38.599	108.21
346	206.951	106.15	346	38.773	107.44	346	38.724	108.05	346	38.724	108.21
347	207.37	106.11	347	38.898	107.44	347	38.851	108.05	347	38.851	108.21
348	207.58	106.10	348	39.023	107.44	348	38.978	108.05	348	38.978	108.21
349	207.58	106.10	349	39.15	107.44	349	39	108.05	349	39	108.21
350	207.58	106.10	350	39.277	107.44	350	39.104	108.05	350	39.104	108.21
351	207.58	106.10	351	39.299	107.44	351	39.207	108.05	351	39.207	108.21



352	207.58	106.10	352	39.403	107.44	352	39.34	108.05	352	39.34	108.21
353	207.58	106.10	353	39.506	107.44	353	39.485	108.05	353	39.485	108.21
354	207.58	106.10	354	39.639	107.44	354	39.518	108.05	354	39.518	108.21
355	207.58	106.10	355	39.784	107.44	355	39.623	108.05	355	39.623	108.21
356	207.58	106.10	356	39.817	107.44	356	39.727	108.05	356	39.727	108.21
357	207.58	106.10	357	39.922	107.44	357	39.834	108.05	357	39.834	108.21
358	207.58	106.10	358	40.027	107.44	358	39.937	108.05	358	39.937	108.21
359	207.58	106.10	359	40.133	107.44	359	39.967	108.05	359	39.967	108.21
360	207.58	106.10	360	40.236	107.44	360	40.056	108.05	360	40.056	108.21
361	207.58	106.10	361	40.266	107.44	361	40.146	108.05	361	40.146	108.21
362	207.58	106.10	362	40.356	107.44	362	40.228	108.05	362	40.228	108.21
363	207.58	106.10	363	40.445	107.44	363	40.356	108.05	363	40.356	108.21
364	207.58	106.10	364	40.528	107.44	364	40.467	108.05	364	40.467	108.21
365	207.58	106.10	365	40.655	107.44	365	40.565	108.05	365	40.565	108.21
366	207.58	106.10	366	40.766	107.44	366	40.728	108.05	366	40.728	108.21
367	207.58	106.10	367	40.864	107.44	367	40.774	108.05	367	40.774	108.21
368	207.58	106.10	368	41.027	107.44	368	40.87	108.05	368	40.87	108.21
369	207.58	106.10	369	41.074	107.44	369	40.966	108.05	369	40.966	108.21
370	207.58	106.10	370	41.17	107.44	370	40.984	108.05	370	40.984	108.21
371	207.58	106.10	371	41.266	107.44	371	41.089	108.05	371	41.089	108.21
372	207.58	106.10	372	41.283	107.44	372	41.193	108.05	372	41.193	108.21
373	207.58	106.10	373	41.388	107.44	373	41.227	108.05	373	41.227	108.21
374	207.58	106.10	374	41.493	107.44	374	41.315	108.05	374	41.315	108.21
375	207.58	106.10	375	41.527	107.44	375	41.403	108.05	375	41.403	108.21
376	207.58	106.10	376	41.614	107.44	376	41.466	108.05	376	41.466	108.21
377	207.58	106.10	377	41.702	107.44	377	41.612	108.05	377	41.612	108.21
378	207.58	106.10	378	41.766	107.44	378	41.727	108.05	378	41.727	108.21
379	207.58	106.10	379	41.911	107.44	379	41.822	108.05	379	41.822	108.21
380	207.58	106.10	380	42.026	107.44	380	41.966	108.05	380	41.966	108.21
381	207.58	106.10	381	42.121	107.44	381	42.031	108.05	381	42.031	108.21
382	207.58	106.10	382	42.265	107.44	382	42.129	108.05	382	42.129	108.21
383	207.58	106.10	383	42.33	107.44	383	42.227	108.05	383	42.227	108.21
384	207.58	106.10	384	42.428	107.44	384	42.241	108.05	384	42.241	108.21
385	207.58	106.10	385	42.526	107.44	385	42.345	108.05	385	42.345	108.21
386	207.789	106.08	386	42.54	107.44	386	42.45	108.05	386	42.45	108.21
387	207.999	106.06	387	42.645	107.44	387	42.466	108.05	387	42.466	108.21
388	207.999	106.06	388	42.749	107.44	388	42.563	108.05	388	42.563	108.21
389	207.999	106.06	389	42.765	107.44	389	42.659	108.05	389	42.659	108.21
390	207.999	106.06	390	42.862	107.44	390	42.726	108.05	390	42.726	108.21
391	207.999	106.06	391	42.959	107.44	391	42.869	108.05	391	42.869	108.21
392	207.999	106.06	392	43.026	107.44	392	42.966	108.05	392	42.966	108.21
393	207.999	106.06	393	43.168	107.44	393	43.078	108.05	393	43.078	108.21
394	207.999	106.06	394	43.265	107.44	394	43.226	108.05	394	43.226	108.21
395	207.999	106.06	395	43.378	107.44	395	43.288	108.05	395	43.288	108.21
396	207.999	106.06	396	43.525	107.44	396	43.376	108.05	396	43.376	108.21

397	207.999	106.06	397	43.587	107.44	397	43.465	108.05	397	43.465	108.21
398	207.999	106.06	398	43.676	107.44	398	43.497	108.05	398	43.497	108.21
399	207.999	106.06	399	43.765	107.44	399	43.602	108.05	399	43.602	108.21
400	207.999	106.06	400	43.796	107.44	400	43.707	108.05	400	43.707	108.21
401	207.999	106.06	401	43.901	107.44	401	43.726	108.05	401	43.726	108.21
402	207.999	106.06	402	44.006	107.44	402	43.821	108.05	402	43.821	108.21
403	207.999	106.06	403	44.025	107.44	403	43.916	108.05	403	43.916	108.21
404	207.999	106.06	404	44.12	107.44	404	43.965	108.05	404	43.965	108.21
405	207.999	106.06	405	44.215	107.44	405	44.125	108.05	405	44.125	108.21
406	207.999	106.06	406	44.264	107.44	406	44.226	108.05	406	44.226	108.21
407	207.999	106.06	407	44.425	107.44	407	44.335	108.05	407	44.335	108.21
408	207.999	106.06	408	44.525	107.44	408	44.465	108.05	408	44.465	108.21
409	207.999	106.06	409	44.634	107.44	409	44.544	108.05	409	44.544	108.21
410	207.999	106.06	410	44.764	107.44	410	44.635	108.05	410	44.635	108.21
411	207.999	106.06	411	44.844	107.43	411	44.726	108.05	411	44.726	108.21
412	207.999	106.06	412	44.934	107.43	412	44.754	108.05	412	44.754	108.21
413	207.999	106.06	413	45.025	107.43	413	44.858	108.05	413	44.858	108.21
414	207.999	106.06	414	45.053	107.43	414	44.963	108.05	414	44.963	108.21
415	207.999	106.06	415	45.157	107.43	415	45.068	108.05	415	45.068	108.21
416	207.999	106.06	416	45.262	107.43	416	45.173	108.05	416	45.173	108.21
417	208.208	106.05	417	45.367	107.43	417	45.226	108.05	417	45.226	108.21
418	208.208	106.05	418	45.472	107.43	418	45.382	108.05	418	45.382	108.21
419	208.208	106.05	419	45.525	107.43	419	45.462	108.05	419	45.462	108.21
420	208.208	106.05	420	45.681	107.43	420	45.591	108.05	420	45.591	108.21
421	208.208	106.05	421	45.761	107.43	421	45.726	108.05	421	45.726	108.21
422	208.208	106.05	422	45.891	107.43	422	45.801	108.05	422	45.801	108.21
423	208.208	106.05	423	46.025	107.43	423	45.958	108.05	423	45.958	108.21
424	208.208	106.05	424	46.1	107.43	424	46.01	108.05	424	46.01	108.21
425	208.208	106.05	425	46.257	107.43	425	46.115	108.05	425	46.115	108.21
426	208.208	106.05	426	46.31	107.43	426	46.22	108.05	426	46.22	108.21
427	208.208	106.05	427	46.414	107.43	427	46.328	108.05	427	46.328	108.21
428	208.208	106.05	428	46.519	107.43	428	46.429	108.05	428	46.429	108.21
429	208.208	106.05	429	46.627	107.43	429	46.538	108.05	429	46.538	108.21
430	208.208	106.05	430	46.729	107.43	430	46.639	108.05	430	46.639	108.21
431	208.208	106.05	431	46.837	107.43	431	46.72	108.05	431	46.72	108.21
432	208.208	106.05	432	46.938	107.43	432	46.848	108.05	432	46.848	108.21
433	208.208	106.05	433	47.019	107.43	433	46.953	108.05	433	46.953	108.21
434	208.208	106.05	434	47.147	107.43	434	47.058	108.05	434	47.058	108.21
435	208.208	106.05	435	47.252	107.43	435	47.211	108.05	435	47.211	108.21
436	208.208	106.05	436	47.357	107.43	436	47.267	108.05	436	47.267	108.21
437	208.208	106.05	437	47.51	107.43	437	47.372	108.05	437	47.372	108.21
438	208.208	106.05	438	47.566	107.43	438	47.476	108.05	438	47.476	108.21
439	208.208	106.05	439	47.671	107.43	439	47.584	108.05	439	47.584	108.21
440	208.208	106.05	440	47.776	107.43	440	47.686	108.05	440	47.686	108.21
441	208.208	106.05	441	47.883	107.43	441	47.711	108.05	441	47.711	108.21

442	208.208	106.05	442	47.985	107.43	442	47.803	108.05	442	47.803	108.21
443	208.208	106.05	443	48.01	107.43	443	47.895	108.05	443	47.895	108.21
444	208.208	106.05	444	48.102	107.43	444	47.975	108.05	444	47.975	108.21
445	208.208	106.05	445	48.195	107.43	445	48.105	108.05	445	48.105	108.21
446	208.208	106.05	446	48.275	107.43	446	48.211	108.05	446	48.211	108.21
447	208.208	106.05	447	48.404	107.43	447	48.314	108.05	447	48.314	108.21
448	208.208	106.05	448	48.51	107.43	448	48.474	108.05	448	48.474	108.21
449	208.418	106.03	449	48.613	107.43	449	48.524	108.05	449	48.524	108.21
450	208.418	106.03	450	48.773	107.43	450	48.617	108.05	450	48.617	108.21
451	208.418	106.03	451	48.823	107.43	451	48.711	108.05	451	48.711	108.21
452	208.418	106.03	452	48.916	107.43	452	48.733	108.05	452	48.733	108.21
453	208.418	106.03	453	49.01	107.43	453	48.838	108.05	453	48.838	108.21
454	208.418	106.03	454	49.032	107.43	454	48.942	108.05	454	48.942	108.21
455	208.418	106.03	455	49.137	107.43	455	48.973	108.05	455	48.973	108.21
456	208.418	106.03	456	49.242	107.43	456	49.062	108.05	456	49.062	108.21
457	208.418	106.03	457	49.272	107.43	457	49.152	108.05	457	49.152	108.21
458	208.418	106.03	458	49.362	107.43	458	49.211	108.05	458	49.211	108.21
459	208.418	106.03	459	49.451	107.43	459	49.361	108.05	459	49.361	108.21
460	208.418	106.03	460	49.51	107.43	460	49.471	108.05	460	49.471	108.21
461	208.418	106.03	461	49.661	107.43	461	49.571	108.05	461	49.571	108.21
462	208.418	106.03	462	49.771	107.43	462	49.71	108.05	462	49.71	108.21
463	208.418	106.03	463	49.87	107.43	463	49.78	108.05	463	49.78	108.21
464	208.418	106.03	464	50.01	107.43	464	49.876	108.05	464	49.876	108.21
465	208.418	106.03	465	50.079	107.43	465	49.971	108.05	465	49.971	108.21
466	208.418	106.03	466	50.175	107.43	466	49.99	108.05	466	49.99	108.21
467	208.418	106.03	467	50.271	107.43	467	50	108.05	467	50	108.21
468	208.418	106.03	468	50.289	107.43	468	50.1	108.05	468	50.1	108.21
469	208.418	106.03	469	50.299	107.43	469	50.199	108.05	469	50.199	108.21
470	208.418	106.03	470	50.399	107.43	470	50.21	108.05	470	50.21	108.21
471	208.418	106.03	471	50.498	107.43	471	50.309	108.05	471	50.309	108.21
472	208.418	106.03	472	50.51	107.43	472	50.409	108.05	472	50.409	108.21
473	208.418	106.03	473	50.609	107.43	473	50.471	108.05	473	50.471	108.21
474	208.418	106.03	474	50.708	107.43	474	50.618	108.05	474	50.618	108.21
475	208.418	106.03	475	50.77	107.43	475	50.71	108.05	475	50.71	108.21
476	208.418	106.03	476	50.917	107.43	476	50.827	108.05	476	50.827	108.21
477	208.418	106.03	477	51.009	107.43	477	50.97	108.05	477	50.97	108.21
478	208.418	106.03	478	51.127	107.43	478	51.037	108.05	478	51.037	108.21
479	208.418	106.03	479	51.27	107.43	479	51.123	108.05	479	51.123	108.21
480	208.418	106.03	480	51.336	107.43	480	51.21	108.05	480	51.21	108.21
481	208.418	106.03	481	51.423	107.43	481	51.246	108.05	481	51.246	108.21
482	208.418	106.03	482	51.509	107.43	482	51.351	108.05	482	51.351	108.21
483	208.418	106.03	483	51.546	107.43	483	51.456	108.05	483	51.456	108.21
484	208.418	106.03	484	51.65	107.43	484	51.47	108.05	484	51.47	108.21
485	208.418	106.03	485	51.755	107.43	485	51.568	108.05	485	51.568	108.21
486	208.418	106.03	486	51.77	107.43	486	51.665	108.05	486	51.665	108.21

487	208.627	106.01	487	51.867	107.43	487	51.71	108.05	487	51.71	108.21
488	208.627	106.01	488	51.964	107.43	488	51.875	108.05	488	51.875	108.21
489	208.627	106.01	489	52.009	107.43	489	51.97	108.05	489	51.97	108.21
490	208.627	106.01	490	52.174	107.43	490	52.084	108.05	490	52.084	108.21
491	208.627	106.01	491	52.27	107.43	491	52.21	108.05	491	52.21	108.21
492	208.627	106.01	492	52.383	107.43	492	52.293	108.05	492	52.293	108.21
493	208.627	106.01	493	52.509	107.43	493	52.382	108.05	493	52.382	108.21
494	208.627	106.01	494	52.593	107.43	494	52.47	108.05	494	52.47	108.21
495	208.627	106.01	495	52.681	107.43	495	52.503	108.05	495	52.503	108.21
496	208.627	106.01	496	52.769	107.43	496	52.606	108.05	496	52.606	108.21
497	208.627	106.01	497	52.802	107.43	497	52.708	108.05	497	52.708	108.21
498	208.627	106.01	498	52.905	107.43	498	52.817	108.05	498	52.817	108.21
499	208.627	106.01	499	53.008	107.43	499	52.922	108.05	499	52.922	108.21
500	208.627	106.01	500	53.116	107.43	500	52.97	108.05	500	52.97	108.21
501	208.627	106.01	501	53.221	107.43	501	53.131	108.05	501	53.131	108.21
502	208.627	106.01	502	53.269	107.43	502	53.208	108.05	502	53.208	108.21
503	208.627	106.01	503	53.43	107.43	503	53.341	108.05	503	53.341	108.21
504	208.627	106.01	504	53.508	107.43	504	53.47	108.05	504	53.47	108.21
505	208.627	106.01	505	53.64	107.43	505	53.55	108.05	505	53.55	108.21
506	208.627	106.01	506	53.769	107.43	506	53.707	108.05	506	53.707	108.21
507	208.627	106.01	507	53.849	107.43	507	53.76	108.05	507	53.76	108.21
508	208.627	106.01	508	54.006	107.43	508	53.864	108.05	508	53.864	108.21
509	208.627	106.01	509	54.059	107.43	509	53.969	108.05	509	53.969	108.21
510	208.627	106.01	510	54.164	107.43	510	54.074	108.05	510	54.074	108.21
511	208.627	106.01	511	54.268	107.43	511	54.178	108.05	511	54.178	108.21
512	208.627	106.01	512	54.373	107.43	512	54.203	108.05	512	54.203	108.21
513	208.627	106.01	513	54.478	107.43	513	54.296	108.05	513	54.296	108.21
514	208.627	106.01	514	54.503	107.43	514	54.388	108.05	514	54.388	108.21
515	208.627	106.01	515	54.595	107.43	515	54.47	108.05	515	54.47	108.21
516	208.627	106.01	516	54.687	107.43	516	54.597	108.05	516	54.597	108.21
517	208.627	106.01	517	54.769	107.43	517	54.697	108.05	517	54.697	108.21
518	208.627	106.01	518	54.897	107.43	518	54.807	108.05	518	54.807	108.21
519	208.836	106.00	519	54.996	107.43	519	54.97	108.05	519	54.97	108.21
520	209.046	105.98	520	55.106	107.43	520	55.016	108.05	520	55.016	108.21
521	209.046	105.98	521	55.269	107.43	521	55.098	108.05	521	55.098	108.21
522	209.046	105.98	522	55.315	107.43	522	55.226	108.05	522	55.226	108.21
523	209.046	105.98	523	55.397	107.43	523	55.33	108.05	523	55.33	108.21
524	209.046	105.98	524	55.525	107.43	524	55.435	108.05	524	55.435	108.21
525	209.046	105.98	525	55.63	107.43	525	55.457	108.05	525	55.457	108.21
526	209.046	105.98	526	55.734	107.43	526	55.551	108.05	526	55.551	108.21
527	209.046	105.98	527	55.756	107.43	527	55.644	108.05	527	55.644	108.21
528	209.046	105.98	528	55.85	107.43	528	55.731	108.05	528	55.731	108.21
529	209.046	105.98	529	55.944	107.43	529	55.854	108.05	529	55.854	108.21
530	209.046	105.98	530	56.03	107.43	530	55.955	108.05	530	55.955	108.21
531	209.046	105.98	531	56.153	107.43	531	56.063	108.05	531	56.063	108.21

532	209.046	105.98	532	56.254	107.43	532	56.222	108.05	532	56.222	108.21
533	209.046	105.98	533	56.363	107.43	533	56.273	108.05	533	56.273	108.21
534	209.046	105.98	534	56.521	107.43	534	56.364	108.05	534	56.364	108.21
535	209.046	105.98	535	56.572	107.43	535	56.455	108.05	535	56.455	108.21
536	209.046	105.98	536	56.663	107.43	536	56.482	108.05	536	56.482	108.21
537	209.046	105.98	537	56.754	107.43	537	56.587	108.05	537	56.587	108.21
538	209.046	105.98	538	56.781	107.43	538	56.692	108.05	538	56.692	108.21
539	209.046	105.98	539	56.886	107.43	539	56.719	108.05	539	56.719	108.21
540	209.046	105.98	540	56.991	107.43	540	56.81	108.05	540	56.81	108.21
541	209.046	105.98	541	57.018	107.43	541	56.901	108.05	541	56.901	108.21
542	209.046	105.98	542	57.109	107.43	542	56.955	108.05	542	56.955	108.21
543	209.046	105.98	543	57.2	107.43	543	57.111	108.05	543	57.111	108.21
544	209.046	105.98	544	57.254	107.43	544	57.217	108.05	544	57.217	108.21
545	209.046	105.98	545	57.41	107.43	545	57.32	108.05	545	57.32	108.21
546	209.046	105.98	546	57.516	107.43	546	57.455	108.05	546	57.455	108.21
547	209.046	105.98	547	57.619	107.43	547	57.529	108.05	547	57.529	108.21
548	209.046	105.98	548	57.754	107.43	548	57.623	108.05	548	57.623	108.21
549	209.046	105.98	549	57.829	107.43	549	57.716	108.05	549	57.716	108.21
550	209.046	105.98	550	57.922	107.43	550	57.739	108.05	550	57.739	108.21
551	209.046	105.98	551	58.016	107.43	551	57.844	108.05	551	57.844	108.21
552	209.255	105.96	552	58.038	107.43	552	57.948	108.05	552	57.948	108.21
553	209.255	105.96	553	58.143	107.43	553	58.056	108.05	553	58.056	108.21
554	209.255	105.96	554	58.248	107.43	554	58.158	108.05	554	58.158	108.21
555	209.255	105.96	555	58.356	107.43	555	58.215	108.05	555	58.215	108.21
556	209.255	105.96	556	58.457	107.43	556	58.367	108.05	556	58.367	108.21
557	209.255	105.96	557	58.515	107.43	557	58.455	108.05	557	58.455	108.21
558	209.255	105.96	558	58.666	107.43	558	58.577	108.05	558	58.577	108.21
559	209.255	105.96	559	58.754	107.43	559	58.715	108.05	559	58.715	108.21
560	209.255	105.96	560	58.876	107.43	560	58.786	108.05	560	58.786	108.21
561	209.255	105.96	561	59.014	107.43	561	58.87	108.05	561	58.87	108.21
562	209.255	105.96	562	59.085	107.43	562	58.955	108.05	562	58.955	108.21
563	209.255	105.96	563	59.17	107.42	563	58.995	108.05	563	58.995	108.21
564	209.255	105.96	564	59.254	107.42	564	59.1	108.05	564	59.1	108.21
565	209.255	105.96	565	59.295	107.42	565	59.205	108.05	565	59.205	108.21
566	209.255	105.96	566	59.399	107.42	566	59.301	108.05	566	59.301	108.21
567	209.255	105.96	567	59.504	107.42	567	59.391	108.05	567	59.391	108.21
568	209.255	105.96	568	59.6	107.42	568	59.463	108.05	568	59.463	108.21
569	209.255	105.96	569	59.69	107.42	569	59.586	108.05	569	59.586	108.21
570	209.255	105.96	570	59.762	107.42	570	59.709	108.05	570	59.709	108.21
571	209.255	105.96	571	59.885	107.42	571	59.834	108.05	571	59.834	108.21
572	209.255	105.96	572	60.008	107.42	572	59.959	108.05	572	59.959	108.21
573	209.255	105.96	573	60.133	107.42	573	60	108.05	573	60	108.21
574	209.255	105.96	574	60.258	107.42	574	60.105	108.05	574	60.105	108.21
575	209.255	105.96	575	60.299	107.42	575	60.209	108.05	575	60.209	108.21
576	209.255	105.96	576	60.404	107.42	576	60.334	108.05	576	60.334	108.21

577	209.255	105.96	577	60.508	107.42	577	60.459	108.05	577	60.459	108.21
578	209.255	105.96	578	60.633	107.42	578	60.584	108.05	578	60.584	108.21
579	209.255	105.96	579	60.758	107.42	579	60.709	108.05	579	60.709	108.21
580	209.255	105.96	580	60.883	107.41	580	60.834	108.05	580	60.834	108.21
581	209.255	105.96	581	61.008	107.41	581	60.958	108.05	581	60.958	108.21
582	209.255	105.96	582	61.133	107.41	582	61.083	108.05	582	61.083	108.21
583	209.255	105.96	583	61.258	107.41	583	61.208	108.05	583	61.208	108.21
584	209.255	105.96	584	61.383	107.41	584	61.333	108.05	584	61.333	108.21
585	209.255	105.96	585	61.508	107.41	585	61.458	108.05	585	61.458	108.21
586	209.255	105.96	586	61.633	107.41	586	61.583	108.05	586	61.583	108.21
587	209.255	105.96	587	61.757	107.41	587	61.708	108.05	587	61.708	108.21
588	209.255	105.96	588	61.882	107.41	588	61.833	108.05	588	61.833	108.21
589	209.255	105.96	589	62.007	107.41	589	61.958	108.05	589	61.958	108.21
590	209.465	105.94	590	62.132	107.41	590	62.083	108.05	590	62.083	108.21
591	209.465	105.94	591	62.257	107.41	591	62.208	108.05	591	62.208	108.21
592	209.465	105.94	592	62.382	107.41	592	62.333	108.05	592	62.333	108.21
593	209.465	105.94	593	62.507	107.41	593	62.457	108.05	593	62.457	108.21
594	209.465	105.94	594	62.632	107.41	594	62.582	108.05	594	62.582	108.21
595	209.465	105.94	595	62.757	107.41	595	62.707	108.05	595	62.707	108.21
596	209.465	105.94	596	62.882	107.41	596	62.832	108.05	596	62.832	108.21
597	209.465	105.94	597	63.007	107.41	597	62.957	108.05	597	62.957	108.21
598	209.465	105.94	598	63.132	107.41	598	63.082	108.05	598	63.082	108.21
599	209.465	105.94	599	63.256	107.41	599	63.207	108.05	599	63.207	108.21
600	209.465	105.94	600	63.381	107.41	600	63.332	108.05	600	63.332	108.21
601	209.465	105.94	601	63.506	107.41	601	63.457	108.05	601	63.457	108.21
602	209.465	105.94	602	63.631	107.41	602	63.582	108.05	602	63.582	108.21
603	209.465	105.94	603	63.756	107.41	603	63.707	108.05	603	63.707	108.21
604	209.465	105.94	604	63.881	107.41	604	63.832	108.05	604	63.832	108.21
605	209.465	105.94	605	64.006	107.40	605	63.956	108.05	605	63.956	108.21
606	209.465	105.94	606	64.131	107.40	606	64.081	108.05	606	64.081	108.21
607	209.465	105.94	607	64.256	107.40	607	64.206	108.05	607	64.206	108.21
608	209.465	105.94	608	64.381	107.40	608	64.331	108.05	608	64.331	108.21
609	209.465	105.94	609	64.506	107.40	609	64.456	108.05	609	64.456	108.21
610	209.465	105.94	610	64.63	107.40	610	64.581	108.05	610	64.581	108.21
611	209.465	105.94	611	64.755	107.40	611	64.706	108.05	611	64.706	108.21
612	209.465	105.94	612	64.88	107.40	612	64.831	108.05	612	64.831	108.21
613	209.465	105.94	613	65.005	107.40	613	64.956	108.05	613	64.956	108.21
614	209.465	105.94	614	65.13	107.40	614	65.081	108.05	614	65.081	108.21
615	209.465	105.94	615	65.255	107.40	615	65.206	108.05	615	65.206	108.21
616	209.465	105.94	616	65.38	107.40	616	65.331	108.05	616	65.331	108.21
617	209.465	105.94	617	65.505	107.40	617	65.455	108.05	617	65.455	108.21
618	209.465	105.94	618	65.63	107.40	618	65.58	108.05	618	65.58	108.21
619	209.465	105.94	619	65.755	107.40	619	65.705	108.05	619	65.705	108.21
620	209.465	105.94	620	65.88	107.40	620	65.83	108.05	620	65.83	108.21
621	209.465	105.94	621	66.005	107.40	621	65.955	108.05	621	65.955	108.21

622	209.674	105.93	622	66.129	107.40	622	66.08	108.05	622	66.08	108.21
623	209.674	105.93	623	66.254	107.40	623	66.205	108.05	623	66.205	108.21
624	209.674	105.93	624	66.379	107.40	624	66.33	108.05	624	66.33	108.21
625	209.674	105.93	625	66.504	107.40	625	66.454	108.05	625	66.454	108.21
626	209.674	105.93	626	66.629	107.40	626	66.531	108.05	626	66.531	108.21
627	209.674	105.93	627	66.754	107.40	627	66.64	108.05	627	66.64	108.21
628	209.674	105.93	628	66.83	107.40	628	66.702	108.05	628	66.702	108.21
629	209.674	105.93	629	66.94	107.40	629	66.85	108.05	629	66.85	108.21
630	209.674	105.93	630	67.001	107.40	630	66.96	108.05	630	66.96	108.21
631	209.674	105.93	631	67.149	107.40	631	67.059	108.05	631	67.059	108.21
632	209.674	105.93	632	67.259	107.40	632	67.199	108.05	632	67.199	108.21
633	209.674	105.93	633	67.359	107.39	633	67.269	108.05	633	67.269	108.21
634	209.674	105.93	634	67.499	107.39	634	67.364	108.05	634	67.364	108.21
635	209.674	105.93	635	67.568	107.39	635	67.46	108.05	635	67.46	108.21
636	209.674	105.93	636	67.663	107.39	636	67.478	108.05	636	67.478	108.21
637	209.674	105.93	637	67.759	107.39	637	67.583	108.05	637	67.583	108.21
638	209.674	105.93	638	67.777	107.39	638	67.688	108.05	638	67.688	108.21
639	209.674	105.93	639	67.882	107.39	639	67.698	108.05	639	67.698	108.21
640	209.674	105.93	640	67.987	107.39	640	67.798	108.05	640	67.798	108.21
641	209.674	105.93	641	67.998	107.39	641	67.897	108.05	641	67.897	108.21
642	209.674	105.93	642	68.097	107.39	642	67.96	108.05	642	67.96	108.21
643	209.674	105.93	643	68.196	107.39	643	68.107	108.05	643	68.107	108.21
644	209.674	105.93	644	68.259	107.39	644	68.198	108.05	644	68.198	108.21
645	209.674	105.93	645	68.406	107.39	645	68.316	108.05	645	68.316	108.21
646	209.674	105.93	646	68.498	107.39	646	68.459	108.05	646	68.459	108.21
647	209.674	105.93	647	68.615	107.39	647	68.525	108.05	647	68.525	108.21
648	209.674	105.93	648	68.759	107.39	648	68.611	108.05	648	68.611	108.21
649	209.674	105.93	649	68.825	107.39	649	68.697	108.05	649	68.697	108.21
650	209.674	105.93	650	68.91	107.39	650	68.735	108.05	650	68.735	108.21
651	209.674	105.93	651	68.996	107.39	651	68.84	108.05	651	68.84	108.21
652	209.674	105.93	652	69.034	107.39	652	68.944	108.05	652	68.944	108.21
653	209.674	105.93	653	69.139	107.39	653	68.959	108.05	653	68.959	108.21
654	209.674	105.93	654	69.244	107.39	654	69.057	108.05	654	69.057	108.21
655	209.884	105.91	655	69.259	107.39	655	69.154	108.05	655	69.154	108.21
656	209.884	105.91	656	69.356	107.39	656	69.195	108.05	656	69.195	108.21
657	209.884	105.91	657	69.453	107.39	657	69.279	108.05	657	69.279	108.21
658	209.884	105.91	658	69.494	107.39	658	69.363	108.05	658	69.363	108.21
659	209.884	105.91	659	69.578	107.39	659	69.459	108.05	659	69.459	108.21
660	209.884	105.91	660	69.662	107.39	660	69.573	108.05	660	69.573	108.21
661	209.884	105.91	661	69.759	107.39	661	69.691	108.05	661	69.691	108.21
662	209.884	105.91	662	69.872	107.38	662	69.782	108.05	662	69.782	108.21
663	209.884	105.91	663	69.991	107.38	663	69.871	108.05	663	69.871	108.21
664	209.884	105.91	664	70.081	107.38	664	69.959	108.05	664	69.959	108.21
665	209.884	105.91	665	70.17	107.38	665	69.991	108.05	665	69.991	108.21
666	209.884	105.91	666	70.259	107.38	666	70.082	108.05	666	70.082	108.21

667	209.884	105.91	667	70.291	107.38	667	70.173	108.05	667	70.173	108.21
668	209.884	105.91	668	70.381	107.38	668	70.201	108.05	668	70.201	108.21
669	209.884	105.91	669	70.472	107.38	669	70.306	108.05	669	70.306	108.21
670	209.884	105.91	670	70.5	107.38	670	70.41	108.05	670	70.41	108.21
671	209.884	105.91	671	70.605	107.38	671	70.451	108.05	671	70.451	108.21
672	209.884	105.91	672	70.71	107.38	672	70.535	108.05	672	70.535	108.21
673	209.884	105.91	673	70.75	107.38	673	70.62	108.05	673	70.62	108.21
674	209.884	105.91	674	70.834	107.38	674	70.705	108.05	674	70.705	108.21
675	209.884	105.91	675	70.919	107.38	675	70.79	108.05	675	70.79	108.21
676	209.884	105.91	676	71.004	107.38	676	70.829	108.05	676	70.829	108.21
677	209.884	105.91	677	71.089	107.38	677	70.945	108.05	677	70.945	108.21
678	209.884	105.91	678	71.128	107.38	678	71	108.05	678	71	108.21
679	209.884	105.91	679	71.244	107.38	679	71.039	108.05	679	71.039	108.21
680	209.884	105.91	680	71.299	107.38	680	71.127	108.05	680	71.127	108.21
681	209.884	105.91	681	71.338	107.38	681	71.216	108.05	681	71.216	108.21
682	209.884	105.91	682	71.426	107.38	682	71.248	108.05	682	71.248	108.21
683	209.884	105.91	683	71.515	107.38	683	71.346	108.05	683	71.346	108.21
684	209.884	105.91	684	71.547	107.38	684	71.445	108.05	684	71.445	108.21
685	209.884	105.91	685	71.646	107.38	685	71.458	108.05	685	71.458	108.21
686	209.884	105.91	686	71.744	107.37	686	71.562	108.05	686	71.562	108.21
687	209.884	105.91	687	71.757	107.37	687	71.667	108.05	687	71.667	108.21
688	209.884	105.91	688	71.862	107.37	688	71.71	108.05	688	71.71	108.21
689	209.884	105.91	689	71.966	107.37	689	71.876	108.05	689	71.876	108.21
690	209.884	105.91	690	72.009	107.37	690	71.945	108.05	690	71.945	108.21
691	209.884	105.91	691	72.176	107.37	691	72.086	108.05	691	72.086	108.21
692	209.884	105.91	692	72.244	107.37	692	72.207	108.05	692	72.207	108.21
693	209.884	105.91	693	72.385	107.37	693	72.295	108.05	693	72.295	108.21
694	209.884	105.91	694	72.506	107.37	694	72.445	108.05	694	72.445	108.21
695	209.884	105.91	695	72.595	107.37	695	72.505	108.05	695	72.505	108.21
696	210	105.90	696	72.744	107.37	696	72.606	108.05	696	72.606	108.21
697	224	106.47	697	72.804	107.37	697	72.707	108.05	697	72.707	108.21
698	234	106.40	698	72.905	107.37	698	72.819	108.05	698	72.819	108.21
699	245	105.80	699	73.006	107.37	699	72.924	108.05	699	72.924	108.21
700	261	106.39	700	73.118	107.37	700	72.945	108.05	700	72.945	108.21
701	273.991	106.32	701	73.223	107.37	701	73.039	108.05	701	73.039	108.21
702	286.721	106.07	702	73.244	107.37	702	73.133	108.05	702	73.133	108.21
703	294.106	106.15	703	73.338	107.37	703	73.205	108.05	703	73.205	108.21
704	296.926	106.72	704	73.432	107.37	704	73.342	108.05	704	73.342	108.21
705	297.225	106.56	705	73.505	107.37	705	73.444	108.05	705	73.444	108.21
706	297.244	106.56	706	73.642	107.37	706	73.552	108.05	706	73.552	108.21
707	297.244	106.56	707	73.744	107.37	707	73.705	108.05	707	73.705	108.21
708	297.244	106.56	708	73.851	107.37	708	73.761	108.05	708	73.761	108.21
709	297.244	106.56	709	74.004	107.37	709	73.853	108.05	709	73.853	108.21
710	297.244	106.56	710	74.061	107.37	710	73.944	108.05	710	73.944	108.21
711	297.244	106.56	711	74.152	107.37	711	73.971	108.05	711	73.971	108.21



712	297.244	106.56	712	74.244	107.37	712	74.075	108.05	712	74.075	108.21
713	297.244	106.56	713	74.27	107.37	713	74.18	108.05	713	74.18	108.21
714	297.244	106.56	714	74.375	107.37	714	74.205	108.05	714	74.205	108.21
715	297.244	106.56	715	74.479	107.37	715	74.297	108.05	715	74.297	108.21
716	297.244	106.56	716	74.504	107.37	716	74.39	108.05	716	74.39	108.21
717	297.244	106.56	717	74.596	107.37	717	74.444	108.05	717	74.444	108.21
718	297.745	106.42	718	74.689	107.37	718	74.599	108.05	718	74.599	108.21
719	297.745	106.42	719	74.743	107.37	719	74.704	108.05	719	74.704	108.21
720	297.745	106.42	720	74.898	107.37	720	74.809	108.05	720	74.809	108.21
721	297.745	106.42	721	75.004	107.37	721	74.944	108.05	721	74.944	108.21
722	297.745	106.42	722	75.108	107.37	722	75.018	108.05	722	75.018	108.21
723	297.745	106.42	723	75.243	107.37	723	75.111	108.05	723	75.111	108.21
724	297.745	106.42	724	75.317	107.37	724	75.204	108.05	724	75.204	108.21
725	297.745	106.42	725	75.41	107.37	725	75.227	108.05	725	75.227	108.21
726	297.745	106.42	726	75.503	107.37	726	75.332	108.05	726	75.332	108.21
727	297.745	106.42	727	75.527	107.37	727	75.437	108.05	727	75.437	108.21
728	297.745	106.42	728	75.631	107.37	728	75.545	108.05	728	75.545	108.21
729	297.745	106.42	729	75.736	107.37	729	75.646	108.05	729	75.646	108.21
730	297.745	106.42	730	75.844	107.37	730	75.704	108.05	730	75.704	108.21
731	297.745	106.42	731	75.946	107.37	731	75.856	108.05	731	75.856	108.21
732	297.745	106.42	732	76.003	107.37	732	75.944	108.05	732	75.944	108.21
733	297.745	106.42	733	76.155	107.36	733	76.065	108.05	733	76.065	108.21
734	297.745	106.42	734	76.243	107.36	734	76.204	108.05	734	76.204	108.21
735	297.745	106.42	735	76.364	107.36	735	76.275	108.05	735	76.275	108.21
736	297.745	106.42	736	76.503	107.36	736	76.359	108.05	736	76.359	108.21
737	297.745	106.42	737	76.574	107.36	737	76.443	108.05	737	76.443	108.21
738	297.745	106.42	738	76.658	107.36	738	76.484	108.05	738	76.484	108.21
739	297.745	106.42	739	76.742	107.36	739	76.589	108.05	739	76.589	108.21
740	297.745	106.42	740	76.783	107.36	740	76.693	108.05	740	76.693	108.21
741	297.745	106.42	741	76.888	107.36	741	76.704	108.05	741	76.704	108.21
742	297.745	106.42	742	76.993	107.36	742	76.803	108.05	742	76.803	108.21
743	297.745	106.42	743	77.003	107.36	743	76.903	108.05	743	76.903	108.21
744	297.745	106.42	744	77.103	107.36	744	76.942	108.05	744	76.942	108.21
745	297.745	106.42	745	77.202	107.36	745	77.027	108.05	745	77.027	108.21
746	298.044	106.34	746	77.241	107.36	746	77.112	108.05	746	77.112	108.21
747	298.044	106.34	747	77.326	107.36	747	77.204	108.05	747	77.204	108.21
748	298.044	106.34	748	77.412	107.36	748	77.322	108.05	748	77.322	108.21
749	298.044	106.34	749	77.503	107.36	749	77.441	108.05	749	77.441	108.21
750	298.044	106.34	750	77.621	107.36	750	77.531	108.05	750	77.531	108.21
751	298.044	106.34	751	77.741	107.36	751	77.617	108.05	751	77.617	108.21
752	298.044	106.34	752	77.83	107.36	752	77.704	108.05	752	77.704	108.21
753	298.044	106.34	753	77.917	107.36	753	77.741	108.05	753	77.741	108.21
754	298.044	106.34	754	78.003	107.36	754	77.839	108.05	754	77.839	108.21
755	298.044	106.34	755	78.04	107.36	755	77.938	108.05	755	77.938	108.21
756	298.044	106.34	756	78.139	107.36	756	77.95	108.05	756	77.95	108.21

757	298.044	106.34	757	78.237	107.36	757	78.055	108.05	757	78.055	108.21
758	298.044	106.34	758	78.249	107.36	758	78.16	108.05	758	78.16	108.21
759	298.044	106.34	759	78.354	107.36	759	78.204	108.05	759	78.204	108.21
760	298.044	106.34	760	78.459	107.36	760	78.369	108.05	760	78.369	108.21
761	298.044	106.34	761	78.503	107.36	761	78.434	108.05	761	78.434	108.21
762	298.044	106.34	762	78.668	107.36	762	78.578	108.05	762	78.578	108.21
763	298.044	106.34	763	78.733	107.36	763	78.703	108.05	763	78.703	108.21
764	298.044	106.34	764	78.878	107.36	764	78.788	108.05	764	78.788	108.21
765	298.044	106.34	765	79.003	107.36	765	78.909	108.05	765	78.909	108.21
766	298.044	106.34	766	79.087	107.36	766	78.997	108.05	766	78.997	108.21
767	298.044	106.34	767	79.208	107.36	767	79.097	108.05	767	79.097	108.21
768	298.044	106.34	768	79.297	107.36	768	79.197	108.05	768	79.197	108.21
769	298.044	106.34	769	79.397	107.36	769	79.311	108.05	769	79.311	108.21
770	298.044	106.34	770	79.497	107.36	770	79.416	108.05	770	79.416	108.21
771	298.044	106.34	771	79.611	107.36	771	79.447	108.05	771	79.447	108.21
772	298.044	106.34	772	79.715	107.36	772	79.536	108.05	772	79.536	108.21
773	298.044	106.34	773	79.747	107.36	773	79.626	108.05	773	79.626	108.21
774	298.044	106.34	774	79.836	107.36	774	79.689	108.05	774	79.689	108.21
775	298.044	106.34	775	79.925	107.36	775	79.835	108.05	775	79.835	108.21
776	298.044	106.34	776	79.988	107.36	776	79.957	108.05	776	79.957	108.21
777	298.044	106.34	777	80.134	107.36	777	80.044	108.05	777	80.044	108.21
778	298.68	106.32	778	80.257	107.36	778	80.189	108.05	778	80.189	108.21
779	298.68	106.32	779	80.344	107.36	779	80.254	108.05	779	80.254	108.21
780	298.979	107.07	780	80.488	107.36	780	80.354	108.05	780	80.354	108.21
			781	80.553	107.36	781	80.454	108.05	781	80.454	108.21
			782	80.653	107.36	782	80.568	108.05	782	80.568	108.21
			783	80.753	107.36	783	80.673	108.05	783	80.673	108.21
			784	80.867	107.36	784	80.689	108.05	784	80.689	108.21
			785	80.972	107.36	785	80.786	108.05	785	80.786	108.21
			786	80.988	107.36	786	80.882	108.05	786	80.882	108.21
			787	81.085	107.36	787	80.951	108.05	787	80.951	108.21
			788	81.181	107.36	788	81.092	108.05	788	81.092	108.21
			789	81.25	107.36	789	81.189	108.05	789	81.189	108.21
			790	81.391	107.36	790	81.301	108.05	790	81.301	108.21
			791	81.488	107.36	791	81.45	108.05	791	81.45	108.21
			792	81.6	107.36	792	81.511	108.05	792	81.511	108.21
			793	81.75	107.36	793	81.6	108.05	793	81.6	108.21
			794	81.81	107.36	794	81.689	108.05	794	81.689	108.21
			795	81.899	107.36	795	81.72	108.05	795	81.72	108.21
			796	81.988	107.36	796	81.825	108.05	796	81.825	108.21
			797	82.019	107.36	797	81.929	108.05	797	81.929	108.21
			798	82.124	107.36	798	81.95	108.05	798	81.95	108.21
			799	82.229	107.36	799	82.044	108.05	799	82.044	108.21
			800	82.249	107.36	800	82.139	108.05	800	82.139	108.21
			801	82.344	107.36	801	82.189	108.05	801	82.189	108.21

			802	82.438	107.36	802	82.348	108.05	802	82.348	108.21
			803	82.488	107.36	803	82.449	108.05	803	82.449	108.21
			804	82.648	107.36	804	82.558	108.05	804	82.558	108.21
			805	82.748	107.36	805	82.688	108.05	805	82.688	108.21
			806	82.857	107.36	806	82.767	108.05	806	82.767	108.21
			807	82.988	107.36	807	82.858	108.05	807	82.858	108.21
			808	83.066	107.36	808	82.949	108.05	808	82.949	108.21
			809	83.157	107.36	809	82.977	108.05	809	82.977	108.21
			810	83.248	107.36	810	83.081	108.05	810	83.081	108.21
			811	83.276	107.36	811	83.186	108.05	811	83.186	108.21
			812	83.381	107.36	812	83.292	108.05	812	83.292	108.21
			813	83.485	107.36	813	83.395	108.05	813	83.395	108.21
			814	83.591	107.36	814	83.449	108.05	814	83.449	108.21
			815	83.695	107.36	815	83.605	108.05	815	83.605	108.21
			816	83.748	107.36	816	83.688	108.05	816	83.688	108.21
			817	83.904	107.36	817	83.814	108.05	817	83.814	108.21
			818	83.987	107.36	818	83.948	108.05	818	83.948	108.21
			819	84.114	107.36	819	84.024	108.05	819	84.024	108.21
			820	84.248	107.36	820	84.188	108.05	820	84.188	108.21
			821	84.323	107.36	821	84.233	108.05	821	84.233	108.21
			822	84.487	107.36	822	84.338	108.05	822	84.338	108.21
			823	84.532	107.36	823	84.443	108.05	823	84.443	108.21
			824	84.637	107.36	824	84.55	108.05	824	84.55	108.21
			825	84.742	107.36	825	84.652	108.05	825	84.652	108.21
			826	84.849	107.36	826	84.687	108.05	826	84.687	108.21
			827	84.951	107.36	827	84.774	108.05	827	84.774	108.21
			828	84.987	107.36	828	84.862	108.05	828	84.862	108.21
			829	85.074	107.36	829	84.948	108.05	829	84.948	108.21
			830	85.161	107.36	830	85	108.05	830	85	108.21
			831	85.247	107.36	831	85.071	108.05	831	85.071	108.21
			832	85.299	107.36	832	85.187	108.05	832	85.187	108.21
			833	85.37	107.36	833	85.28	108.05	833	85.28	108.21
			834	85.487	107.36	834	85.364	108.05	834	85.364	108.21
			835	85.58	107.36	835	85.448	108.05	835	85.448	108.21
			836	85.663	107.36	836	85.49	108.05	836	85.49	108.21
			837	85.747	107.36	837	85.588	108.05	837	85.588	108.21
			838	85.789	107.36	838	85.686	108.05	838	85.686	108.21
			839	85.887	107.36	839	85.699	108.05	839	85.699	108.21
			840	85.985	107.36	840	85.804	108.05	840	85.804	108.21
			841	85.999	107.36	841	85.909	108.05	841	85.909	108.21
			842	86.103	107.36	842	85.948	108.05	842	85.948	108.21
			843	86.208	107.36	843	86.033	108.05	843	86.033	108.21
			844	86.247	107.36	844	86.118	108.05	844	86.118	108.21
			845	86.332	107.36	845	86.185	108.05	845	86.185	108.21
			846	86.417	107.36	846	86.328	108.05	846	86.328	108.21

			847	86.484	107.36	847	86.448	108.05	847	86.448	108.21
			848	86.627	107.36	848	86.537	108.05	848	86.537	108.21
			849	86.747	107.36	849	86.683	108.05	849	86.683	108.21
			850	86.836	107.36	850	86.746	108.05	850	86.746	108.21
			851	86.982	107.36	851	86.847	108.05	851	86.847	108.21
			852	87.046	107.36	852	86.948	108.05	852	86.948	108.21
			853	87.146	107.36	853	87.061	108.05	853	87.061	108.21
			854	87.247	107.36	854	87.165	108.05	854	87.165	108.21
			855	87.36	107.36	855	87.275	108.05	855	87.275	108.21
			856	87.465	107.35	856	87.375	108.05	856	87.375	108.21
			857	87.574	107.35	857	87.448	108.05	857	87.448	108.21
			858	87.674	107.35	858	87.584	108.05	858	87.584	108.21
			859	87.747	107.35	859	87.614	108.05	859	87.614	108.21
			860	87.883	107.35	860	87.704	108.05	860	87.704	108.21
			861	87.914	107.35	861	87.794	108.05	861	87.794	108.21
			862	88.003	107.35	862	87.944	108.05	862	87.944	108.21
			863	88.093	107.35	863	88.003	108.05	863	88.003	108.21
			864	88.243	107.35	864	88.091	108.05	864	88.091	108.21
			865	88.302	107.35	865	88.213	108.05	865	88.213	108.21
			866	88.39	107.35	866	88.317	108.05	866	88.317	108.21
			867	88.512	107.35	867	88.422	108.05	867	88.422	108.21
			868	88.617	107.35	868	88.433	108.05	868	88.433	108.21
			869	88.721	107.35	869	88.532	108.05	869	88.532	108.21
			870	88.732	107.35	870	88.631	108.05	870	88.631	108.21
			871	88.831	107.35	871	88.7	108.05	871	88.7	108.21
			872	88.931	107.35	872	88.841	108.05	872	88.841	108.21
			873	88.999	107.35	873	88.933	108.05	873	88.933	108.21
			874	89.14	107.35	874	89.05	108.05	874	89.05	108.21
			875	89.232	107.35	875	89.197	108.05	875	89.197	108.21
			876	89.35	107.35	876	89.26	108.05	876	89.26	108.21
			877	89.496	107.35	877	89.346	108.05	877	89.346	108.21
			878	89.559	107.35	878	89.433	108.05	878	89.433	108.21
			879	89.646	107.35	879	89.469	108.05	879	89.469	108.21
			880	89.732	107.35	880	89.574	108.05	880	89.574	108.21
			881	89.768	107.35	881	89.679	108.05	881	89.679	108.21
			882	89.873	107.35	882	89.696	108.05	882	89.696	108.21
			883	89.978	107.35	883	89.792	108.05	883	89.792	108.21
			884	89.995	107.35	884	89.888	108.05	884	89.888	108.21
			885	90.091	107.35	885	89.933	108.05	885	89.933	108.21
			886	90.187	107.35	886	90.097	108.05	886	90.097	108.21
			887	90.232	107.35	887	90.194	108.05	887	90.194	108.21
			888	90.397	107.35	888	90.307	108.05	888	90.307	108.21
			889	90.493	107.35	889	90.433	108.05	889	90.433	108.21
			890	90.606	107.35	890	90.516	108.05	890	90.516	108.21
			891	90.732	107.35	891	90.605	108.05	891	90.605	108.21

			892	90.816	107.35	892	90.694	108.05	892	90.694	108.21
			893	90.904	107.35	893	90.726	108.05	893	90.726	108.21
			894	90.993	107.35	894	90.829	108.05	894	90.829	108.21
			895	91.025	107.35	895	90.933	108.05	895	90.933	108.21
			896	91.129	107.35	896	91.04	108.05	896	91.04	108.21
			897	91.232	107.35	897	91.145	108.05	897	91.145	108.21
			898	91.339	107.35	898	91.193	108.05	898	91.193	108.21
			899	91.444	107.35	899	91.354	108.05	899	91.354	108.21
			900	91.493	107.35	900	91.433	108.05	900	91.433	108.21
			901	91.653	107.35	901	91.564	108.05	901	91.564	108.21
			902	91.732	107.35	902	91.693	108.05	902	91.693	108.21
			903	91.863	107.35	903	91.773	108.05	903	91.773	108.21
			904	91.992	107.35	904	91.932	108.05	904	91.932	108.21
			905	92.072	107.35	905	91.982	108.05	905	91.982	108.21
			906	92.232	107.35	906	92.087	108.05	906	92.087	108.21
			907	92.282	107.35	907	92.192	108.05	907	92.192	108.21
			908	92.386	107.35	908	92.297	108.05	908	92.297	108.21
			909	92.491	107.35	909	92.401	108.05	909	92.401	108.21
			910	92.596	107.35	910	92.432	108.05	910	92.432	108.21
			911	92.701	107.35	911	92.521	108.05	911	92.521	108.21
			912	92.731	107.35	912	92.611	108.05	912	92.611	108.21
			913	92.821	107.35	913	92.693	108.05	913	92.693	108.21
			914	92.91	107.35	914	92.82	108.05	914	92.82	108.21
			915	92.992	107.35	915	92.932	108.05	915	92.932	108.21
			916	93.119	107.35	916	93.03	108.05	916	93.03	108.21
			917	93.231	107.35	917	93.192	108.05	917	93.192	108.21
			918	93.329	107.35	918	93.239	108.05	918	93.239	108.21
			919	93.492	107.35	919	93.335	108.05	919	93.335	108.21
			920	93.538	107.35	920	93.431	108.05	920	93.431	108.21
			921	93.634	107.35	921	93.448	108.05	921	93.448	108.21
			922	93.73	107.35	922	93.553	108.05	922	93.553	108.21
			923	93.748	107.35	923	93.658	108.05	923	93.658	108.21
			924	93.852	107.35	924	93.692	108.05	924	93.692	108.21
			925	93.957	107.35	925	93.78	108.05	925	93.78	108.21
			926	93.992	107.35	926	93.867	108.05	926	93.867	108.21
			927	94.079	107.35	927	93.931	108.05	927	93.931	108.21
			928	94.167	107.35	928	94.077	108.05	928	94.077	108.21
			929	94.23	107.35	929	94.192	108.05	929	94.192	108.21
			930	94.376	107.35	930	94.286	108.05	930	94.286	108.21
			931	94.491	107.35	931	94.43	108.05	931	94.43	108.21
			932	94.585	107.35	932	94.496	108.05	932	94.496	108.21
			933	94.73	107.35	933	94.594	108.05	933	94.594	108.21
			934	94.795	107.35	934	94.692	108.05	934	94.692	108.21
			935	94.893	107.35	935	94.705	108.05	935	94.705	108.21
			936	94.991	107.35	936	94.81	108.05	936	94.81	108.21

			937	95.004	107.35	937	94.915	108.05	937	94.915	108.21
			938	95.109	107.35	938	94.928	108.05	938	94.928	108.21
			939	95.214	107.35	939	95.026	108.05	939	95.026	108.21
			940	95.227	107.35	940	95.124	108.05	940	95.124	108.21
			941	95.325	107.35	941	95.192	108.05	941	95.192	108.21
			942	95.423	107.35	942	95.333	108.05	942	95.333	108.21
			943	95.491	107.35	943	95.426	108.05	943	95.426	108.21
			944	95.633	107.34	944	95.543	108.05	944	95.543	108.21
			945	95.725	107.34	945	95.692	108.05	945	95.692	108.21
			946	95.842	107.34	946	95.752	108.05	946	95.752	108.21
			947	95.991	107.34	947	95.918	108.05	947	95.918	108.21
			948	96.052	107.34	948	95.962	108.05	948	95.962	108.21
			949	96.217	107.34	949	96.066	108.05	949	96.066	108.21
			950	96.261	107.34	950	96.171	108.05	950	96.171	108.21
			951	96.366	107.34	951	96.192	108.05	951	96.192	108.21
			952	96.47	107.34	952	96.222	108.05	952	96.222	108.21
			953	96.491	107.34	953	96.381	108.05	953	96.381	108.21
			954	96.521	107.34	954	96.485	108.05	954	96.485	108.21
			955	96.68	107.34	955	96.59	108.05	955	96.59	108.21
			956	96.785	107.34	956	96.678	108.05	956	96.678	108.21
			957	96.889	107.34	957	96.799	108.05	957	96.799	108.21
			958	96.977	107.34	958	96.953	108.05	958	96.953	108.21
			959	97.099	107.34	959	97.009	108.05	959	97.009	108.21
			960	97.252	107.34	960	97.093	108.05	960	97.093	108.21
			961	97.308	107.34	961	97.177	108.05	961	97.177	108.21
			962	97.392	107.34	962	97.218	108.05	962	97.218	108.21
			963	97.477	107.34	963	97.323	108.05	963	97.323	108.21
			964	97.518	107.34	964	97.428	108.05	964	97.428	108.21
			965	97.622	107.34	965	97.444	108.05	965	97.444	108.21
			966	97.727	107.34	966	97.541	108.05	966	97.541	108.21
			967	97.744	107.34	967	97.637	108.05	967	97.637	108.21
			968	97.84	107.34	968	97.677	108.05	968	97.677	108.21
			969	97.936	107.34	969	97.762	108.05	969	97.762	108.21
			970	97.977	107.34	970	97.847	108.05	970	97.847	108.21
			971	98.061	107.33	971	97.946	108.05	971	97.946	108.21
			972	98.146	107.33	972	98	108.05	972	98	108.21
			973	98.245	107.33	973	98.056	108.05	973	98.056	108.21
			974	98.299	107.33	974	98.122	108.05	974	98.122	108.21
			975	98.355	107.33	975	98.171	108.05	975	98.171	108.21
			976	98.421	107.33	976	98.302	108.05	976	98.302	108.21
			977	98.47	107.33	977	98.433	108.05	977	98.433	108.21
			978	98.601	107.33	978	98.558	108.05	978	98.558	108.21
			979	98.733	107.33	979	98.683	108.05	979	98.683	108.21
			980	98.858	107.33	980	98.808	108.05	980	98.808	108.21
			981	98.982	107.33	981	98.933	108.05	981	98.933	108.21

			982	99.107	107.33	982	99.058	108.05	982	99.058	108.21
			983	99.232	107.33	983	99.183	108.05	983	99.183	108.21
			984	99.357	107.33	984	99.308	108.05	984	99.308	108.21
			985	99.482	107.32	985	99.433	108.05	985	99.433	108.21
			986	99.607	107.32	986	99.558	108.05	986	99.558	108.21
			987	99.732	107.32	987	99.683	108.05	987	99.683	108.21
			988	99.857	107.32	988	99.807	108.05	988	99.807	108.21
			989	99.982	107.32	989	99.932	108.05	989	99.932	108.21
			990	100.107	107.32	990	100.057	108.05	990	100.057	108.21
			991	100.232	107.32	991	100.182	108.05	991	100.182	108.21
			992	100.356	107.32	992	100.307	108.05	992	100.307	108.21
			993	100.481	107.32	993	100.432	108.05	993	100.432	108.21
			994	100.606	107.32	994	100.557	108.05	994	100.557	108.21
			995	100.731	107.32	995	100.682	108.05	995	100.682	108.21
			996	100.856	107.32	996	100.807	108.05	996	100.807	108.21
			997	100.981	107.32	997	100.932	108.05	997	100.932	108.21
			998	101.106	107.32	998	101.057	108.05	998	101.057	108.21
			999	101.231	107.32	999	101.181	108.05	999	101.181	108.21
			1000	101.356	107.32	1000	101.306	108.05	1000	101.306	108.21
			1001	101.481	107.32	1001	101.431	108.05	1001	101.431	108.21
			1002	101.606	107.32	1002	101.556	108.05	1002	101.556	108.21
			1003	101.73	107.32	1003	101.681	108.05	1003	101.681	108.21
			1004	101.855	107.32	1004	101.806	108.05	1004	101.806	108.21
			1005	101.98	107.32	1005	101.931	108.05	1005	101.931	108.21
			1006	102.105	107.32	1006	102.056	108.05	1006	102.056	108.21
			1007	102.23	107.32	1007	102.181	108.05	1007	102.181	108.21
			1008	102.355	107.32	1008	102.306	108.05	1008	102.306	108.21
			1009	102.48	107.32	1009	102.431	108.05	1009	102.431	108.21
			1010	102.605	107.32	1010	102.555	108.05	1010	102.555	108.21
			1011	102.73	107.32	1011	102.68	108.05	1011	102.68	108.21
			1012	102.855	107.32	1012	102.805	108.05	1012	102.805	108.21
			1013	102.98	107.32	1013	102.93	108.05	1013	102.93	108.21
			1014	103.105	107.32	1014	103.055	108.05	1014	103.055	108.21
			1015	103.229	107.32	1015	103.18	108.05	1015	103.18	108.21
			1016	103.354	107.32	1016	103.305	108.05	1016	103.305	108.21
			1017	103.479	107.32	1017	103.43	108.05	1017	103.43	108.21
			1018	103.604	107.31	1018	103.555	108.05	1018	103.555	108.21
			1019	103.729	107.31	1019	103.68	108.05	1019	103.68	108.21
			1020	103.854	107.31	1020	103.805	108.05	1020	103.805	108.21
			1021	103.979	107.31	1021	103.929	108.05	1021	103.929	108.21
			1022	104.104	107.31	1022	104.054	108.05	1022	104.054	108.21
			1023	104.229	107.31	1023	104.179	108.05	1023	104.179	108.21
			1024	104.354	107.31	1024	104.304	108.05	1024	104.304	108.21
			1025	104.479	107.31	1025	104.429	108.05	1025	104.429	108.21
			1026	104.603	107.31	1026	104.554	108.05	1026	104.554	108.21

			1027	104.728	107.31	1027	104.679	108.05	1027	104.679	108.21
			1028	104.853	107.31	1028	104.804	108.05	1028	104.804	108.21
			1029	104.978	107.31	1029	104.929	108.05	1029	104.929	108.21
			1030	105.103	107.31	1030	105.054	108.05	1030	105.054	108.21
			1031	105.228	107.31	1031	105.179	108.05	1031	105.179	108.21
			1032	105.353	107.31	1032	105.304	108.05	1032	105.304	108.21
			1033	105.478	107.31	1033	105.428	108.05	1033	105.428	108.21
			1034	105.603	107.31	1034	105.553	108.05	1034	105.553	108.21
			1035	105.728	107.31	1035	105.678	108.05	1035	105.678	108.21
			1036	105.853	107.31	1036	105.801	108.05	1036	105.801	108.21
			1037	105.978	107.31	1037	105.924	108.05	1037	105.924	108.21
			1038	106.101	107.31	1038	106.037	108.05	1038	106.037	108.21
			1039	106.224	107.30	1039	106.149	108.05	1039	106.149	108.21
			1040	106.336	107.30	1040	106.191	108.05	1040	106.191	108.21
			1041	106.448	107.30	1041	106.229	108.05	1041	106.229	108.21
			1042	106.491	107.30	1042	106.324	108.05	1042	106.324	108.21
			1043	106.529	107.30	1043	106.418	108.05	1043	106.418	108.21
			1044	106.623	107.30	1044	106.439	108.05	1044	106.439	108.21
			1045	106.718	107.30	1045	106.543	108.05	1045	106.543	108.21
			1046	106.738	107.30	1046	106.648	108.05	1046	106.648	108.21
			1047	106.843	107.30	1047	106.684	108.05	1047	106.684	108.21
			1048	106.947	107.30	1048	106.771	108.05	1048	106.771	108.21
			1049	106.984	107.30	1049	106.858	108.05	1049	106.858	108.21
			1050	107.07	107.30	1050	106.916	108.05	1050	106.916	108.21
			1051	107.157	107.30	1051	107	108.05	1051	107	108.21
			1052	107.215	107.30	1052	107.067	108.05	1052	107.067	108.21
			1053	107.299	107.30	1053	107.184	108.05	1053	107.184	108.21
			1054	107.366	107.30	1054	107.277	108.05	1054	107.277	108.21
			1055	107.483	107.30	1055	107.4	108.05	1055	107.4	108.21
			1056	107.576	107.30	1056	107.486	108.05	1056	107.486	108.21
			1057	107.699	107.30	1057	107.582	108.05	1057	107.582	108.21
			1058	107.785	107.30	1058	107.678	108.05	1058	107.678	108.21
			1059	107.881	107.29	1059	107.695	108.05	1059	107.695	108.21
			1060	107.978	107.29	1060	107.8	108.05	1060	107.8	108.21
			1061	107.995	107.29	1061	107.905	108.05	1061	107.905	108.21
			1062	108.099	107.29	1062	108.006	108.05	1062	108.006	108.21
			1063	108.204	107.29	1063	108.114	108.05	1063	108.114	108.21
			1064	108.305	107.29	1064	108.169	108.05	1064	108.169	108.21
			1065	108.414	107.29	1065	108.324	108.05	1065	108.324	108.21
			1066	108.469	107.29	1066	108.439	108.05	1066	108.439	108.21
			1067	108.623	107.29	1067	108.533	108.05	1067	108.533	108.21
			1068	108.738	107.29	1068	108.669	108.05	1068	108.669	108.21
			1069	108.832	107.29	1069	108.743	108.05	1069	108.743	108.21
			1070	108.969	107.29	1070	108.839	108.05	1070	108.839	108.21
			1071	109.042	107.29	1071	108.935	108.05	1071	108.935	108.21



			1072	109.138	107.29	1072	108.952	108.05	1072	108.952	108.21
			1073	109.234	107.29	1073	109.057	108.05	1073	109.057	108.21
			1074	109.251	107.29	1074	109.161	108.05	1074	109.161	108.21
			1075	109.356	107.29	1075	109.27	108.05	1075	109.27	108.21
			1076	109.461	107.29	1076	109.371	108.05	1076	109.371	108.21
			1077	109.569	107.29	1077	109.432	108.05	1077	109.432	108.21
			1078	109.67	107.29	1078	109.58	108.05	1078	109.58	108.21
			1079	109.731	107.29	1079	109.669	108.05	1079	109.669	108.21
			1080	109.88	107.29	1080	109.79	108.05	1080	109.79	108.21
			1081	109.969	107.29	1081	109.931	108.05	1081	109.931	108.21
			1082	110.089	107.29	1082	109.999	108.05	1082	109.999	108.21
			1083	110.23	107.29	1083	110.084	108.05	1083	110.084	108.21
			1084	110.298	107.29	1084	110.169	108.05	1084	110.169	108.21
			1085	110.383	107.29	1085	110.209	108.05	1085	110.209	108.21
			1086	110.468	107.29	1086	110.313	108.05	1086	110.313	108.21
			1087	110.508	107.29	1087	110.418	108.05	1087	110.418	108.21
			1088	110.613	107.29	1088	110.431	108.05	1088	110.431	108.21
			1089	110.717	107.29	1089	110.529	108.05	1089	110.529	108.21
			1090	110.73	107.29	1090	110.628	108.05	1090	110.628	108.21
			1091	110.828	107.28	1091	110.669	108.05	1091	110.669	108.21
			1092	110.927	107.28	1092	110.753	108.05	1092	110.753	108.21
			1093	110.968	107.28	1093	110.837	108.05	1093	110.837	108.21
			1094	111.052	107.28	1094	110.93	108.05	1094	110.93	108.21
			1095	111.136	107.28	1095	111.046	108.05	1095	111.046	108.21
			1096	111.229	107.28	1096	111.169	108.05	1096	111.169	108.21
			1097	111.346	107.28	1097	111.256	108.05	1097	111.256	108.21
			1098	111.468	107.28	1098	111.343	108.05	1098	111.343	108.21
			1099	111.555	107.28	1099	111.429	108.05	1099	111.429	108.21
			1100	111.642	107.28	1100	111.465	108.05	1100	111.465	108.21
			1101	111.729	107.28	1101	111.567	108.05	1101	111.567	108.21
			1102	111.765	107.28	1102	111.669	108.05	1102	111.669	108.21
			1103	111.866	107.28	1103	111.779	108.05	1103	111.779	108.21
			1104	111.968	107.28	1104	111.884	108.05	1104	111.884	108.21
			1105	112.079	107.28	1105	111.929	108.05	1105	111.929	108.21
			1106	112.183	107.28	1106	112.094	108.05	1106	112.094	108.21
			1107	112.228	107.28	1107	112.169	108.05	1107	112.169	108.21
			1108	112.393	107.28	1108	112.303	108.05	1108	112.303	108.21
			1109	112.468	107.28	1109	112.429	108.05	1109	112.429	108.21
			1110	112.602	107.28	1110	112.512	108.05	1110	112.512	108.21
			1111	112.728	107.28	1111	112.668	108.05	1111	112.668	108.21
			1112	112.812	107.28	1112	112.722	108.05	1112	112.722	108.21
			1113	112.968	107.28	1113	112.825	108.05	1113	112.825	108.21
			1114	113.021	107.28	1114	112.929	108.05	1114	112.929	108.21
			1115	113.125	107.28	1115	113.036	108.05	1115	113.036	108.21
			1116	113.228	107.28	1116	113.141	108.05	1116	113.141	108.21

			1117	113.335	107.28	1117	113.168	108.05	1117	113.168	108.21
			1118	113.44	107.28	1118	113.259	108.05	1118	113.259	108.21
			1119	113.467	107.28	1119	113.35	108.05	1119	113.35	108.21
			1120	113.558	107.28	1120	113.429	108.05	1120	113.429	108.21
			1121	113.649	107.28	1121	113.56	108.05	1121	113.56	108.21
			1122	113.728	107.28	1122	113.668	108.05	1122	113.668	108.21
			1123	113.859	107.28	1123	113.769	108.05	1123	113.769	108.21
			1124	113.967	107.28	1124	113.929	108.05	1124	113.929	108.21
			1125	114.068	107.28	1125	113.978	108.05	1125	113.978	108.21
			1126	114.228	107.28	1126	114.072	108.05	1126	114.072	108.21
			1127	114.278	107.28	1127	114.166	108.05	1127	114.166	108.21
			1128	114.372	107.28	1128	114.188	108.05	1128	114.188	108.21
			1129	114.465	107.28	1129	114.293	108.05	1129	114.293	108.21
			1130	114.487	107.28	1130	114.397	108.05	1130	114.397	108.21
			1131	114.592	107.28	1131	114.428	108.05	1131	114.428	108.21
			1132	114.697	107.28	1132	114.518	108.05	1132	114.518	108.21
			1133	114.728	107.28	1133	114.607	108.05	1133	114.607	108.21
			1134	114.817	107.28	1134	114.665	108.05	1134	114.665	108.21
			1135	114.906	107.28	1135	114.816	108.05	1135	114.816	108.21
			1136	114.964	107.28	1136	114.928	108.05	1136	114.928	108.21
			1137	115.116	107.28	1137	115.026	108.05	1137	115.026	108.21
			1138	115.228	107.28	1138	115.163	108.05	1138	115.163	108.21
			1139	115.325	107.28	1139	115.235	108.05	1139	115.235	108.21
			1140	115.462	107.28	1140	115.332	108.05	1140	115.332	108.21
			1141	115.534	107.28	1141	115.429	108.05	1141	115.429	108.21
			1142	115.631	107.28	1142	115.445	108.05	1142	115.445	108.21
			1143	115.728	107.28	1143	115.549	108.05	1143	115.549	108.21
			1144	115.744	107.28	1144	115.653	108.05	1144	115.653	108.21
			1145	115.848	107.28	1145	115.759	108.05	1145	115.759	108.21
			1146	115.952	107.28	1146	115.863	108.05	1146	115.863	108.21
			1147	116.058	107.28	1147	115.928	108.05	1147	115.928	108.21
			1148	116.163	107.28	1148	116.027	108.05	1148	116.027	108.21
			1149	116.227	107.28	1149	116.073	108.05	1149	116.073	108.21
			1150	116.326	107.28	1150	116.178	108.05	1150	116.178	108.21
			1151	116.372	107.28	1151	116.282	108.05	1151	116.282	108.21
			1152	116.477	107.28	1152	116.415	108.05	1152	116.415	108.21
			1153	116.582	107.28	1153	116.492	108.05	1153	116.492	108.21
			1154	116.714	107.28	1154	116.592	108.05	1154	116.592	108.21
			1155	116.791	107.28	1155	116.692	108.05	1155	116.692	108.21
			1156	116.891	107.28	1156	116.806	108.05	1156	116.806	108.21
			1157	116.991	107.28	1157	116.911	108.05	1157	116.911	108.21
			1158	117.105	107.28	1158	117.017	108.05	1158	117.017	108.21
			1159	117.21	107.28	1159	117.12	108.05	1159	117.12	108.21
			1160	117.316	107.28	1160	117.18	108.05	1160	117.18	108.21
			1161	117.419	107.28	1161	117.33	108.05	1161	117.33	108.21

			1162	117.479	107.28	1162	117.414	108.05	1162	117.414	108.21
			1163	117.629	107.28	1163	117.539	108.05	1163	117.539	108.21
			1164	117.713	107.28	1164	117.677	108.05	1164	117.677	108.21
			1165	117.838	107.27	1165	117.748	108.05	1165	117.748	108.21
			1166	117.976	107.28	1166	117.913	108.05	1166	117.913	108.21
			1167	118.048	107.27	1167	117.958	108.05	1167	117.958	108.21
			1168	118.213	107.27	1168	118.063	108.05	1168	118.063	108.21
			1169	118.257	107.27	1169	118.167	108.05	1169	118.167	108.21
			1170	118.362	107.27	1170	118.276	108.05	1170	118.276	108.21
			1171	118.467	107.27	1171	118.377	108.05	1171	118.377	108.21
			1172	118.576	107.27	1172	118.413	108.05	1172	118.413	108.21
			1173	118.676	107.27	1173	118.5	108.05	1173	118.5	108.21
			1174	118.713	107.27	1174	118.586	108.05	1174	118.586	108.21
			1175	118.799	107.27	1175	118.674	108.05	1175	118.674	108.21
			1176	118.885	107.27	1176	118.796	108.05	1176	118.796	108.21
			1177	118.974	107.27	1177	118.913	108.05	1177	118.913	108.21
			1178	119.095	107.27	1178	119.005	108.05	1178	119.005	108.21
			1179	119.213	107.27	1179	119.09	108.05	1179	119.09	108.21
			1180	119.304	107.27	1180	119.174	108.05	1180	119.174	108.21
			1181	119.389	107.27	1181	119.214	108.05	1181	119.214	108.21
			1182	119.474	107.27	1182	119.314	108.05	1182	119.314	108.21
			1183	119.514	107.27	1183	119.413	108.05	1183	119.413	108.21
			1184	119.613	107.27	1184	119.424	108.05	1184	119.424	108.21
			1185	119.712	107.27	1185	119.529	108.05	1185	119.529	108.21
			1186	119.723	107.27	1186	119.633	108.05	1186	119.633	108.21
			1187	119.828	107.27	1187	119.674	108.05	1187	119.674	108.21
			1188	119.933	107.27	1188	119.758	108.05	1188	119.758	108.21
			1189	119.973	107.27	1189	119.843	108.05	1189	119.843	108.21
			1190	120.058	107.27	1190	119.913	108.05	1190	119.913	108.21
			1191	120.142	107.27	1191	120	108.05	1191	120	108.21
			1192	120.212	107.27	1192	120.052	108.05	1192	120.052	108.21
			1193	120.299	107.27	1193	120.173	108.05	1193	120.173	108.21
			1194	120.351	107.27	1194	120.262	108.05	1194	120.262	108.21
			1195	120.473	107.27	1195	120.413	108.05	1195	120.413	108.21
			1196	120.561	107.27	1196	120.471	108.05	1196	120.471	108.21
			1197	120.712	107.27	1197	120.572	108.05	1197	120.572	108.21
			1198	120.77	107.27	1198	120.673	108.05	1198	120.673	108.21
			1199	120.871	107.27	1199	120.785	108.05	1199	120.785	108.21
			1200	120.973	107.27	1200	120.89	108.05	1200	120.89	108.21
			1201	121.084	107.27	1201	120.912	108.05	1201	120.912	108.21
			1202	121.189	107.27	1202	121.006	108.05	1202	121.006	108.21
			1203	121.212	107.27	1203	121.099	108.05	1203	121.099	108.21
			1204	121.305	107.27	1204	121.173	108.05	1204	121.173	108.21
			1205	121.399	107.27	1205	121.309	108.05	1205	121.309	108.21
			1206	121.472	107.27	1206	121.413	108.05	1206	121.413	108.21

			1207	121.608	107.27	1207	121.518	108.05	1207	121.518	108.21
			1208	121.712	107.27	1208	121.673	108.05	1208	121.673	108.21
			1209	121.818	107.27	1209	121.728	108.05	1209	121.728	108.21
			1210	121.972	107.27	1210	121.82	108.05	1210	121.82	108.21
			1211	122.027	107.27	1211	121.912	108.05	1211	121.912	108.21
			1212	122.119	107.27	1212	121.937	108.05	1212	121.937	108.21
			1213	122.211	107.27	1213	122.042	108.05	1213	122.042	108.21
			1214	122.236	107.27	1214	122.147	108.05	1214	122.147	108.21
			1215	122.341	107.27	1215	122.173	108.05	1215	122.173	108.21
			1216	122.446	107.27	1216	122.264	108.05	1216	122.264	108.21
			1217	122.472	107.27	1217	122.356	108.05	1217	122.356	108.21
			1218	122.564	107.27	1218	122.411	108.05	1218	122.411	108.21
			1219	122.655	107.27	1219	122.565	108.05	1219	122.565	108.21
			1220	122.71	107.27	1220	122.673	108.05	1220	122.673	108.21
			1221	122.865	107.27	1221	122.775	108.05	1221	122.775	108.21
			1222	122.972	107.27	1222	122.91	108.05	1222	122.91	108.21
			1223	123.074	107.27	1223	122.984	108.05	1223	122.984	108.21
			1224	123.21	107.27	1224	123.079	108.05	1224	123.079	108.21
			1225	123.284	107.27	1225	123.173	108.05	1225	123.173	108.21
			1226	123.378	107.27	1226	123.194	108.05	1226	123.194	108.21
			1227	123.472	107.27	1227	123.298	108.05	1227	123.298	108.21
			1228	123.493	107.27	1228	123.403	108.05	1228	123.403	108.21
			1229	123.598	107.27	1229	123.51	108.05	1229	123.51	108.21
			1230	123.702	107.27	1230	123.613	108.05	1230	123.613	108.21
			1231	123.809	107.27	1231	123.673	108.05	1231	123.673	108.21
			1232	123.912	107.27	1232	123.822	108.05	1232	123.822	108.21
			1233	123.972	107.27	1233	123.904	108.05	1233	123.904	108.21
			1234	124.121	107.27	1234	124.032	108.05	1234	124.032	108.21
			1235	124.204	107.27	1235	124.172	108.05	1235	124.172	108.21
			1236	124.331	107.27	1236	124.241	108.05	1236	124.241	108.21
			1237	124.472	107.27	1237	124.387	108.05	1237	124.387	108.21
			1238	124.54	107.27	1238	124.45	108.05	1238	124.45	108.21
			1239	124.686	107.27	1239	124.555	108.05	1239	124.555	108.21
			1240	124.75	107.27	1240	124.66	108.05	1240	124.66	108.21
			1241	124.854	107.27	1241	124.768	108.05	1241	124.768	108.21
			1242	124.959	107.27	1242	124.869	108.05	1242	124.869	108.21
			1243	125.067	107.27	1243	124.978	108.05	1243	124.978	108.21
			1244	125.169	107.27	1244	125.079	108.05	1244	125.079	108.21
			1245	125.277	107.27	1245	125.158	108.05	1245	125.158	108.21
			1246	125.378	107.27	1246	125.288	108.05	1246	125.288	108.21
			1247	125.457	107.27	1247	125.427	108.05	1247	125.427	108.21
			1248	125.587	107.27	1248	125.498	108.05	1248	125.498	108.21
			1249	125.726	107.27	1249	125.658	108.05	1249	125.658	108.21
			1250	125.797	107.27	1250	125.707	108.05	1250	125.707	108.21
			1251	125.957	107.27	1251	125.812	108.05	1251	125.812	108.21

			1252	126.006	107.27	1252	125.916	108.05	1252	125.916	108.21
			1253	126.111	107.27	1253	126.025	108.05	1253	126.025	108.21
			1254	126.216	107.27	1254	126.126	108.05	1254	126.126	108.21
			1255	126.324	107.27	1255	126.158	108.05	1255	126.158	108.21
			1256	126.425	107.27	1256	126.247	108.05	1256	126.247	108.21
			1257	126.457	107.27	1257	126.335	108.05	1257	126.335	108.21
			1258	126.546	107.27	1258	126.42	108.05	1258	126.42	108.21
			1259	126.635	107.27	1259	126.545	108.05	1259	126.545	108.21
			1260	126.719	107.27	1260	126.658	108.05	1260	126.658	108.21
			1261	126.844	107.27	1261	126.754	108.05	1261	126.754	108.21
			1262	126.957	107.27	1262	126.919	108.05	1262	126.919	108.21
			1263	127.053	107.27	1263	126.964	108.05	1263	126.964	108.21
			1264	127.219	107.27	1264	127.061	108.05	1264	127.061	108.21
			1265	127.263	107.27	1265	127.158	108.05	1265	127.158	108.21
			1266	127.36	107.27	1266	127.173	108.05	1266	127.173	108.21
			1267	127.457	107.27	1267	127.278	108.05	1267	127.278	108.21
			1268	127.472	107.27	1268	127.383	108.05	1268	127.383	108.21
			1269	127.577	107.27	1269	127.419	108.05	1269	127.419	108.21
			1270	127.682	107.27	1270	127.505	108.05	1270	127.505	108.21
			1271	127.718	107.27	1271	127.592	108.05	1271	127.592	108.21
			1272	127.805	107.27	1272	127.657	108.05	1272	127.657	108.21
			1273	127.891	107.26	1273	127.801	108.05	1273	127.801	108.21
			1274	127.957	107.26	1274	127.918	108.05	1274	127.918	108.21
			1275	128.101	107.26	1275	128.011	108.05	1275	128.011	108.21
			1276	128.217	107.26	1276	128.157	108.05	1276	128.157	108.21
			1277	128.31	107.26	1277	128.22	108.05	1277	128.22	108.21
			1278	128.457	107.26	1278	128.319	108.05	1278	128.319	108.21
			1279	128.52	107.26	1279	128.418	108.05	1279	128.418	108.21
			1280	128.618	107.26	1280	128.43	108.05	1280	128.43	108.21
			1281	128.717	107.26	1281	128.534	108.05	1281	128.534	108.21
			1282	128.729	107.26	1282	128.639	108.05	1282	128.639	108.21
			1283	128.834	107.26	1283	128.657	108.05	1283	128.657	108.21
			1284	128.938	107.26	1284	128.761	108.05	1284	128.761	108.21
			1285	128.957	107.26	1285	128.914	108.05	1285	128.914	108.21
			1286	129.06	107.26	1286	129.038	108.05	1286	129.038	108.21
			1287	129.214	107.26	1287	129.162	108.05	1287	129.162	108.21
			1288	129.338	107.26	1288	129.287	108.05	1288	129.287	108.21
			1289	129.461	107.26	1289	129.412	108.05	1289	129.412	108.21
			1290	129.586	107.26	1290	129.537	108.05	1290	129.537	108.21
			1291	129.711	107.26	1291	129.662	108.05	1291	129.662	108.21
			1292	129.836	107.26	1292	129.787	108.05	1292	129.787	108.21
			1293	129.961	107.26	1293	129.912	108.05	1293	129.912	108.21
			1294	130.086	107.26	1294	130.037	108.05	1294	130.037	108.21
			1295	130.211	107.26	1295	130.161	108.05	1295	130.161	108.21
			1296	130.336	107.26	1296	130.286	108.05	1296	130.286	108.21

			1297	130.461	107.26	1297	130.411	108.05	1297	130.411	108.21
			1298	130.586	107.26	1298	130.536	108.05	1298	130.536	108.21
			1299	130.711	107.26	1299	130.661	108.05	1299	130.661	108.21
			1300	130.835	107.26	1300	130.786	108.05	1300	130.786	108.21
			1301	130.96	107.25	1301	130.911	108.05	1301	130.911	108.21
			1302	131.085	107.25	1302	131.036	108.05	1302	131.036	108.21
			1303	131.21	107.25	1303	131.161	108.05	1303	131.161	108.21
			1304	131.335	107.25	1304	131.286	108.05	1304	131.286	108.21
			1305	131.46	107.25	1305	131.411	108.05	1305	131.411	108.21
			1306	131.585	107.25	1306	131.536	108.05	1306	131.536	108.21
			1307	131.71	107.25	1307	131.66	108.05	1307	131.66	108.21
			1308	131.835	107.25	1308	131.785	108.05	1308	131.785	108.21
			1309	131.96	107.25	1309	131.91	108.05	1309	131.91	108.21
			1310	132.085	107.25	1310	132	108.05	1310	132	108.21
			1311	132.21	107.25	1311	132.16	108.05	1311	132.16	108.21
			1312	132.299	107.25	1312	132.285	108.05	1312	132.285	108.21
			1313	132.459	107.25	1313	132.41	108.05	1313	132.41	108.21
			1314	132.584	107.24	1314	132.535	108.05	1314	132.535	108.21
			1315	132.709	107.24	1315	132.66	108.05	1315	132.66	108.21
			1316	132.834	107.24	1316	132.785	108.05	1316	132.785	108.21
			1317	132.959	107.24	1317	132.91	108.05	1317	132.91	108.21
			1318	133.084	107.24	1318	133.035	108.05	1318	133.035	108.21
			1319	133.209	107.24	1319	133.159	108.05	1319	133.159	108.21
			1320	133.334	107.24	1320	133.284	108.05	1320	133.284	108.21
			1321	133.459	107.24	1321	133.409	108.05	1321	133.409	108.21
			1322	133.584	107.24	1322	133.534	108.05	1322	133.534	108.21
			1323	133.709	107.24	1323	133.659	108.05	1323	133.659	108.21
			1324	133.833	107.24	1324	133.784	108.05	1324	133.784	108.21
			1325	133.958	107.24	1325	133.909	108.05	1325	133.909	108.21
			1326	134.083	107.24	1326	134.034	108.05	1326	134.034	108.21
			1327	134.208	107.24	1327	134.159	108.05	1327	134.159	108.21
			1328	134.333	107.24	1328	134.284	108.05	1328	134.284	108.21
			1329	134.458	107.24	1329	134.409	108.05	1329	134.409	108.21
			1330	134.583	107.24	1330	134.534	108.05	1330	134.534	108.21
			1331	134.708	107.23	1331	134.658	108.05	1331	134.658	108.21
			1332	134.833	107.23	1332	134.783	108.05	1332	134.783	108.21
			1333	134.958	107.23	1333	134.908	108.05	1333	134.908	108.21
			1334	135.083	107.23	1334	135.033	108.05	1334	135.033	108.21
			1335	135.208	107.23	1335	135.158	108.05	1335	135.158	108.21
			1336	135.332	107.23	1336	135.283	108.05	1336	135.283	108.21
			1337	135.457	107.23	1337	135.408	108.05	1337	135.408	108.21
			1338	135.582	107.23	1338	135.533	108.05	1338	135.533	108.21
			1339	135.707	107.23	1339	135.658	108.05	1339	135.658	108.21
			1340	135.832	107.23	1340	135.783	108.05	1340	135.783	108.21
			1341	135.957	107.23	1341	135.908	108.05	1341	135.908	108.21

			1342	136.082	107.23	1342	136.033	108.05	1342	136.033	108.21
			1343	136.207	107.23	1343	136.157	108.05	1343	136.157	108.21
			1344	136.332	107.23	1344	136.282	108.05	1344	136.282	108.21
			1345	136.457	107.23	1345	136.407	108.05	1345	136.407	108.21
			1346	136.582	107.23	1346	136.532	108.05	1346	136.532	108.21
			1347	136.707	107.23	1347	136.657	108.05	1347	136.657	108.21
			1348	136.831	107.23	1348	136.782	108.05	1348	136.782	108.21
			1349	136.956	107.23	1349	136.907	108.05	1349	136.907	108.21
			1350	137.081	107.22	1350	137.032	108.05	1350	137.032	108.21
			1351	137.206	107.22	1351	137.157	108.05	1351	137.157	108.21
			1352	137.331	107.22	1352	137.282	108.05	1352	137.282	108.21
			1353	137.456	107.22	1353	137.407	108.05	1353	137.407	108.21
			1354	137.581	107.22	1354	137.532	108.05	1354	137.532	108.21
			1355	137.706	107.22	1355	137.656	108.05	1355	137.656	108.21
			1356	137.831	107.22	1356	137.781	108.05	1356	137.781	108.21
			1357	137.956	107.22	1357	137.906	108.05	1357	137.906	108.21
			1358	138.081	107.22	1358	138.031	108.05	1358	138.031	108.21
			1359	138.206	107.22	1359	138.156	108.05	1359	138.156	108.21
			1360	138.33	107.22	1360	138.281	108.05	1360	138.281	108.21
			1361	138.455	107.22	1361	138.406	108.05	1361	138.406	108.21
			1362	138.58	107.22	1362	138.531	108.05	1362	138.531	108.21
			1363	138.705	107.22	1363	138.656	108.05	1363	138.656	108.21
			1364	138.83	107.22	1364	138.781	108.05	1364	138.781	108.21
			1365	138.955	107.22	1365	138.906	108.05	1365	138.906	108.21
			1366	139.08	107.22	1366	139.031	108.05	1366	139.031	108.21
			1367	139.205	107.21	1367	139.155	108.05	1367	139.155	108.21
			1368	139.33	107.21	1368	139.28	108.05	1368	139.28	108.21
			1369	139.455	107.21	1369	139.405	108.05	1369	139.405	108.21
			1370	139.58	107.21	1370	139.53	108.05	1370	139.53	108.21
			1371	139.705	107.21	1371	139.655	108.05	1371	139.655	108.21
			1372	139.829	107.21	1372	139.78	108.05	1372	139.78	108.21
			1373	139.954	107.21	1373	139.905	108.05	1373	139.905	108.21
			1374	140.079	107.21	1374	140	108.05	1374	140	108.21
			1375	140.204	107.21	1375	140.155	108.05	1375	140.155	108.21
			1376	140.299	107.21	1376	140.281	108.05	1376	140.281	108.21
			1377	140.454	107.21	1377	140.407	108.05	1377	140.407	108.21
			1378	140.58	107.21	1378	140.522	108.05	1378	140.522	108.21
			1379	140.706	107.21	1379	140.655	108.05	1379	140.655	108.21
			1380	140.822	107.21	1380	140.716	108.05	1380	140.716	108.21
			1381	140.954	107.21	1381	140.807	108.05	1381	140.807	108.21
			1382	141.015	107.21	1382	140.899	108.05	1382	140.899	108.21
			1383	141.107	107.20	1383	140.925	108.05	1383	140.925	108.21
			1384	141.198	107.20	1384	141.03	108.05	1384	141.03	108.21
			1385	141.224	107.20	1385	141.135	108.05	1385	141.135	108.21
			1386	141.329	107.20	1386	141.159	108.05	1386	141.159	108.21

			1387	141.434	107.20	1387	141.252	108.05	1387	141.252	108.21
			1388	141.459	107.20	1388	141.344	108.05	1388	141.344	108.21
			1389	141.551	107.20	1389	141.399	108.05	1389	141.399	108.21
			1390	141.643	107.20	1390	141.553	108.05	1390	141.553	108.21
			1391	141.698	107.20	1391	141.659	108.05	1391	141.659	108.21
			1392	141.853	107.20	1392	141.763	108.05	1392	141.763	108.21
			1393	141.958	107.20	1393	141.899	108.05	1393	141.899	108.21
			1394	142.062	107.20	1394	141.972	108.05	1394	141.972	108.21
			1395	142.198	107.20	1395	142.066	108.05	1395	142.066	108.21
			1396	142.272	107.20	1396	142.159	108.05	1396	142.159	108.21
			1397	142.365	107.20	1397	142.182	108.05	1397	142.182	108.21
			1398	142.458	107.20	1398	142.287	108.05	1398	142.287	108.21
			1399	142.481	107.20	1399	142.391	108.05	1399	142.391	108.21
			1400	142.586	107.20	1400	142.499	108.05	1400	142.499	108.21
			1401	142.69	107.20	1401	142.601	108.05	1401	142.601	108.21
			1402	142.798	107.20	1402	142.659	108.05	1402	142.659	108.21
			1403	142.9	107.20	1403	142.81	108.05	1403	142.81	108.21
			1404	142.958	107.20	1404	142.898	108.05	1404	142.898	108.21
			1405	143.109	107.20	1405	143.02	108.05	1405	143.02	108.21
			1406	143.197	107.20	1406	143.159	108.05	1406	143.159	108.21
			1407	143.319	107.20	1407	143.229	108.05	1407	143.229	108.21
			1408	143.458	107.20	1408	143.313	108.05	1408	143.313	108.21
			1409	143.528	107.20	1409	143.396	108.05	1409	143.396	108.21
			1410	143.612	107.20	1410	143.438	108.05	1410	143.438	108.21
			1411	143.696	107.20	1411	143.543	108.05	1411	143.543	108.21
			1412	143.738	107.20	1412	143.648	108.05	1412	143.648	108.21
			1413	143.842	107.20	1413	143.659	108.05	1413	143.659	108.21
			1414	143.947	107.20	1414	143.758	108.05	1414	143.758	108.21
			1415	143.958	107.20	1415	143.857	108.05	1415	143.857	108.21
			1416	144.057	107.20	1416	143.894	108.05	1416	143.894	108.21
			1417	144.157	107.20	1417	143.981	108.05	1417	143.981	108.21
			1418	144.194	107.20	1418	144.067	108.05	1418	144.067	108.21
			1419	144.28	107.20	1419	144.159	108.05	1419	144.159	108.21
			1420	144.366	107.20	1420	144.276	108.05	1420	144.276	108.21
			1421	144.458	107.20	1421	144.391	108.05	1421	144.391	108.21
			1422	144.575	107.20	1422	144.486	108.05	1422	144.486	108.21
			1423	144.691	107.20	1423	144.572	108.05	1423	144.572	108.21
			1424	144.785	107.20	1424	144.659	108.05	1424	144.659	108.21
			1425	144.871	107.20	1425	144.695	108.05	1425	144.695	108.21
			1426	144.958	107.20	1426	144.786	108.05	1426	144.786	108.21
			1427	144.994	107.20	1427	144.876	108.05	1427	144.876	108.21
			1428	145.085	107.20	1428	144.905	108.05	1428	144.905	108.21
			1429	145.176	107.20	1429	145.009	108.05	1429	145.009	108.21
			1430	145.204	107.20	1430	145.114	108.05	1430	145.114	108.21
			1431	145.309	107.20	1431	145.149	108.05	1431	145.149	108.21



			1432	145.413	107.20	1432	145.236	108.05	1432	145.236	108.21
			1433	145.448	107.20	1433	145.323	108.05	1433	145.323	108.21
			1434	145.535	107.20	1434	145.428	108.05	1434	145.428	108.21
			1435	145.623	107.20	1435	145.533	108.05	1435	145.533	108.21
			1436	145.727	107.20	1436	145.644	108.05	1436	145.644	108.21
			1437	145.832	107.20	1437	145.742	108.05	1437	145.742	108.21
			1438	145.944	107.20	1438	145.829	108.05	1438	145.829	108.21
			1439	146.042	107.20	1439	145.916	108.05	1439	145.916	108.21
			1440	146.128	107.20	1440	145.952	108.05	1440	145.952	108.21
			1441	146.215	107.20	1441	146.048	108.05	1441	146.048	108.21
			1442	146.251	107.20	1442	146.144	108.05	1442	146.144	108.21
			1443	146.347	107.20	1443	146.161	108.05	1443	146.161	108.21
			1444	146.443	107.20	1444	146.266	108.05	1444	146.266	108.21
			1445	146.46	107.20	1445	146.371	108.05	1445	146.371	108.21
			1446	146.565	107.20	1446	146.409	108.05	1446	146.409	108.21
			1447	146.67	107.20	1447	146.495	108.05	1447	146.495	108.21
			1448	146.709	107.20	1448	146.58	108.05	1448	146.58	108.21
			1449	146.794	107.20	1449	146.644	108.05	1449	146.644	108.21
			1450	146.879	107.20	1450	146.789	108.05	1450	146.789	108.21
			1451	146.943	107.20	1451	146.906	108.05	1451	146.906	108.21
			1452	147.089	107.20	1452	146.999	108.05	1452	146.999	108.21
			1453	147.206	107.20	1453	147.144	108.05	1453	147.144	108.21
			1454	147.298	107.20	1454	147.208	108.05	1454	147.208	108.21
			1455	147.443	107.20	1455	147.307	108.05	1455	147.307	108.21
			1456	147.508	107.20	1456	147.406	108.05	1456	147.406	108.21
			1457	147.607	107.20	1457	147.418	108.05	1457	147.418	108.21
			1458	147.705	107.20	1458	147.522	108.05	1458	147.522	108.21
			1459	147.717	107.20	1459	147.627	108.05	1459	147.627	108.21
			1460	147.822	107.19	1460	147.644	108.05	1460	147.644	108.21
			1461	147.926	107.19	1461	147.74	108.05	1461	147.74	108.21
			1462	147.943	107.19	1462	147.837	108.05	1462	147.837	108.21
			1463	148.04	107.19	1463	147.905	108.05	1463	147.905	108.21
			1464	148.136	107.19	1464	148.046	108.05	1464	148.046	108.21
			1465	148.204	107.19	1465	148.144	108.05	1465	148.144	108.21
			1466	148.345	107.19	1466	148.256	108.05	1466	148.256	108.21
			1467	148.443	107.19	1467	148.404	108.05	1467	148.404	108.21
			1468	148.555	107.19	1468	148.465	108.05	1468	148.465	108.21
			1469	148.704	107.19	1469	148.554	108.05	1469	148.554	108.21
			1470	148.764	107.19	1470	148.644	108.05	1470	148.644	108.21
			1471	148.854	107.19	1471	148.674	108.05	1471	148.674	108.21
			1472	148.943	107.19	1472	148.779	108.05	1472	148.779	108.21
			1473	148.974	107.19	1473	148.884	108.05	1473	148.884	108.21
			1474	149.078	107.19	1474	148.904	108.05	1474	148.904	108.21
			1475	149.183	107.19	1475	148.999	108.05	1475	148.999	108.21
			1476	149.204	107.19	1476	149.093	108.05	1476	149.093	108.21

			1477	149.298	107.19	1477	149.144	108.05	1477	149.144	108.21
			1478	149.393	107.19	1478	149.303	108.05	1478	149.303	108.21
			1479	149.443	107.19	1479	149.404	108.05	1479	149.404	108.21
			1480	149.602	107.19	1480	149.512	108.05	1480	149.512	108.21
			1481	149.703	107.19	1481	149.643	108.05	1481	149.643	108.21
			1482	149.811	107.19	1482	149.722	108.05	1482	149.722	108.21
			1483	149.943	107.19	1483	149.813	108.05	1483	149.813	108.21
			1484	150.021	107.19	1484	149.904	108.05	1484	149.904	108.21
			1485	150.112	107.19	1485	149.931	108.05	1485	149.931	108.21
			1486	150.203	107.19	1486	150	108.05	1486	150	108.21
			1487	150.23	107.19	1487	150.14	108.05	1487	150.14	108.21
			1488	150.3	107.19	1488	150.246	108.05	1488	150.246	108.21
			1489	150.44	107.19	1489	150.35	108.05	1489	150.35	108.21
			1490	150.546	107.19	1490	150.403	108.05	1490	150.403	108.21
			1491	150.649	107.19	1491	150.559	108.05	1491	150.559	108.21
			1492	150.703	107.19	1492	150.643	108.05	1492	150.643	108.21
			1493	150.859	107.19	1493	150.769	108.05	1493	150.769	108.21
			1494	150.942	107.19	1494	150.903	108.05	1494	150.903	108.21
			1495	151.068	107.19	1495	150.978	108.05	1495	150.978	108.21
			1496	151.203	107.19	1496	151.142	108.05	1496	151.142	108.21
			1497	151.277	107.19	1497	151.188	108.05	1497	151.188	108.21
			1498	151.441	107.19	1498	151.292	108.05	1498	151.292	108.21
			1499	151.487	107.19	1499	151.397	108.05	1499	151.397	108.21
			1500	151.592	107.19	1500	151.505	108.05	1500	151.505	108.21
			1501	151.696	107.19	1501	151.607	108.05	1501	151.607	108.21
			1502	151.804	107.19	1502	151.641	108.05	1502	151.641	108.21
			1503	151.906	107.19	1503	151.729	108.05	1503	151.729	108.21
			1504	151.941	107.19	1504	151.816	108.05	1504	151.816	108.21
			1505	152.028	107.19	1505	151.903	108.05	1505	151.903	108.21
			1506	152.115	107.19	1506	152.025	108.05	1506	152.025	108.21
			1507	152.202	107.19	1507	152.141	108.05	1507	152.141	108.21
			1508	152.325	107.19	1508	152.235	108.05	1508	152.235	108.21
			1509	152.44	107.19	1509	152.319	108.05	1509	152.319	108.21
			1510	152.534	107.19	1510	152.403	108.05	1510	152.403	108.21
			1511	152.618	107.19	1511	152.444	108.05	1511	152.444	108.21
			1512	152.702	107.19	1512	152.541	108.05	1512	152.541	108.21
			1513	152.744	107.19	1513	152.638	108.05	1513	152.638	108.21
			1514	152.84	107.19	1514	152.654	108.05	1514	152.654	108.21
			1515	152.937	107.19	1515	152.758	108.05	1515	152.758	108.21
			1516	152.953	107.19	1516	152.863	108.05	1516	152.863	108.21
			1517	153.058	107.19	1517	152.903	108.05	1517	152.903	108.21
			1518	153.162	107.19	1518	152.988	108.05	1518	152.988	108.21
			1519	153.202	107.19	1519	153.073	108.05	1519	153.073	108.21
			1520	153.287	107.19	1520	153.134	108.05	1520	153.134	108.21
			1521	153.372	107.19	1521	153.282	108.05	1521	153.282	108.21

			1522	153.433	107.19	1522	153.403	108.05	1522	153.403	108.21
			1523	153.581	107.19	1523	153.491	108.05	1523	153.491	108.21
			1524	153.702	107.19	1524	153.615	108.05	1524	153.615	108.21
			1525	153.791	107.19	1525	153.701	108.05	1525	153.701	108.21
			1526	153.914	107.19	1526	153.798	108.05	1526	153.798	108.21
			1527	154	107.19	1527	153.895	108.05	1527	153.895	108.21
			1528	154.097	107.19	1528	153.91	108.05	1528	153.91	108.21
			1529	154.194	107.19	1529	154.015	108.05	1529	154.015	108.21
			1530	154.21	107.19	1530	154.12	108.05	1530	154.12	108.21
			1531	154.314	107.19	1531	154.194	108.05	1531	154.194	108.21
			1532	154.419	107.19	1532	154.329	108.05	1532	154.329	108.21
			1533	154.493	107.19	1533	154.388	108.05	1533	154.388	108.21
			1534	154.629	107.19	1534	154.539	108.05	1534	154.539	108.21
			1535	154.688	107.19	1535	154.658	108.05	1535	154.658	108.21
			1536	154.838	107.19	1536	154.748	108.05	1536	154.748	108.21
			1537	154.957	107.19	1537	154.888	108.05	1537	154.888	108.21
			1538	155.047	107.19	1538	154.958	108.05	1538	154.958	108.21
			1539	155.188	107.19	1539	155.056	108.05	1539	155.056	108.21
			1540	155.257	107.19	1540	155.154	108.05	1540	155.154	108.21
			1541	155.355	107.19	1541	155.167	108.05	1541	155.167	108.21
			1542	155.453	107.19	1542	155.272	108.05	1542	155.272	108.21
			1543	155.466	107.19	1543	155.376	108.05	1543	155.376	108.21
			1544	155.571	107.19	1544	155.388	108.05	1544	155.388	108.21
			1545	155.676	107.19	1545	155.487	108.05	1545	155.487	108.21
			1546	155.687	107.19	1546	155.586	108.05	1546	155.586	108.21
			1547	155.786	107.19	1547	155.651	108.05	1547	155.651	108.21
			1548	155.885	107.19	1548	155.795	108.05	1548	155.795	108.21
			1549	155.95	107.19	1549	155.888	108.05	1549	155.888	108.21
			1550	156.095	107.19	1550	156.005	108.05	1550	156.005	108.21
			1551	156.187	107.19	1551	156.15	108.05	1551	156.15	108.21
			1552	156.304	107.19	1552	156.214	108.05	1552	156.214	108.21
			1553	156.449	107.19	1553	156.301	108.05	1553	156.301	108.21
			1554	156.513	107.19	1554	156.388	108.05	1554	156.388	108.21
			1555	156.6	107.19	1555	156.424	108.05	1555	156.424	108.21
			1556	156.687	107.19	1556	156.528	108.05	1556	156.528	108.21
			1557	156.723	107.19	1557	156.633	108.05	1557	156.633	108.21
			1558	156.828	107.19	1558	156.649	108.05	1558	156.649	108.21
			1559	156.932	107.19	1559	156.746	108.05	1559	156.746	108.21
			1560	156.949	107.19	1560	156.843	108.05	1560	156.843	108.21
			1561	157.045	107.19	1561	156.888	108.05	1561	156.888	108.21
			1562	157.142	107.19	1562	157.052	108.05	1562	157.052	108.21
			1563	157.187	107.18	1563	157.148	108.05	1563	157.148	108.21
			1564	157.351	107.18	1564	157.261	108.05	1564	157.261	108.21
			1565	157.448	107.18	1565	157.388	108.05	1565	157.388	108.21
			1566	157.561	107.18	1566	157.471	108.05	1566	157.471	108.21

			1567	157.687	107.18	1567	157.56	108.05	1567	157.56	108.21
			1568	157.77	107.18	1568	157.648	108.05	1568	157.648	108.21
			1569	157.859	107.18	1569	157.68	108.05	1569	157.68	108.21
			1570	157.948	107.18	1570	157.784	108.05	1570	157.784	108.21
			1571	157.98	107.18	1571	157.888	108.05	1571	157.888	108.21
			1572	158.083	107.18	1572	157.994	108.05	1572	157.994	108.21
			1573	158.187	107.18	1573	158.099	108.05	1573	158.099	108.21
			1574	158.294	107.18	1574	158.148	108.05	1574	158.148	108.21
			1575	158.398	107.18	1575	158.309	108.05	1575	158.309	108.21
			1576	158.447	107.18	1576	158.388	108.05	1576	158.388	108.21
			1577	158.608	107.18	1577	158.518	108.05	1577	158.518	108.21
			1578	158.687	107.18	1578	158.648	108.05	1578	158.648	108.21
			1579	158.817	107.18	1579	158.727	108.05	1579	158.727	108.21
			1580	158.947	107.18	1580	158.887	108.05	1580	158.887	108.21
			1581	159.027	107.18	1581	158.937	108.05	1581	158.937	108.21
			1582	159.187	107.18	1582	159.042	108.05	1582	159.042	108.21
			1583	159.236	107.18	1583	159.146	108.05	1583	159.146	108.21
			1584	159.341	107.18	1584	159.252	108.05	1584	159.252	108.21
			1585	159.446	107.18	1585	159.356	108.05	1585	159.356	108.21
			1586	159.551	107.18	1586	159.387	108.05	1586	159.387	108.21
			1587	159.655	107.18	1587	159.476	108.05	1587	159.476	108.21
			1588	159.686	107.18	1588	159.565	108.05	1588	159.565	108.21
			1589	159.775	107.18	1589	159.648	108.05	1589	159.648	108.21
			1590	159.865	107.18	1590	159.775	108.05	1590	159.775	108.21
			1591	159.947	107.18	1591	159.887	108.05	1591	159.887	108.21
			1592	160.074	107.18	1592	159.984	108.05	1592	159.984	108.21
			1593	160.186	107.18	1593	160.147	108.05	1593	160.147	108.21
			1594	160.283	107.18	1594	160.194	108.05	1594	160.194	108.21
			1595	160.447	107.18	1595	160.29	108.05	1595	160.29	108.21
			1596	160.493	107.18	1596	160.386	108.05	1596	160.386	108.21
			1597	160.589	107.17	1597	160.403	108.05	1597	160.403	108.21
			1598	160.685	107.17	1598	160.508	108.05	1598	160.508	108.21
			1599	160.702	107.17	1599	160.612	108.05	1599	160.612	108.21
			1600	160.807	107.17	1600	160.648	108.05	1600	160.648	108.21
			1601	160.912	107.17	1601	160.697	108.05	1601	160.697	108.21
			1602	160.948	107.17	1602	160.793	108.05	1602	160.793	108.21
			1603	160.996	107.17	1603	160.888	108.05	1603	160.888	108.21
			1604	161.092	107.17	1604	161	108.05	1604	161	108.21
			1605	161.188	107.17	1605	161.141	108.05	1605	161.141	108.21
			1606	161.3	107.17	1606	161.266	108.05	1606	161.266	108.21
			1607	161.44	107.17	1607	161.391	108.05	1607	161.391	108.21
			1608	161.565	107.17	1608	161.516	108.05	1608	161.516	108.21
			1609	161.69	107.16	1609	161.64	108.05	1609	161.64	108.21
			1610	161.815	107.17	1610	161.765	108.05	1610	161.765	108.21
			1611	161.94	107.16	1611	161.89	108.05	1611	161.89	108.21

			1612	162.065	107.16	1612	162.015	108.05	1612	162.015	108.21
			1613	162.19	107.16	1613	162.14	108.05	1613	162.14	108.21
			1614	162.315	107.16	1614	162.265	108.05	1614	162.265	108.21
			1615	162.439	107.16	1615	162.39	108.05	1615	162.39	108.21
			1616	162.564	107.16	1616	162.515	108.05	1616	162.515	108.21
			1617	162.689	107.16	1617	162.64	108.05	1617	162.64	108.21
			1618	162.814	107.16	1618	162.765	108.05	1618	162.765	108.21
			1619	162.939	107.16	1619	162.89	108.05	1619	162.89	108.21
			1620	163.064	107.16	1620	163.015	108.05	1620	163.015	108.21
			1621	163.189	107.16	1621	163.139	108.05	1621	163.139	108.21
			1622	163.314	107.16	1622	163.264	108.05	1622	163.264	108.21
			1623	163.439	107.16	1623	163.389	108.05	1623	163.389	108.21
			1624	163.564	107.16	1624	163.514	108.05	1624	163.514	108.21
			1625	163.689	107.15	1625	163.639	108.05	1625	163.639	108.21
			1626	163.814	107.15	1626	163.764	108.05	1626	163.764	108.21
			1627	163.938	107.15	1627	163.889	108.05	1627	163.889	108.21
			1628	164.063	107.15	1628	164.014	108.05	1628	164.014	108.21
			1629	164.188	107.15	1629	164.139	108.05	1629	164.139	108.21
			1630	164.313	107.15	1630	164.264	108.05	1630	164.264	108.21
			1631	164.438	107.15	1631	164.389	108.05	1631	164.389	108.21
			1632	164.563	107.15	1632	164.514	108.05	1632	164.514	108.21
			1633	164.688	107.15	1633	164.638	108.05	1633	164.638	108.21
			1634	164.813	107.15	1634	164.763	108.05	1634	164.763	108.21
			1635	164.938	107.15	1635	164.888	108.05	1635	164.888	108.21
			1636	165.063	107.15	1636	165.013	108.05	1636	165.013	108.21
			1637	165.188	107.15	1637	165.138	108.05	1637	165.138	108.21
			1638	165.313	107.15	1638	165.263	108.05	1638	165.263	108.21
			1639	165.437	107.15	1639	165.388	108.05	1639	165.388	108.21
			1640	165.562	107.15	1640	165.513	108.05	1640	165.513	108.21
			1641	165.687	107.15	1641	165.638	108.05	1641	165.638	108.21
			1642	165.812	107.15	1642	165.763	108.05	1642	165.763	108.21
			1643	165.937	107.15	1643	165.888	108.05	1643	165.888	108.21
			1644	166.062	107.15	1644	166.013	108.05	1644	166.013	108.21
			1645	166.187	107.14	1645	166.137	108.05	1645	166.137	108.21
			1646	166.312	107.14	1646	166.262	108.05	1646	166.262	108.21
			1647	166.437	107.14	1647	166.387	108.05	1647	166.387	108.21
			1648	166.562	107.14	1648	166.512	108.05	1648	166.512	108.21
			1649	166.687	107.14	1649	166.637	108.05	1649	166.637	108.21
			1650	166.812	107.14	1650	166.762	108.05	1650	166.762	108.21
			1651	166.936	107.14	1651	166.887	108.05	1651	166.887	108.21
			1652	167.061	107.14	1652	167.012	108.05	1652	167.012	108.21
			1653	167.186	107.14	1653	167.137	108.05	1653	167.137	108.21
			1654	167.311	107.14	1654	167.262	108.05	1654	167.262	108.21
			1655	167.436	107.14	1655	167.387	108.05	1655	167.387	108.21
			1656	167.561	107.14	1656	167.512	108.05	1656	167.512	108.21

			1657	167.686	107.14	1657	167.636	108.05	1657	167.636	108.21
			1658	167.811	107.14	1658	167.761	108.05	1658	167.761	108.21
			1659	167.936	107.14	1659	167.886	108.05	1659	167.886	108.21
			1660	168.061	107.14	1660	168.011	108.05	1660	168.011	108.21
			1661	168.186	107.14	1661	168.136	108.05	1661	168.136	108.21
			1662	168.311	107.14	1662	168.261	108.05	1662	168.261	108.21
			1663	168.435	107.14	1663	168.386	108.05	1663	168.386	108.21
			1664	168.56	107.13	1664	168.511	108.05	1664	168.511	108.21
			1665	168.685	107.13	1665	168.636	108.05	1665	168.636	108.21
			1666	168.81	107.13	1666	168.761	108.05	1666	168.761	108.21
			1667	168.935	107.13	1667	168.886	108.05	1667	168.886	108.21
			1668	169.06	107.13	1668	169.001	108.05	1668	169.001	108.21
			1669	169.185	107.13	1669	169.135	108.05	1669	169.135	108.21
			1670	169.3	107.13	1670	169.26	108.05	1670	169.26	108.21
			1671	169.435	107.13	1671	169.385	108.05	1671	169.385	108.21
			1672	169.56	107.13	1672	169.51	108.05	1672	169.51	108.21
			1673	169.685	107.13	1673	169.635	108.05	1673	169.635	108.21
			1674	169.809	107.13	1674	169.76	108.05	1674	169.76	108.21
			1675	169.934	107.13	1675	169.885	108.05	1675	169.885	108.21
			1676	170.059	107.13	1676	170.01	108.05	1676	170.01	108.21
			1677	170.184	107.13	1677	170.135	108.05	1677	170.135	108.21
			1678	170.309	107.13	1678	170.26	108.05	1678	170.26	108.21
			1679	170.434	107.13	1679	170.385	108.05	1679	170.385	108.21
			1680	170.559	107.13	1680	170.51	108.05	1680	170.51	108.21
			1681	170.684	107.13	1681	170.634	108.05	1681	170.634	108.21
			1682	170.809	107.13	1682	170.759	108.05	1682	170.759	108.21
			1683	170.934	107.13	1683	170.884	108.05	1683	170.884	108.21
			1684	171.059	107.13	1684	171.012	108.05	1684	171.012	108.21
			1685	171.184	107.13	1685	171.141	108.05	1685	171.141	108.21
			1686	171.312	107.13	1686	171.205	108.05	1686	171.205	108.21
			1687	171.44	107.13	1687	171.268	108.05	1687	171.268	108.21
			1688	171.504	107.13	1688	171.383	108.05	1688	171.383	108.21
			1689	171.567	107.13	1689	171.477	108.05	1689	171.477	108.21
			1690	171.683	107.13	1690	171.628	108.05	1690	171.628	108.21
			1691	171.777	107.13	1691	171.687	108.05	1691	171.687	108.21
			1692	171.928	107.13	1692	171.789	108.05	1692	171.789	108.21
			1693	171.986	107.13	1693	171.891	108.05	1693	171.891	108.21
			1694	172.088	107.13	1694	172.001	108.05	1694	172.001	108.21
			1695	172.19	107.13	1695	172.106	108.05	1695	172.106	108.21
			1696	172.3	107.13	1696	172.127	108.05	1696	172.127	108.21
			1697	172.405	107.13	1697	172.221	108.05	1697	172.221	108.21
			1698	172.427	107.13	1698	172.315	108.05	1698	172.315	108.21
			1699	172.52	107.13	1699	172.389	108.05	1699	172.389	108.21
			1700	172.614	107.13	1700	172.524	108.05	1700	172.524	108.21
			1701	172.688	107.13	1701	172.627	108.05	1701	172.627	108.21

			1702	172.824	107.13	1702	172.734	108.05	1702	172.734	108.21
			1703	172.926	107.13	1703	172.888	108.05	1703	172.888	108.21
			1704	173.033	107.13	1704	172.943	108.05	1704	172.943	108.21
			1705	173.188	107.13	1705	173.035	108.05	1705	173.035	108.21
			1706	173.243	107.13	1706	173.127	108.05	1706	173.127	108.21
			1707	173.334	107.13	1707	173.153	108.05	1707	173.153	108.21
			1708	173.426	107.13	1708	173.257	108.05	1708	173.257	108.21
			1709	173.452	107.13	1709	173.362	108.05	1709	173.362	108.21
			1710	173.557	107.13	1710	173.388	108.05	1710	173.388	108.21
			1711	173.661	107.13	1711	173.48	108.05	1711	173.48	108.21
			1712	173.687	107.13	1712	173.572	108.05	1712	173.572	108.21
			1713	173.779	107.12	1713	173.627	108.05	1713	173.627	108.21
			1714	173.871	107.12	1714	173.781	108.05	1714	173.781	108.21
			1715	173.926	107.12	1715	173.887	108.05	1715	173.887	108.21
			1716	174.08	107.12	1716	173.991	108.05	1716	173.991	108.21
			1717	174.187	107.12	1717	174.127	108.05	1717	174.127	108.21
			1718	174.29	107.12	1718	174.2	108.05	1718	174.2	108.21
			1719	174.426	107.12	1719	174.294	108.05	1719	174.294	108.21
			1720	174.499	107.12	1720	174.387	108.05	1720	174.387	108.21
			1721	174.593	107.12	1721	174.409	108.05	1721	174.409	108.21
			1722	174.687	107.12	1722	174.514	108.05	1722	174.514	108.21
			1723	174.709	107.12	1723	174.619	108.05	1723	174.619	108.21
			1724	174.813	107.12	1724	174.727	108.05	1724	174.727	108.21
			1725	174.918	107.12	1725	174.828	108.05	1725	174.828	108.21
			1726	175.027	107.12	1726	174.887	108.05	1726	174.887	108.21
			1727	175.128	107.12	1727	175.038	108.05	1727	175.038	108.21
			1728	175.186	107.12	1728	175.126	108.05	1728	175.126	108.21
			1729	175.337	107.12	1729	175.247	108.05	1729	175.247	108.21
			1730	175.426	107.12	1730	175.387	108.05	1730	175.387	108.21
			1731	175.546	107.12	1731	175.457	108.05	1731	175.457	108.21
			1732	175.686	107.12	1732	175.541	108.05	1732	175.541	108.21
			1733	175.756	107.12	1733	175.626	108.05	1733	175.626	108.21
			1734	175.841	107.12	1734	175.666	108.05	1734	175.666	108.21
			1735	175.925	107.12	1735	175.771	108.05	1735	175.771	108.21
			1736	175.965	107.12	1736	175.875	108.05	1736	175.875	108.21
			1737	176.07	107.12	1737	175.887	108.05	1737	175.887	108.21
			1738	176.175	107.12	1738	175.986	108.05	1738	175.986	108.21
			1739	176.186	107.12	1739	176.085	108.05	1739	176.085	108.21
			1740	176.285	107.12	1740	176.125	108.05	1740	176.125	108.21
			1741	176.384	107.12	1741	176.21	108.05	1741	176.21	108.21
			1742	176.425	107.12	1742	176.294	108.05	1742	176.294	108.21
			1743	176.509	107.12	1743	176.387	108.05	1743	176.387	108.21
			1744	176.594	107.12	1744	176.504	108.05	1744	176.504	108.21
			1745	176.686	107.12	1745	176.625	108.05	1745	176.625	108.21
			1746	176.803	107.12	1746	176.713	108.05	1746	176.713	108.21

			1747	176.924	107.12	1747	176.8	108.05	1747	176.8	108.21
			1748	177.013	107.12	1748	176.886	108.05	1748	176.886	108.21
			1749	177.099	107.12	1749	176.923	108.05	1749	176.923	108.21
			1750	177.186	107.12	1750	177.023	108.05	1750	177.023	108.21
			1751	177.222	107.12	1751	177.123	108.05	1751	177.123	108.21
			1752	177.322	107.12	1752	177.237	108.05	1752	177.237	108.21
			1753	177.422	107.12	1753	177.342	108.05	1753	177.342	108.21
			1754	177.536	107.12	1754	177.386	108.05	1754	177.386	108.21
			1755	177.641	107.12	1755	177.551	108.05	1755	177.551	108.21
			1756	177.686	107.12	1756	177.622	108.05	1756	177.622	108.21
			1757	177.85	107.12	1757	177.76	108.05	1757	177.76	108.21
			1758	177.921	107.12	1758	177.886	108.05	1758	177.886	108.21
			1759	178.06	107.12	1759	177.97	108.05	1759	177.97	108.21
			1760	178.186	107.12	1760	178.116	108.05	1760	178.116	108.21
			1761	178.269	107.12	1761	178.179	108.05	1761	178.179	108.21
			1762	178.415	107.12	1762	178.283	108.05	1762	178.283	108.21
			1763	178.479	107.12	1763	178.387	108.05	1763	178.387	108.21
			1764	178.582	107.12	1764	178.48	108.05	1764	178.48	108.21
			1765	178.686	107.12	1765	178.571	108.05	1765	178.571	108.21
			1766	178.779	107.12	1766	178.598	108.05	1766	178.598	108.21
			1767	178.87	107.12	1767	178.703	108.05	1767	178.703	108.21
			1768	178.897	107.12	1768	178.808	108.05	1768	178.808	108.21
			1769	179.002	107.12	1769	178.876	108.05	1769	178.876	108.21
			1770	179.107	107.12	1770	179.017	108.05	1770	179.017	108.21
			1771	179.175	107.12	1771	179.062	108.05	1771	179.062	108.21
			1772	179.316	107.12	1772	179.226	108.05	1772	179.226	108.21
			1773	179.361	107.12	1773	179.372	108.05	1773	179.372	108.21
			1774	179.526	107.12	1774	179.436	108.05	1774	179.436	108.21
			1775	179.671	107.12	1775	179.538	108.05	1775	179.538	108.21
			1776	179.735	107.12	1776	179.641	108.05	1776	179.641	108.21
			1777	179.837	107.12	1777	179.75	108.05	1777	179.75	108.21
			1778	179.94	107.12	1778	179.855	108.05	1778	179.855	108.21
			1779	180.049	107.12	1779	179.871	108.05	1779	179.871	108.21
			1780	180.154	107.12	1780	180.001	108.05	1780	180.001	108.21
			1781	180.171	107.12	1781	180.064	108.05	1781	180.064	108.21
			1782	180.3	107.12	1782	180.135	108.05	1782	180.135	108.21
			1783	180.363	107.12	1783	180.274	108.05	1783	180.274	108.21
			1784	180.434	107.12	1784	180.371	108.05	1784	180.371	108.21
			1785	180.573	107.12	1785	180.483	108.05	1785	180.483	108.21
			1786	180.671	107.12	1786	180.634	108.05	1786	180.634	108.21
			1787	180.782	107.12	1787	180.693	108.05	1787	180.693	108.21
			1788	180.933	107.12	1788	180.782	108.05	1788	180.782	108.21
			1789	180.992	107.12	1789	180.871	108.05	1789	180.871	108.21
			1790	181.081	107.12	1790	180.902	108.05	1790	180.902	108.21
			1791	181.171	107.12	1791	181.007	108.05	1791	181.007	108.21



			1792	181.201	107.12	1792	181.111	108.05	1792	181.111	108.21
			1793	181.306	107.12	1793	181.133	108.05	1793	181.133	108.21
			1794	181.411	107.12	1794	181.227	108.05	1794	181.227	108.21
			1795	181.432	107.12	1795	181.321	108.05	1795	181.321	108.21
			1796	181.526	107.12	1796	181.371	108.05	1796	181.371	108.21
			1797	181.62	107.12	1797	181.53	108.05	1797	181.53	108.21
			1798	181.671	107.12	1798	181.632	108.05	1798	181.632	108.21
			1799	181.83	107.12	1799	181.74	108.05	1799	181.74	108.21
			1800	181.931	107.12	1800	181.871	108.05	1800	181.871	108.21
			1801	182.039	107.12	1801	181.949	108.05	1801	181.949	108.21
			1802	182.17	107.12	1802	182.041	108.05	1802	182.041	108.21
			1803	182.248	107.12	1803	182.132	108.05	1803	182.132	108.21
			1804	182.34	107.12	1804	182.159	108.05	1804	182.159	108.21
			1805	182.431	107.12	1805	182.263	108.05	1805	182.263	108.21
			1806	182.458	107.12	1806	182.368	108.05	1806	182.368	108.21
			1807	182.563	107.12	1807	182.474	108.05	1807	182.474	108.21
			1808	182.667	107.12	1808	182.577	108.05	1808	182.577	108.21
			1809	182.773	107.12	1809	182.631	108.05	1809	182.631	108.21
			1810	182.877	107.12	1810	182.787	108.05	1810	182.787	108.21
			1811	182.931	107.12	1811	182.871	108.05	1811	182.871	108.21
			1812	183.086	107.12	1812	182.996	108.05	1812	182.996	108.21
			1813	183.17	107.12	1813	183.131	108.05	1813	183.131	108.21
			1814	183.296	107.12	1814	183.206	108.05	1814	183.206	108.21
			1815	183.43	107.12	1815	183.371	108.05	1815	183.371	108.21
			1816	183.505	107.12	1816	183.415	108.05	1816	183.415	108.21
			1817	183.67	107.12	1817	183.52	108.05	1817	183.52	108.21
			1818	183.714	107.12	1818	183.625	108.05	1818	183.625	108.21
			1819	183.819	107.12	1819	183.733	108.05	1819	183.733	108.21
			1820	183.924	107.12	1820	183.834	108.05	1820	183.834	108.21
			1821	184.032	107.12	1821	183.87	108.05	1821	183.87	108.21
			1822	184.133	107.12	1822	183.957	108.05	1822	183.957	108.21
			1823	184.169	107.12	1823	184.044	108.05	1823	184.044	108.21
			1824	184.256	107.12	1824	184.131	108.05	1824	184.131	108.21
			1825	184.343	107.12	1825	184.253	108.05	1825	184.253	108.21
			1826	184.43	107.12	1826	184.37	108.05	1826	184.37	108.21
			1827	184.552	107.12	1827	184.462	108.05	1827	184.462	108.21
			1828	184.669	107.12	1828	184.547	108.05	1828	184.547	108.21
			1829	184.762	107.12	1829	184.631	108.05	1829	184.631	108.21
			1830	184.846	107.12	1830	184.672	108.05	1830	184.672	108.21
			1831	184.93	107.12	1831	184.77	108.05	1831	184.77	108.21
			1832	184.971	107.12	1832	184.869	108.05	1832	184.869	108.21
			1833	185.07	107.12	1833	184.881	108.05	1833	184.881	108.21
			1834	185.168	107.12	1834	184.986	108.05	1834	184.986	108.21
			1835	185.181	107.12	1835	185.091	108.05	1835	185.091	108.21
			1836	185.285	107.12	1836	185.131	108.05	1836	185.131	108.21

			1837	185.39	107.12	1837	185.215	108.05	1837	185.215	108.21
			1838	185.43	107.12	1838	185.3	108.05	1838	185.3	108.21
			1839	185.515	107.12	1839	185.369	108.05	1839	185.369	108.21
			1840	185.599	107.12	1840	185.51	108.05	1840	185.51	108.21
			1841	185.668	107.12	1841	185.631	108.05	1841	185.631	108.21
			1842	185.809	107.12	1842	185.719	108.05	1842	185.719	108.21
			1843	185.93	107.12	1843	185.867	108.05	1843	185.867	108.21
			1844	186.018	107.12	1844	185.928	108.05	1844	185.928	108.21
			1845	186.166	107.12	1845	186.03	108.05	1845	186.03	108.21
			1846	186.228	107.12	1846	186.131	108.05	1846	186.131	108.21
			1847	186.329	107.12	1847	186.243	108.05	1847	186.243	108.21
			1848	186.43	107.12	1848	186.347	108.05	1848	186.347	108.21
			1849	186.542	107.12	1849	186.362	108.05	1849	186.362	108.21
			1850	186.647	107.12	1850	186.46	108.05	1850	186.46	108.21
			1851	186.662	107.12	1851	186.557	108.05	1851	186.557	108.21
			1852	186.759	107.12	1852	186.63	108.05	1852	186.63	108.21
			1853	186.856	107.12	1853	186.766	108.05	1853	186.766	108.21
			1854	186.93	107.12	1854	186.851	108.05	1854	186.851	108.21
			1855	187.066	107.12	1855	186.976	108.05	1855	186.976	108.21
			1856	187.151	107.11	1856	187.128	108.05	1856	187.128	108.21
			1857	187.275	107.11	1857	187.185	108.05	1857	187.185	108.21
			1858	187.427	107.11	1858	187.29	108.05	1858	187.29	108.21
			1859	187.484	107.11	1859	187.395	108.05	1859	187.395	108.21
			1860	187.589	107.11	1860	187.536	108.05	1860	187.536	108.21
			1861	187.694	107.11	1861	187.604	108.05	1861	187.604	108.21
			1862	187.835	107.11	1862	187.616	108.05	1862	187.616	108.21
			1863	187.903	107.11	1863	187.714	108.05	1863	187.714	108.21
			1864	187.915	107.11	1864	187.813	108.05	1864	187.813	108.21
			1865	188.014	107.11	1865	187.887	108.05	1865	187.887	108.21
			1866	188.113	107.11	1866	188.023	108.05	1866	188.023	108.21
			1867	188.186	107.11	1867	188.116	108.05	1867	188.116	108.21
			1868	188.322	107.11	1868	188.232	108.05	1868	188.232	108.21
			1869	188.415	107.11	1869	188.381	108.05	1869	188.381	108.21
			1870	188.532	107.11	1870	188.442	108.05	1870	188.442	108.21
			1871	188.68	107.11	1871	188.529	108.05	1871	188.529	108.21
			1872	188.741	107.11	1872	188.616	108.05	1872	188.616	108.21
			1873	188.828	107.11	1873	188.651	108.05	1873	188.651	108.21
			1874	188.915	107.11	1874	188.756	108.05	1874	188.756	108.21
			1875	188.95	107.11	1875	188.861	108.05	1875	188.861	108.21
			1876	189.055	107.11	1876	188.879	108.05	1876	188.879	108.21
			1877	189.16	107.11	1877	188.975	108.05	1877	188.975	108.21
			1878	189.178	107.11	1878	189.07	108.05	1878	189.07	108.21
			1879	189.274	107.11	1879	189.116	108.05	1879	189.116	108.21
			1880	189.369	107.11	1880	189.279	108.05	1880	189.279	108.21
			1881	189.415	107.11	1881	189.377	108.05	1881	189.377	108.21

			1882	189.579	107.11	1882	189.489	108.05	1882	189.489	108.21
			1883	189.676	107.11	1883	189.615	108.05	1883	189.615	108.21
			1884	189.788	107.11	1884	189.698	108.05	1884	189.698	108.21
			1885	189.915	107.11	1885	189.788	108.05	1885	189.788	108.21
			1886	189.998	107.11	1886	189.877	108.05	1886	189.877	108.21
			1887	190.087	107.11	1887	189.908	108.05	1887	189.908	108.21
			1888	190.176	107.11	1888	190.012	108.05	1888	190.012	108.21
			1889	190.207	107.11	1889	190.115	108.05	1889	190.115	108.21
			1890	190.311	107.11	1890	190.222	108.05	1890	190.222	108.21
			1891	190.415	107.11	1891	190.327	108.05	1891	190.327	108.21
			1892	190.521	107.11	1892	190.376	108.05	1892	190.376	108.21
			1893	190.626	107.11	1893	190.536	108.05	1893	190.536	108.21
			1894	190.675	107.11	1894	190.615	108.05	1894	190.615	108.21
			1895	190.835	107.11	1895	190.746	108.05	1895	190.746	108.21
			1896	190.915	107.11	1896	190.876	108.05	1896	190.876	108.21
			1897	191.045	107.11	1897	190.955	108.05	1897	190.955	108.21
			1898	191.175	107.11	1898	191.115	108.05	1898	191.115	108.21
			1899	191.254	107.11	1899	191.164	108.05	1899	191.164	108.21
			1900	191.414	107.11	1900	191.269	108.05	1900	191.269	108.21
			1901	191.464	107.11	1901	191.374	108.05	1901	191.374	108.21
			1902	191.568	107.11	1902	191.48	108.05	1902	191.48	108.21
			1903	191.673	107.11	1903	191.583	108.05	1903	191.583	108.21
			1904	191.779	107.11	1904	191.615	108.05	1904	191.615	108.21
			1905	191.883	107.10	1905	191.704	108.05	1905	191.704	108.21
			1906	191.914	107.10	1906	191.793	108.05	1906	191.793	108.21
			1907	192.003	107.10	1907	191.875	108.05	1907	191.875	108.21
			1908	192.092	107.10	1908	192.002	108.05	1908	192.002	108.21
			1909	192.175	107.10	1909	192.115	108.05	1909	192.115	108.21
			1910	192.301	107.10	1910	192.212	108.05	1910	192.212	108.21
			1911	192.414	107.10	1911	192.375	108.05	1911	192.375	108.21
			1912	192.511	107.10	1912	192.421	108.05	1912	192.421	108.21
			1913	192.674	107.10	1913	192.518	108.05	1913	192.518	108.21
			1914	192.72	107.10	1914	192.614	108.05	1914	192.614	108.21
			1915	192.817	107.10	1915	192.63	108.05	1915	192.63	108.21
			1916	192.913	107.10	1916	192.735	108.05	1916	192.735	108.21
			1917	192.93	107.10	1917	192.84	108.05	1917	192.84	108.21
			1918	193.034	107.10	1918	192.869	108.05	1918	192.869	108.21
			1919	193.139	107.10	1919	192.959	108.05	1919	192.959	108.21
			1920	193.168	107.10	1920	193.049	108.05	1920	193.049	108.21
			1921	193.258	107.10	1921	193.137	108.05	1921	193.137	108.21
			1922	193.349	107.10	1922	193.148	108.05	1922	193.148	108.21
			1923	193.436	107.10	1923	193.254	108.05	1923	193.254	108.21
			1924	193.448	107.10	1924	193.36	108.05	1924	193.36	108.21
			1925	193.554	107.10	1925	193.49	108.05	1925	193.49	108.21
			1926	193.66	107.10	1926	193.619	108.05	1926	193.619	108.21

			1927	193.789	107.10	1927	193.744	108.05	1927	193.744	108.21
			1928	193.918	107.10	1928	193.869	108.05	1928	193.869	108.21
			1929	194.043	107.10	1929	193.994	108.05	1929	193.994	108.21
			1930	194.168	107.10	1930	194.118	108.05	1930	194.118	108.21
			1931	194.293	107.10	1931	194.243	108.05	1931	194.243	108.21
			1932	194.418	107.09	1932	194.368	108.05	1932	194.368	108.21
			1933	194.543	107.09	1933	194.493	108.05	1933	194.493	108.21
			1934	194.668	107.09	1934	194.618	108.05	1934	194.618	108.21
			1935	194.792	107.09	1935	194.743	108.05	1935	194.743	108.21
			1936	194.917	107.09	1936	194.868	108.05	1936	194.868	108.21
			1937	195.042	107.09	1937	195.001	108.05	1937	195.001	108.21
			1938	195.167	107.09	1938	195.118	108.05	1938	195.118	108.21
			1939	195.3	107.09	1939	195.243	108.05	1939	195.243	108.21
			1940	195.417	107.09	1940	195.368	108.05	1940	195.368	108.21
			1941	195.542	107.09	1941	195.493	108.05	1941	195.493	108.21
			1942	195.667	107.08	1942	195.617	108.05	1942	195.617	108.21
			1943	195.792	107.08	1943	195.742	108.05	1943	195.742	108.21
			1944	195.917	107.08	1944	195.867	108.05	1944	195.867	108.21
			1945	196.042	107.08	1945	195.992	108.05	1945	195.992	108.21
			1946	196.167	107.08	1946	196.117	108.05	1946	196.117	108.21
			1947	196.291	107.08	1947	196.242	108.05	1947	196.242	108.21
			1948	196.416	107.08	1948	196.367	108.05	1948	196.367	108.21
			1949	196.541	107.08	1949	196.492	108.05	1949	196.492	108.21
			1950	196.666	107.08	1950	196.617	108.05	1950	196.617	108.21
			1951	196.791	107.08	1951	196.742	108.05	1951	196.742	108.21
			1952	196.916	107.08	1952	196.867	108.05	1952	196.867	108.21
			1953	197.041	107.08	1953	196.992	108.05	1953	196.992	108.21
			1954	197.166	107.08	1954	197.116	108.05	1954	197.116	108.21
			1955	197.291	107.08	1955	197.241	108.05	1955	197.241	108.21
			1956	197.416	107.08	1956	197.366	108.05	1956	197.366	108.21
			1957	197.541	107.08	1957	197.491	108.05	1957	197.491	108.21
			1958	197.666	107.08	1958	197.616	108.05	1958	197.616	108.21
			1959	197.79	107.08	1959	197.741	108.05	1959	197.741	108.21
			1960	197.915	107.07	1960	197.866	108.05	1960	197.866	108.21
			1961	198.04	107.07	1961	197.991	108.05	1961	197.991	108.21
			1962	198.165	107.07	1962	198.116	108.05	1962	198.116	108.21
			1963	198.29	107.07	1963	198.241	108.05	1963	198.241	108.21
			1964	198.415	107.07	1964	198.366	108.05	1964	198.366	108.21
			1965	198.54	107.07	1965	198.491	108.05	1965	198.491	108.21
			1966	198.665	107.07	1966	198.615	108.05	1966	198.615	108.21
			1967	198.79	107.07	1967	198.74	108.05	1967	198.74	108.21
			1968	198.915	107.07	1968	198.865	108.05	1968	198.865	108.21
			1969	199.04	107.07	1969	198.99	108.05	1969	198.99	108.21
			1970	199.165	107.07	1970	199.115	108.05	1970	199.115	108.21
			1971	199.289	107.07	1971	199.24	108.05	1971	199.24	108.21

			1972	199.414	107.07	1972	199.365	108.05	1972	199.365	108.21
			1973	199.539	107.07	1973	199.49	108.05	1973	199.49	108.21
			1974	199.664	107.07	1974	199.615	108.05	1974	199.615	108.21
			1975	199.789	107.07	1975	199.74	108.05	1975	199.74	108.21
			1976	199.914	107.07	1976	199.865	108.05	1976	199.865	108.21
			1977	200.039	107.07	1977	199.99	108.05	1977	199.99	108.21
			1978	200.164	107.07	1978	200.114	108.05	1978	200.114	108.21
			1979	200.289	107.07	1979	200.239	108.05	1979	200.239	108.21
			1980	200.414	107.06	1980	200.364	108.05	1980	200.364	108.21
			1981	200.539	107.06	1981	200.489	108.05	1981	200.489	108.21
			1982	200.664	107.06	1982	200.614	108.05	1982	200.614	108.21
			1983	200.788	107.06	1983	200.739	108.05	1983	200.739	108.21
			1984	200.913	107.06	1984	200.864	108.05	1984	200.864	108.21
			1985	201.038	107.06	1985	200.989	108.05	1985	200.989	108.21
			1986	201.163	107.06	1986	201.114	108.05	1986	201.114	108.21
			1987	201.288	107.06	1987	201.239	108.05	1987	201.239	108.21
			1988	201.413	107.06	1988	201.364	108.05	1988	201.364	108.21
			1989	201.538	107.06	1989	201.489	108.05	1989	201.489	108.21
			1990	201.663	107.06	1990	201.613	108.05	1990	201.613	108.21
			1991	201.788	107.06	1991	201.738	108.05	1991	201.738	108.21
			1992	201.913	107.06	1992	201.863	108.05	1992	201.863	108.21
			1993	202.038	107.06	1993	201.988	108.05	1993	201.988	108.21
			1994	202.163	107.06	1994	202.113	108.05	1994	202.113	108.21
			1995	202.287	107.06	1995	202.238	108.05	1995	202.238	108.21
			1996	202.412	107.06	1996	202.363	108.05	1996	202.363	108.21
			1997	202.537	107.05	1997	202.488	108.05	1997	202.488	108.21
			1998	202.662	107.05	1998	202.613	108.05	1998	202.613	108.21
			1999	202.787	107.05	1999	202.738	108.05	1999	202.738	108.21
			2000	202.912	107.05	2000	202.863	108.05	2000	202.863	108.21
			2001	203.037	107.05	2001	203.001	108.05	2001	203.001	108.21
			2002	203.162	107.05	2002	203.112	108.05	2002	203.112	108.21
			2003	203.3	107.05	2003	203.237	108.05	2003	203.237	108.21
			2004	203.412	107.05	2004	203.362	108.05	2004	203.362	108.21
			2005	203.537	107.05	2005	203.487	108.05	2005	203.487	108.21
			2006	203.662	107.05	2006	203.612	108.05	2006	203.612	108.21
			2007	203.786	107.05	2007	203.736	108.05	2007	203.736	108.21
			2008	203.911	107.05	2008	203.861	108.05	2008	203.861	108.21
			2009	204.036	107.05	2009	203.989	108.05	2009	203.989	108.21
			2010	204.16	107.05	2010	204.117	108.05	2010	204.117	108.21
			2011	204.288	107.05	2011	204.132	108.05	2011	204.132	108.21
			2012	204.417	107.05	2012	204.23	108.05	2012	204.23	108.21
			2013	204.432	107.05	2013	204.356	108.05	2013	204.356	108.21
			2014	204.529	107.05	2014	204.439	108.05	2014	204.439	108.21
			2015	204.655	107.05	2015	204.528	108.05	2015	204.528	108.21
			2016	204.738	107.05	2016	204.617	108.05	2016	204.617	108.21

			2017	204.827	107.05	2017	204.648	108.05	2017	204.648	108.21
			2018	204.916	107.05	2018	204.752	108.05	2018	204.752	108.21
			2019	204.948	107.05	2019	204.856	108.05	2019	204.856	108.21
			2020	205.051	107.05	2020	204.963	108.05	2020	204.963	108.21
			2021	205.155	107.05	2021	205.067	108.05	2021	205.067	108.21
			2022	205.262	107.05	2022	205.117	108.05	2022	205.117	108.21
			2023	205.367	107.05	2023	205.277	108.05	2023	205.277	108.21
			2024	205.416	107.05	2024	205.356	108.05	2024	205.356	108.21
			2025	205.576	107.05	2025	205.486	108.05	2025	205.486	108.21
			2026	205.655	107.05	2026	205.616	108.05	2026	205.616	108.21
			2027	205.785	107.05	2027	205.696	108.05	2027	205.696	108.21
			2028	205.916	107.05	2028	205.855	108.05	2028	205.855	108.21
			2029	205.995	107.05	2029	205.905	108.05	2029	205.905	108.21
			2030	206.155	107.05	2030	206.01	108.05	2030	206.01	108.21
			2031	206.204	107.05	2031	206.114	108.05	2031	206.114	108.21
			2032	206.309	107.05	2032	206.22	108.05	2032	206.22	108.21
			2033	206.414	107.05	2033	206.324	108.05	2033	206.324	108.21
			2034	206.519	107.05	2034	206.354	108.05	2034	206.354	108.21
			2035	206.623	107.05	2035	206.444	108.05	2035	206.444	108.21
			2036	206.654	107.05	2036	206.533	108.05	2036	206.533	108.21
			2037	206.743	107.05	2037	206.616	108.05	2037	206.616	108.21
			2038	206.833	107.05	2038	206.743	108.05	2038	206.743	108.21
			2039	206.916	107.05	2039	206.854	108.05	2039	206.854	108.21
			2040	207.042	107.05	2040	206.952	108.05	2040	206.952	108.21
			2041	207.153	107.05	2041	207.116	108.05	2041	207.116	108.21
			2042	207.251	107.05	2042	207.162	108.05	2042	207.162	108.21
			2043	207.415	107.05	2043	207.256	108.05	2043	207.256	108.21
			2044	207.461	107.05	2044	207.351	108.05	2044	207.351	108.21
			2045	207.555	107.05	2045	207.371	108.05	2045	207.371	108.21
			2046	207.65	107.05	2046	207.476	108.05	2046	207.476	108.21
			2047	207.67	107.05	2047	207.58	108.05	2047	207.58	108.21
			2048	207.775	107.05	2048	207.616	108.05	2048	207.616	108.21
			2049	207.88	107.05	2049	207.703	108.05	2049	207.703	108.21
			2050	207.915	107.05	2050	207.79	108.05	2050	207.79	108.21
			2051	208.002	107.05	2051	207.846	108.05	2051	207.846	108.21
			2052	208.089	107.05	2052	207.999	108.05	2052	207.999	108.21
			2053	208.145	107.05	2053	208.116	108.05	2053	208.116	108.21
			2054	208.299	107.05	2054	208.209	108.05	2054	208.209	108.21
			2055	208.415	107.05	2055	208.313	108.05	2055	208.313	108.21
			2056	208.508	107.05	2056	208.418	108.05	2056	208.418	108.21
			2057	208.613	107.05	2057	208.515	108.05	2057	208.515	108.21
			2058	208.718	107.05	2058	208.611	108.05	2058	208.611	108.21
			2059	208.814	107.05	2059	208.628	108.05	2059	208.628	108.21
			2060	208.91	107.05	2060	208.727	108.05	2060	208.727	108.21
			2061	208.927	107.05	2061	208.827	108.05	2061	208.827	108.21

			2062	209.027	107.05	2062	208.837	108.05	2062	208.837	108.21
			2063	209.126	107.05	2063	208.942	108.05	2063	208.942	108.21
			2064	209.136	107.05	2064	209.047	108.05	2064	209.047	108.21
			2065	209.241	107.05	2065	209.102	108.05	2065	209.102	108.21
			2066	209.346	107.05	2066	209.256	108.05	2066	209.256	108.21
			2067	209.401	107.05	2067	209.369	108.05	2067	209.369	108.21
			2068	209.555	107.05	2068	209.465	108.05	2068	209.465	108.21
			2069	209.669	107.05	2069	209.602	108.05	2069	209.602	108.21
			2070	209.765	107.05	2070	209.675	108.05	2070	209.675	108.21
			2071	209.901	107.05	2071	209.771	108.05	2071	209.771	108.21
			2072	209.974	107.05	2072	209.866	108.05	2072	209.866	108.21
			2073	210.07	107.05	2073	209.884	108.05	2073	209.884	108.21
			2074	210.165	107.05	2074	210.001	108.05	2074	210.001	108.21
			2075	210.184	107.05	2075	210.094	108.05	2075	210.094	108.21
			2076	210.3	107.05	2076	210.202	108.05	2076	210.202	108.21
			2077	210.393	107.05	2077	210.303	108.05	2077	210.303	108.21
			2078	210.501	107.05	2078	210.364	108.05	2078	210.364	108.21
			2079	210.602	107.05	2079	210.513	108.05	2079	210.513	108.21
			2080	210.663	107.05	2080	210.601	108.05	2080	210.601	108.21
			2081	210.812	107.05	2081	210.722	108.05	2081	210.722	108.21
			2082	210.901	107.05	2082	210.863	108.05	2082	210.863	108.21
			2083	211.021	107.05	2083	210.931	108.05	2083	210.931	108.21
			2084	211.162	107.05	2084	211.016	108.05	2084	211.016	108.21
			2085	211.231	107.05	2085	211.101	108.05	2085	211.101	108.21
			2086	211.316	107.05	2086	211.141	108.05	2086	211.141	108.21
			2087	211.4	107.05	2087	211.246	108.05	2087	211.246	108.21
			2088	211.44	107.05	2088	211.35	108.05	2088	211.35	108.21
			2089	211.545	107.05	2089	211.362	108.05	2089	211.362	108.21
			2090	211.65	107.05	2090	211.461	108.05	2090	211.461	108.21
			2091	211.662	107.05	2091	211.56	108.05	2091	211.56	108.21
			2092	211.76	107.05	2092	211.601	108.05	2092	211.601	108.21
			2093	211.859	107.05	2093	211.685	108.05	2093	211.685	108.21
			2094	211.9	107.05	2094	211.769	108.05	2094	211.769	108.21
			2095	211.984	107.05	2095	211.861	108.05	2095	211.861	108.21
			2096	212.068	107.05	2096	211.979	108.05	2096	211.979	108.21
			2097	212.161	107.05	2097	212.101	108.05	2097	212.101	108.21
			2098	212.278	107.05	2098	212.188	108.05	2098	212.188	108.21
			2099	212.4	107.04	2099	212.275	108.05	2099	212.275	108.21
			2100	212.487	107.04	2100	212.361	108.05	2100	212.361	108.21
			2101	212.574	107.04	2101	212.398	108.05	2101	212.398	108.21
			2102	212.661	107.04	2102	212.499	108.05	2102	212.499	108.21
			2103	212.697	107.04	2103	212.601	108.05	2103	212.601	108.21
			2104	212.798	107.04	2104	212.712	108.05	2104	212.712	108.21
			2105	212.9	107.04	2105	212.816	108.05	2105	212.816	108.21
			2106	213.011	107.04	2106	212.861	108.05	2106	212.861	108.21

			2107	213.116	107.04	2107	213.026	108.05	2107	213.026	108.21
			2108	213.16	107.04	2108	213.101	108.05	2108	213.101	108.21
			2109	213.325	107.04	2109	213.235	108.05	2109	213.235	108.21
			2110	213.4	107.04	2110	213.361	108.05	2110	213.361	108.21
			2111	213.535	107.04	2111	213.445	108.05	2111	213.445	108.21
			2112	213.66	107.04	2112	213.6	108.05	2112	213.6	108.21
			2113	213.744	107.04	2113	213.654	108.05	2113	213.654	108.21
			2114	213.9	107.04	2114	213.757	108.05	2114	213.757	108.21
			2115	213.953	107.04	2115	213.861	108.05	2115	213.861	108.21
			2116	214.057	107.04	2116	213.968	108.05	2116	213.968	108.21
			2117	214.16	107.04	2117	214.073	108.05	2117	214.073	108.21
			2118	214.268	107.04	2118	214.1	108.05	2118	214.1	108.21
			2119	214.372	107.04	2119	214.191	108.05	2119	214.191	108.21
			2120	214.399	107.04	2120	214.282	108.05	2120	214.282	108.21
			2121	214.49	107.04	2121	214.361	108.05	2121	214.361	108.21
			2122	214.582	107.04	2122	214.492	108.05	2122	214.492	108.21
			2123	214.66	107.04	2123	214.6	108.05	2123	214.6	108.21
			2124	214.791	107.04	2124	214.701	108.05	2124	214.701	108.21
			2125	214.899	107.04	2125	214.86	108.05	2125	214.86	108.21
			2126	215.001	107.04	2126	214.911	108.05	2126	214.911	108.21
			2127	215.16	107.04	2127	215.004	108.05	2127	215.004	108.21
			2128	215.21	107.04	2128	215.098	108.05	2128	215.098	108.21
			2129	215.304	107.04	2129	215.12	108.05	2129	215.12	108.21
			2130	215.397	107.04	2130	215.225	108.05	2130	215.225	108.21
			2131	215.419	107.04	2131	215.33	108.05	2131	215.33	108.21
			2132	215.524	107.04	2132	215.36	108.05	2132	215.36	108.21
			2133	215.629	107.04	2133	215.45	108.05	2133	215.45	108.21
			2134	215.66	107.04	2134	215.539	108.05	2134	215.539	108.21
			2135	215.749	107.04	2135	215.597	108.05	2135	215.597	108.21
			2136	215.838	107.04	2136	215.748	108.05	2136	215.748	108.21
			2137	215.896	107.04	2137	215.86	108.05	2137	215.86	108.21
			2138	216.048	107.04	2138	215.958	108.05	2138	215.958	108.21
			2139	216.159	107.04	2139	216.095	108.05	2139	216.095	108.21
			2140	216.257	107.04	2140	216.167	108.05	2140	216.167	108.21
			2141	216.394	107.04	2141	216.264	108.05	2141	216.264	108.21
			2142	216.467	107.04	2142	216.36	108.05	2142	216.36	108.21
			2143	216.563	107.04	2143	216.377	108.05	2143	216.377	108.21
			2144	216.66	107.04	2144	216.481	108.05	2144	216.481	108.21
			2145	216.676	107.04	2145	216.586	108.05	2145	216.586	108.21
			2146	216.78	107.04	2146	216.691	108.05	2146	216.691	108.21
			2147	216.885	107.04	2147	216.796	108.05	2147	216.796	108.21
			2148	216.99	107.04	2148	216.86	108.05	2148	216.86	108.21
			2149	217.095	107.04	2149	216.994	108.05	2149	216.994	108.21
			2150	217.159	107.04	2150	217.005	108.05	2150	217.005	108.21
			2151	217.293	107.04	2151	217.11	108.05	2151	217.11	108.21



			2152	217.304	107.04	2152	217.215	108.05	2152	217.215	108.21
			2153	217.409	107.04	2153	217.358	108.05	2153	217.358	108.21
			2154	217.514	107.04	2154	217.424	108.05	2154	217.424	108.21
			2155	217.657	107.04	2155	217.462	108.05	2155	217.462	108.21
			2156	217.723	107.04	2156	217.548	108.05	2156	217.548	108.21
			2157	217.761	107.04	2157	217.633	108.05	2157	217.633	108.21
			2158	217.847	107.04	2158	217.738	108.05	2158	217.738	108.21
			2159	217.933	107.04	2159	217.843	108.05	2159	217.843	108.21
			2160	218.037	107.04	2160	217.949	108.05	2160	217.949	108.21
			2161	218.142	107.04	2161	218.052	108.05	2161	218.052	108.21
			2162	218.248	107.04	2162	218.112	108.05	2162	218.112	108.21
			2163	218.352	107.04	2163	218.262	108.05	2163	218.262	108.21
			2164	218.412	107.04	2164	218.346	108.05	2164	218.346	108.21
			2165	218.561	107.04	2165	218.471	108.05	2165	218.471	108.21
			2166	218.645	107.04	2166	218.609	108.05	2166	218.609	108.21
			2167	218.77	107.04	2167	218.681	108.05	2167	218.681	108.21
			2168	218.908	107.04	2168	218.846	108.05	2168	218.846	108.21
			2169	218.98	107.04	2169	218.89	108.05	2169	218.89	108.21
			2170	219.145	107.04	2170	218.995	108.05	2170	218.995	108.21
			2171	219.189	107.04	2171	219.1	108.05	2171	219.1	108.21
			2172	219.294	107.04	2172	219.209	108.05	2172	219.209	108.21
			2173	219.399	107.04	2173	219.309	108.05	2173	219.309	108.21
			2174	219.508	107.04	2174	219.345	108.05	2174	219.345	108.21
			2175	219.608	107.04	2175	219.432	108.05	2175	219.432	108.21
			2176	219.645	107.04	2176	219.518	108.05	2176	219.518	108.21
			2177	219.731	107.04	2177	219.606	108.05	2177	219.606	108.21
			2178	219.818	107.04	2178	219.728	108.05	2178	219.728	108.21
			2179	219.906	107.04	2179	219.845	108.05	2179	219.845	108.21
			2180	220.027	107.04	2180	219.937	108.05	2180	219.937	108.21
			2181	220.145	107.04	2181	220.022	108.05	2181	220.022	108.21
			2182	220.237	107.04	2182	220.106	108.05	2182	220.106	108.21
			2183	220.321	107.04	2183	220.147	108.05	2183	220.147	108.21
			2184	220.405	107.04	2184	220.246	108.05	2184	220.246	108.21
			2185	220.446	107.03	2185	220.345	108.05	2185	220.345	108.21
			2186	220.545	107.03	2186	220.356	108.05	2186	220.356	108.21
			2187	220.645	107.03	2187	220.461	108.05	2187	220.461	108.21
			2188	220.655	107.03	2188	220.566	108.05	2188	220.566	108.21
			2189	220.76	107.03	2189	220.606	108.05	2189	220.606	108.21
			2190	220.865	107.03	2190	220.69	108.05	2190	220.69	108.21
			2191	220.905	107.03	2191	220.775	108.05	2191	220.775	108.21
			2192	220.99	107.03	2192	220.845	108.05	2192	220.845	108.21
			2193	221.074	107.03	2193	220.984	108.05	2193	220.984	108.21
			2194	221.144	107.03	2194	221.105	108.05	2194	221.105	108.21
			2195	221.284	107.03	2195	221.194	108.05	2195	221.194	108.21
			2196	221.405	107.03	2196	221.345	108.05	2196	221.345	108.21

			2197	221.493	107.03	2197	221.403	108.05	2197	221.403	108.21
			2198	221.644	107.03	2198	221.504	108.05	2198	221.504	108.21
			2199	221.703	107.03	2199	221.605	108.05	2199	221.605	108.21
			2200	221.804	107.03	2200	221.718	108.05	2200	221.718	108.21
			2201	221.905	107.03	2201	221.822	108.05	2201	221.822	108.21
			2202	222.017	107.03	2202	221.845	108.05	2202	221.845	108.21
			2203	222.121	107.03	2203	221.938	108.05	2203	221.938	108.21
			2204	222.144	107.03	2204	222.032	108.05	2204	222.032	108.21
			2205	222.237	107.03	2205	222.105	108.05	2205	222.105	108.21
			2206	222.331	107.03	2206	222.241	108.05	2206	222.241	108.21
			2207	222.404	107.03	2207	222.345	108.05	2207	222.345	108.21
			2208	222.54	107.03	2208	222.451	108.05	2208	222.451	108.21
			2209	222.644	107.03	2209	222.605	108.05	2209	222.605	108.21
			2210	222.75	107.03	2210	222.66	108.05	2210	222.66	108.21
			2211	222.904	107.03	2211	222.752	108.05	2211	222.752	108.21
			2212	222.959	107.03	2212	222.844	108.05	2212	222.844	108.21
			2213	223.051	107.03	2213	222.869	108.05	2213	222.869	108.21
			2214	223.143	107.03	2214	222.974	108.05	2214	222.974	108.21
			2215	223.169	107.03	2215	223.079	108.05	2215	223.079	108.21
			2216	223.273	107.03	2216	223.105	108.05	2216	223.105	108.21
			2217	223.378	107.03	2217	223.196	108.05	2217	223.196	108.21
			2218	223.404	107.03	2218	223.288	108.05	2218	223.288	108.21
			2219	223.496	107.03	2219	223.343	108.05	2219	223.343	108.21
			2220	223.588	107.03	2220	223.498	108.05	2220	223.498	108.21
			2221	223.643	107.03	2221	223.586	108.05	2221	223.586	108.21
			2222	223.797	107.03	2222	223.707	108.05	2222	223.707	108.21
			2223	223.885	107.03	2223	223.771	108.05	2223	223.771	108.21
			2224	224.006	107.03	2224	223.871	108.05	2224	223.871	108.21
			2225	224.07	107.03	2225	224.001	108.05	2225	224.001	108.21
			2226	224.17	107.03	2226	224.092	108.05	2226	224.092	108.21
			2227	224.3	107.02	2227	224.22	108.05	2227	224.22	108.21
			2228	224.391	107.02	2228	224.348	108.05	2228	224.348	108.21
			2229	224.519	107.02	2229	224.473	108.05	2229	224.473	108.21
			2230	224.647	107.02	2230	224.598	108.05	2230	224.598	108.21
			2231	224.772	107.02	2231	224.723	108.05	2231	224.723	108.21
			2232	224.897	107.02	2232	224.848	108.05	2232	224.848	108.21
			2233	225.022	107.02	2233	224.973	108.05	2233	224.973	108.21
			2234	225.147	107.02	2234	225.098	108.05	2234	225.098	108.21
			2235	225.272	107.02	2235	225.223	108.05	2235	225.223	108.21
			2236	225.397	107.02	2236	225.347	108.05	2236	225.347	108.21
			2237	225.522	107.02	2237	225.472	108.05	2237	225.472	108.21
			2238	225.647	107.02	2238	225.597	108.05	2238	225.597	108.21
			2239	225.772	107.02	2239	225.722	108.05	2239	225.722	108.21
			2240	225.896	107.02	2240	225.847	108.05	2240	225.847	108.21
			2241	226.021	107.02	2241	225.972	108.05	2241	225.972	108.21

			2242	226.146	107.02	2242	226.097	108.05	2242	226.097	108.21
			2243	226.271	107.02	2243	226.222	108.05	2243	226.222	108.21
			2244	226.396	107.02	2244	226.347	108.05	2244	226.347	108.21
			2245	226.521	107.02	2245	226.472	108.05	2245	226.472	108.21
			2246	226.646	107.02	2246	226.597	108.05	2246	226.597	108.21
			2247	226.771	107.02	2247	226.722	108.05	2247	226.722	108.21
			2248	226.896	107.02	2248	226.846	108.05	2248	226.846	108.21
			2249	227.021	107.02	2249	226.971	108.05	2249	226.971	108.21
			2250	227.146	107.02	2250	227.096	108.05	2250	227.096	108.21
			2251	227.271	107.02	2251	227.221	108.05	2251	227.221	108.21
			2252	227.395	107.02	2252	227.346	108.05	2252	227.346	108.21
			2253	227.52	107.02	2253	227.471	108.05	2253	227.471	108.21
			2254	227.645	107.02	2254	227.596	108.05	2254	227.596	108.21
			2255	227.77	107.02	2255	227.721	108.05	2255	227.721	108.21
			2256	227.895	107.01	2256	227.846	108.05	2256	227.846	108.21
			2257	228.02	107.01	2257	227.971	108.05	2257	227.971	108.21
			2258	228.145	107.01	2258	228.096	108.05	2258	228.096	108.21
			2259	228.27	107.01	2259	228.221	108.05	2259	228.221	108.21
			2260	228.395	107.01	2260	228.345	108.05	2260	228.345	108.21
			2261	228.52	107.01	2261	228.47	108.05	2261	228.47	108.21
			2262	228.645	107.01	2262	228.595	108.05	2262	228.595	108.21
			2263	228.77	107.01	2263	228.72	108.05	2263	228.72	108.21
			2264	228.894	107.01	2264	228.845	108.05	2264	228.845	108.21
			2265	229.019	107.01	2265	228.97	108.05	2265	228.97	108.21
			2266	229.144	107.01	2266	229.095	108.05	2266	229.095	108.21
			2267	229.269	107.01	2267	229.22	108.05	2267	229.22	108.21
			2268	229.394	107.01	2268	229.345	108.05	2268	229.345	108.21
			2269	229.519	107.01	2269	229.47	108.05	2269	229.47	108.21
			2270	229.644	107.01	2270	229.595	108.05	2270	229.595	108.21
			2271	229.769	107.01	2271	229.72	108.05	2271	229.72	108.21
			2272	229.894	107.01	2272	229.844	108.05	2272	229.844	108.21
			2273	230.019	107.01	2273	229.969	108.05	2273	229.969	108.21
			2274	230.144	107.01	2274	230.094	108.05	2274	230.094	108.21
			2275	230.269	107.01	2275	230.219	108.05	2275	230.219	108.21
			2276	230.393	107.01	2276	230.344	108.05	2276	230.344	108.21
			2277	230.518	107.01	2277	230.469	108.05	2277	230.469	108.21
			2278	230.643	107.01	2278	230.594	108.05	2278	230.594	108.21
			2279	230.768	107.01	2279	230.719	108.05	2279	230.719	108.21
			2280	230.893	107.01	2280	230.844	108.05	2280	230.844	108.21
			2281	231.018	107.01	2281	230.969	108.05	2281	230.969	108.21
			2282	231.143	107.01	2282	231.094	108.05	2282	231.094	108.21
			2283	231.268	107.01	2283	231.218	108.05	2283	231.218	108.21
			2284	231.393	107.01	2284	231.343	108.05	2284	231.343	108.21
			2285	231.518	107.01	2285	231.468	108.05	2285	231.468	108.21
			2286	231.643	107.01	2286	231.593	108.05	2286	231.593	108.21

			2287	231.768	107.01	2287	231.718	108.05	2287	231.718	108.21
			2288	231.892	107.01	2288	231.843	108.05	2288	231.843	108.21
			2289	232.017	107.01	2289	231.968	108.05	2289	231.968	108.21
			2290	232.142	107.01	2290	232.093	108.05	2290	232.093	108.21
			2291	232.267	107.01	2291	232.218	108.05	2291	232.218	108.21
			2292	232.392	107.01	2292	232.343	108.05	2292	232.343	108.21
			2293	232.517	107.01	2293	232.468	108.05	2293	232.468	108.21
			2294	232.642	107.01	2294	232.593	108.05	2294	232.593	108.21
			2295	232.767	107.01	2295	232.717	108.05	2295	232.717	108.21
			2296	232.892	107.00	2296	232.842	108.05	2296	232.842	108.21
			2297	233.017	107.00	2297	232.967	108.05	2297	232.967	108.21
			2298	233.142	107.00	2298	233.092	108.05	2298	233.092	108.21
			2299	233.267	107.00	2299	233.217	108.05	2299	233.217	108.21
			2300	233.391	107.00	2300	233.342	108.05	2300	233.342	108.21
			2301	233.516	107.00	2301	233.467	108.05	2301	233.467	108.21
			2302	233.641	107.00	2302	233.592	108.05	2302	233.592	108.21
			2303	233.766	107.00	2303	233.717	108.05	2303	233.717	108.21
			2304	233.891	107.00	2304	233.842	108.05	2304	233.842	108.21
			2305	234.016	107.00	2305	234.001	108.05	2305	234.001	108.21
			2306	234.141	107.00	2306	234.092	108.05	2306	234.092	108.21
			2307	234.3	107.00	2307	234.216	108.05	2307	234.216	108.21
			2308	234.391	107.00	2308	234.341	108.05	2308	234.341	108.21
			2309	234.516	107.00	2309	234.466	108.05	2309	234.466	108.21
			2310	234.641	107.00	2310	234.591	108.05	2310	234.591	108.21
			2311	234.766	107.00	2311	234.716	108.05	2311	234.716	108.21
			2312	234.89	107.00	2312	234.841	108.05	2312	234.841	108.21
			2313	235.015	107.00	2313	234.966	108.05	2313	234.966	108.21
			2314	235.14	107.00	2314	235.091	108.05	2314	235.091	108.21
			2315	235.265	107.00	2315	235.216	108.05	2315	235.216	108.21
			2316	235.39	107.00	2316	235.341	108.05	2316	235.341	108.21
			2317	235.515	107.00	2317	235.465	108.05	2317	235.465	108.21
			2318	235.64	107.00	2318	235.59	108.05	2318	235.59	108.21
			2319	235.765	107.00	2319	235.677	108.05	2319	235.677	108.21
			2320	235.889	107.00	2320	235.765	108.05	2320	235.765	108.21
			2321	235.977	107.00	2321	235.844	108.05	2321	235.844	108.21
			2322	236.064	107.00	2322	235.899	108.05	2322	235.899	108.21
			2323	236.143	107.00	2323	235.992	108.05	2323	235.992	108.21
			2324	236.198	107.00	2324	236.085	108.05	2324	236.085	108.21
			2325	236.291	107.00	2325	236.109	108.05	2325	236.109	108.21
			2326	236.384	107.00	2326	236.213	108.05	2326	236.213	108.21
			2327	236.408	107.00	2327	236.318	108.05	2327	236.318	108.21
			2328	236.513	107.00	2328	236.346	108.05	2328	236.346	108.21
			2329	236.617	107.00	2329	236.437	108.05	2329	236.437	108.21
			2330	236.645	107.00	2330	236.528	108.05	2330	236.528	108.21
			2331	236.736	107.00	2331	236.585	108.05	2331	236.585	108.21

			2332	236.827	107.00	2332	236.737	108.05	2332	236.737	108.21
			2333	236.884	107.00	2333	236.845	108.05	2333	236.845	108.21
			2334	237.036	107.00	2334	236.946	108.05	2334	236.946	108.21
			2335	237.145	107.00	2335	237.085	108.05	2335	237.085	108.21
			2336	237.246	107.00	2336	237.156	108.05	2336	237.156	108.21
			2337	237.384	107.00	2337	237.251	108.05	2337	237.251	108.21
			2338	237.455	107.00	2338	237.345	108.05	2338	237.345	108.21
			2339	237.55	107.00	2339	237.365	108.05	2339	237.365	108.21
			2340	237.645	107.00	2340	237.47	108.05	2340	237.47	108.21
			2341	237.665	107.00	2341	237.575	108.05	2341	237.575	108.21
			2342	237.769	107.00	2342	237.684	108.05	2342	237.684	108.21
			2343	237.874	107.00	2343	237.784	108.05	2343	237.784	108.21
			2344	237.983	107.00	2344	237.845	108.05	2344	237.845	108.21
			2345	238.083	107.00	2345	237.994	108.05	2345	237.994	108.21
			2346	238.145	107.00	2346	238.083	108.05	2346	238.083	108.21
			2347	238.293	107.00	2347	238.203	108.05	2347	238.203	108.21
			2348	238.382	107.00	2348	238.345	108.05	2348	238.345	108.21
			2349	238.502	107.00	2349	238.412	108.05	2349	238.412	108.21
			2350	238.644	107.00	2350	238.497	108.05	2350	238.497	108.21
			2351	238.712	107.00	2351	238.581	108.05	2351	238.581	108.21
			2352	238.796	107.00	2352	238.622	108.05	2352	238.622	108.21
			2353	238.88	107.00	2353	238.727	108.05	2353	238.727	108.21
			2354	238.921	107.00	2354	238.831	108.05	2354	238.831	108.21
			2355	239.026	107.00	2355	238.845	108.05	2355	238.845	108.21
			2356	239.131	107.00	2356	238.943	108.05	2356	238.943	108.21
			2357	239.145	107.00	2357	239.041	108.05	2357	239.041	108.21
			2358	239.242	107.00	2358	239.076	108.05	2358	239.076	108.21
			2359	239.34	107.00	2359	239.163	108.05	2359	239.163	108.21
			2360	239.376	107.00	2360	239.25	108.05	2360	239.25	108.21
			2361	239.463	107.00	2361	239.345	108.05	2361	239.345	108.21
			2362	239.55	107.00	2362	239.46	108.05	2362	239.46	108.21
			2363	239.644	107.00	2363	239.561	108.05	2363	239.561	108.21
			2364	239.759	107.00	2364	239.669	108.05	2364	239.669	108.21
			2365	239.86	107.00	2365	239.754	108.05	2365	239.754	108.21
			2366	239.968	107.00	2366	239.84	108.05	2366	239.84	108.21
			2367	240.054	107.00	2367	239.879	108.05	2367	239.879	108.21
			2368	240.139	107.00	2368	239.983	108.05	2368	239.983	108.21
			2369	240.178	107.00	2369	240.088	108.05	2369	240.088	108.21
			2370	240.283	107.00	2370	240.181	108.05	2370	240.181	108.21
			2371	240.387	107.00	2371	240.297	108.05	2371	240.297	108.21
			2372	240.48	107.00	2372	240.33	108.05	2372	240.33	108.21
			2373	240.597	107.00	2373	240.419	108.05	2373	240.419	108.21
			2374	240.629	107.00	2374	240.507	108.05	2374	240.507	108.21
			2375	240.718	107.00	2375	240.6	108.05	2375	240.6	108.21
			2376	240.806	107.00	2376	240.716	108.05	2376	240.716	108.21

			2377	240.899	107.00	2377	240.83	108.05	2377	240.83	108.21
			2378	241.016	107.00	2378	240.926	108.05	2378	240.926	108.21
			2379	241.13	107.00	2379	241.011	108.05	2379	241.011	108.21
			2380	241.225	107.00	2380	241.095	108.05	2380	241.095	108.21
			2381	241.31	107.00	2381	241.135	108.05	2381	241.135	108.21
			2382	241.395	107.00	2382	241.233	108.05	2382	241.233	108.21
			2383	241.434	107.00	2383	241.33	108.05	2383	241.33	108.21
			2384	241.532	107.00	2384	241.345	108.05	2384	241.345	108.21
			2385	241.629	107.00	2385	241.449	108.05	2385	241.449	108.21
			2386	241.644	107.00	2386	241.554	108.05	2386	241.554	108.21
			2387	241.749	107.00	2387	241.593	108.05	2387	241.593	108.21
			2388	241.853	107.00	2388	241.678	108.05	2388	241.678	108.21
			2389	241.892	107.00	2389	241.763	108.05	2389	241.763	108.21
			2390	241.978	107.00	2390	241.83	108.05	2390	241.83	108.21
			2391	242.063	107.00	2391	241.973	108.05	2391	241.973	108.21
			2392	242.129	107.00	2392	242.091	108.05	2392	242.091	108.21
			2393	242.272	107.00	2393	242.182	108.05	2393	242.182	108.21
			2394	242.391	107.00	2394	242.33	108.05	2394	242.33	108.21
			2395	242.482	107.00	2395	242.392	108.05	2395	242.392	108.21
			2396	242.629	107.00	2396	242.492	108.05	2396	242.492	108.21
			2397	242.691	107.00	2397	242.592	108.05	2397	242.592	108.21
			2398	242.791	107.00	2398	242.706	108.05	2398	242.706	108.21
			2399	242.891	107.00	2399	242.811	108.05	2399	242.811	108.21
			2400	243.005	107.00	2400	242.83	108.05	2400	242.83	108.21
			2401	243.11	107.00	2401	242.925	108.05	2401	242.925	108.21
			2402	243.129	107.00	2402	243.02	108.05	2402	243.02	108.21
			2403	243.224	107.00	2403	243.09	108.05	2403	243.09	108.21
			2404	243.319	107.00	2404	243.229	108.05	2404	243.229	108.21
			2405	243.39	107.00	2405	243.33	108.05	2405	243.33	108.21
			2406	243.529	107.00	2406	243.439	108.05	2406	243.439	108.21
			2407	243.629	107.00	2407	243.59	108.05	2407	243.59	108.21
			2408	243.738	107.00	2408	243.648	108.05	2408	243.648	108.21
			2409	243.889	107.00	2409	243.739	108.05	2409	243.739	108.21
			2410	243.948	107.00	2410	243.83	108.05	2410	243.83	108.21
			2411	244.038	107.00	2411	243.858	108.05	2411	243.858	108.21
			2412	244.129	107.00	2412	243.963	108.05	2412	243.963	108.21
			2413	244.157	107.00	2413	244.067	108.05	2413	244.067	108.21
			2414	244.262	107.00	2414	244.09	108.05	2414	244.09	108.21
			2415	244.367	107.00	2415	244.183	108.05	2415	244.183	108.21
			2416	244.389	107.00	2416	244.277	108.05	2416	244.277	108.21
			2417	244.483	107.00	2417	244.33	108.05	2417	244.33	108.21
			2418	244.576	107.00	2418	244.486	108.05	2418	244.486	108.21
			2419	244.629	107.00	2419	244.59	108.05	2419	244.59	108.21
			2420	244.785	107.00	2420	244.696	108.05	2420	244.696	108.21
			2421	244.889	107.00	2421	244.829	108.05	2421	244.829	108.21

			2422	244.995	107.00	2422	244.905	108.05	2422	244.905	108.21
			2423	245.129	107.00	2423	245.001	108.05	2423	245.001	108.21
			2424	245.204	107.00	2424	245.09	108.05	2424	245.09	108.21
			2425	245.3	107.00	2425	245.114	108.05	2425	245.114	108.21
			2426	245.389	107.00	2426	245.219	108.05	2426	245.219	108.21
			2427	245.414	107.00	2427	245.324	108.05	2427	245.324	108.21
			2428	245.518	107.00	2428	245.431	108.05	2428	245.431	108.21
			2429	245.623	107.00	2429	245.533	108.05	2429	245.533	108.21
			2430	245.73	107.00	2430	245.59	108.05	2430	245.59	108.21
			2431	245.833	107.00	2431	245.743	108.05	2431	245.743	108.21
			2432	245.889	107.00	2432	245.829	108.05	2432	245.829	108.21
			2433	246.042	107.00	2433	245.952	108.05	2433	245.952	108.21
			2434	246.128	107.00	2434	246.089	108.05	2434	246.089	108.21
			2435	246.251	107.00	2435	246.162	108.05	2435	246.162	108.21
			2436	246.389	107.00	2436	246.327	108.05	2436	246.327	108.21
			2437	246.461	107.00	2437	246.371	108.05	2437	246.371	108.21
			2438	246.627	107.00	2438	246.476	108.05	2438	246.476	108.21
			2439	246.67	107.00	2439	246.58	108.05	2439	246.58	108.21
			2440	246.775	107.00	2440	246.69	108.05	2440	246.69	108.21
			2441	246.88	107.00	2441	246.79	108.05	2441	246.79	108.21
			2442	246.989	107.00	2442	246.826	108.05	2442	246.826	108.21
			2443	247.089	107.00	2443	246.913	108.05	2443	246.913	108.21
			2444	247.125	107.00	2444	246.999	108.05	2444	246.999	108.21
			2445	247.212	107.00	2445	247.089	108.05	2445	247.089	108.21
			2446	247.299	107.00	2446	247.209	108.05	2446	247.209	108.21
			2447	247.389	107.00	2447	247.324	108.05	2447	247.324	108.21
			2448	247.508	107.00	2448	247.418	108.05	2448	247.418	108.21
			2449	247.623	107.00	2449	247.504	108.05	2449	247.504	108.21
			2450	247.717	107.00	2450	247.589	108.05	2450	247.589	108.21
			2451	247.803	107.00	2451	247.628	108.05	2451	247.628	108.21
			2452	247.889	107.00	2452	247.721	108.05	2452	247.721	108.21
			2453	247.927	107.00	2453	247.815	108.05	2453	247.815	108.21
			2454	248.021	107.00	2454	247.837	108.05	2454	247.837	108.21
			2455	248.115	107.00	2455	247.942	108.05	2455	247.942	108.21
			2456	248.136	107.00	2456	248.047	108.05	2456	248.047	108.21
			2457	248.241	107.00	2457	248.089	108.05	2457	248.089	108.21
			2458	248.346	107.00	2458	248.207	108.05	2458	248.207	108.21
			2459	248.388	107.00	2459	248.256	108.05	2459	248.256	108.21
			2460	248.506	107.00	2460	248.361	108.05	2460	248.361	108.21
			2461	248.555	107.00	2461	248.465	108.05	2461	248.465	108.21
			2462	248.66	107.00	2462	248.576	108.05	2462	248.576	108.21
			2463	248.765	107.00	2463	248.675	108.05	2463	248.675	108.21
			2464	248.875	107.00	2464	248.764	108.05	2464	248.764	108.21
			2465	248.974	107.00	2465	248.852	108.05	2465	248.852	108.21
			2466	249.063	107.00	2466	248.884	108.05	2466	248.884	108.21

			2467	249.152	107.00	2467	248.979	108.05	2467	248.979	108.21
			2468	249.184	107.00	2468	249.074	108.05	2468	249.074	108.21
			2469	249.279	107.00	2469	249.094	108.05	2469	249.094	108.21
			2470	249.374	107.00	2470	249.198	108.05	2470	249.198	108.21
			2471	249.393	107.00	2471	249.303	108.05	2471	249.303	108.21
			2472	249.498	107.00	2472	249.341	108.05	2472	249.341	108.21
			2473	249.602	107.00	2473	249.427	108.05	2473	249.427	108.21
			2474	249.641	107.00	2474	249.513	108.05	2474	249.513	108.21
			2475	249.726	107.00	2475	249.574	108.05	2475	249.574	108.21
			2476	249.812	107.00	2476	249.722	108.05	2476	249.722	108.21
			2477	249.874	107.00	2477	249.838	108.05	2477	249.838	108.21
			2478	250.021	107.00	2478	249.932	108.05	2478	249.932	108.21
			2479	250.137	107.00	2479	250.074	108.05	2479	250.074	108.21
			2480	250.231	107.00	2480	250.141	108.05	2480	250.141	108.21
			2481	250.374	107.00	2481	250.239	108.05	2481	250.239	108.21
			2482	250.44	107.00	2482	250.337	108.05	2482	250.337	108.21
			2483	250.538	107.00	2483	250.35	108.05	2483	250.35	108.21
			2484	250.636	107.00	2484	250.455	108.05	2484	250.455	108.21
			2485	250.65	107.00	2485	250.56	108.05	2485	250.56	108.21
			2486	250.754	107.00	2486	250.574	108.05	2486	250.574	108.21
			2487	250.859	107.00	2487	250.672	108.05	2487	250.672	108.21
			2488	250.874	107.00	2488	250.769	108.05	2488	250.769	108.21
			2489	250.971	107.00	2489	250.835	108.05	2489	250.835	108.21
			2490	251.069	107.00	2490	250.979	108.05	2490	250.979	108.21
			2491	251.135	107.00	2491	251.074	108.05	2491	251.074	108.21
			2492	251.278	107.00	2492	251.188	108.05	2492	251.188	108.21
			2493	251.373	107.00	2493	251.335	108.05	2493	251.335	108.21
			2494	251.487	107.00	2494	251.398	108.05	2494	251.398	108.21
			2495	251.634	107.00	2495	251.486	108.05	2495	251.486	108.21
			2496	251.697	107.00	2496	251.574	108.05	2496	251.574	108.21
			2497	251.785	107.00	2497	251.607	108.05	2497	251.607	108.21
			2498	251.873	107.00	2498	251.712	108.05	2498	251.712	108.21
			2499	251.906	107.00	2499	251.817	108.05	2499	251.817	108.21
			2500	252.011	107.00	2500	251.835	108.05	2500	251.835	108.21
			2501	252.116	107.00	2501	251.93	108.05	2501	251.93	108.21
			2502	252.134	107.00	2502	252.026	108.05	2502	252.026	108.21
			2503	252.23	107.00	2503	252.074	108.05	2503	252.074	108.21
			2504	252.325	107.00	2504	252.235	108.05	2504	252.235	108.21
			2505	252.373	107.00	2505	252.334	108.05	2505	252.334	108.21
			2506	252.535	107.00	2506	252.445	108.05	2506	252.445	108.21
			2507	252.634	107.00	2507	252.574	108.05	2507	252.574	108.21
			2508	252.744	107.00	2508	252.654	108.05	2508	252.654	108.21
			2509	252.873	107.00	2509	252.744	108.05	2509	252.744	108.21
			2510	252.953	107.00	2510	252.834	108.05	2510	252.834	108.21
			2511	253.043	107.00	2511	252.864	108.05	2511	252.864	108.21



			2512	253.133	107.00	2512	252.968	108.05	2512	252.968	108.21
			2513	253.163	106.99	2513	253.073	108.05	2513	253.073	108.21
			2514	253.268	106.99	2514	253.178	108.05	2514	253.178	108.21
			2515	253.372	106.99	2515	253.283	108.05	2515	253.283	108.21
			2516	253.477	106.99	2516	253.334	108.05	2516	253.334	108.21
			2517	253.582	106.99	2517	253.492	108.05	2517	253.492	108.21
			2518	253.633	106.99	2518	253.573	108.05	2518	253.573	108.21
			2519	253.791	106.99	2519	253.701	108.05	2519	253.701	108.21
			2520	253.873	106.99	2520	253.834	108.05	2520	253.834	108.21
			2521	254.001	106.99	2521	253.911	108.05	2521	253.911	108.21
			2522	254.133	106.99	2522	254.073	108.05	2522	254.073	108.21
			2523	254.21	106.99	2523	254.12	108.05	2523	254.12	108.21
			2524	254.372	106.99	2524	254.225	108.05	2524	254.225	108.21
			2525	254.42	106.99	2525	254.33	108.05	2525	254.33	108.21
			2526	254.524	106.99	2526	254.436	108.05	2526	254.436	108.21
			2527	254.629	106.99	2527	254.539	108.05	2527	254.539	108.21
			2528	254.736	106.99	2528	254.572	108.05	2528	254.572	108.21
			2529	254.838	106.99	2529	254.66	108.05	2529	254.66	108.21
			2530	254.871	106.99	2530	254.749	108.05	2530	254.749	108.21
			2531	254.959	106.99	2531	254.834	108.05	2531	254.834	108.21
			2532	255.048	106.99	2532	254.958	108.05	2532	254.958	108.21
			2533	255.133	106.99	2533	255.072	108.05	2533	255.072	108.21
			2534	255.257	106.99	2534	255.167	108.05	2534	255.167	108.21
			2535	255.371	106.99	2535	255.334	108.05	2535	255.334	108.21
			2536	255.467	106.99	2536	255.377	108.05	2536	255.377	108.21
			2537	255.633	106.99	2537	255.473	108.05	2537	255.473	108.21
			2538	255.676	106.99	2538	255.569	108.05	2538	255.569	108.21
			2539	255.772	106.99	2539	255.586	108.05	2539	255.586	108.21
			2540	255.868	106.99	2540	255.691	108.05	2540	255.691	108.21
			2541	255.886	106.99	2541	255.796	108.05	2541	255.796	108.21
			2542	255.99	106.99	2542	255.833	108.05	2542	255.833	108.21
			2543	256.095	106.99	2543	255.919	108.05	2543	255.919	108.21
			2544	256.133	106.99	2544	256.005	108.05	2544	256.005	108.21
			2545	256.219	106.99	2545	256.065	108.05	2545	256.065	108.21
			2546	256.304	106.99	2546	256.215	108.05	2546	256.215	108.21
			2547	256.364	106.99	2547	256.333	108.05	2547	256.333	108.21
			2548	256.514	106.99	2548	256.424	108.05	2548	256.424	108.21
			2549	256.633	106.99	2549	256.549	108.05	2549	256.549	108.21
			2550	256.723	106.99	2550	256.634	108.05	2550	256.634	108.21
			2551	256.848	106.99	2551	256.731	108.05	2551	256.731	108.21
			2552	256.933	106.99	2552	256.828	108.05	2552	256.828	108.21
			2553	257.03	106.99	2553	256.843	108.05	2553	256.843	108.21
			2554	257.127	106.99	2554	256.948	108.05	2554	256.948	108.21
			2555	257.142	106.99	2555	257.052	108.05	2555	257.052	108.21
			2556	257.247	106.99	2556	257.152	108.05	2556	257.152	108.21

			2557	257.352	106.99	2557	257.262	108.05	2557	257.262	108.21
			2558	257.452	106.99	2558	257.319	108.05	2558	257.319	108.21
			2559	257.561	106.99	2559	257.471	108.05	2559	257.471	108.21
			2560	257.618	106.99	2560	257.588	108.05	2560	257.588	108.21
			2561	257.77	106.99	2561	257.681	108.05	2561	257.681	108.21
			2562	257.887	106.99	2562	257.819	108.05	2562	257.819	108.21
			2563	257.98	106.99	2563	257.89	108.05	2563	257.89	108.21
			2564	258.118	106.99	2564	257.984	108.05	2564	257.984	108.21
			2565	258.189	106.99	2565	258.079	108.05	2565	258.079	108.21
			2566	258.284	106.99	2566	258.1	108.05	2566	258.1	108.21
			2567	258.378	106.99	2567	258.204	108.05	2567	258.204	108.21
			2568	258.399	106.99	2568	258.309	108.05	2568	258.309	108.21
			2569	258.503	106.99	2569	258.418	108.05	2569	258.418	108.21
			2570	258.608	106.99	2570	258.518	108.05	2570	258.518	108.21
			2571	258.718	106.99	2571	258.581	108.05	2571	258.581	108.21
			2572	258.818	106.99	2572	258.728	108.05	2572	258.728	108.21
			2573	258.88	106.99	2573	258.82	108.05	2573	258.82	108.21
			2574	259.027	106.99	2574	258.937	108.05	2574	258.937	108.21
			2575	259.119	106.99	2575	259.013	108.05	2575	259.013	108.21
			2576	259.237	106.99	2576	259.075	108.05	2576	259.075	108.21
			2577	259.312	106.99	2577	259.2	108.05	2577	259.2	108.21
			2578	259.375	106.99	2578	259.324	108.05	2578	259.324	108.21
			2579	259.499	106.99	2579	259.449	108.05	2579	259.449	108.21
			2580	259.623	106.99	2580	259.574	108.05	2580	259.574	108.21
			2581	259.748	106.99	2581	259.699	108.05	2581	259.699	108.21
			2582	259.873	106.99	2582	259.824	108.05	2582	259.824	108.21
			2583	259.998	106.99	2583	259.949	108.05	2583	259.949	108.21
			2584	260.123	106.99	2584	260.074	108.05	2584	260.074	108.21
			2585	260.248	106.99	2585	260.199	108.05	2585	260.199	108.21
			2586	260.373	106.99	2586	260.324	108.05	2586	260.324	108.21
			2587	260.498	106.99	2587	260.448	108.05	2587	260.448	108.21
			2588	260.623	106.99	2588	260.573	108.05	2588	260.573	108.21
			2589	260.748	106.99	2589	260.698	108.05	2589	260.698	108.21
			2590	260.873	106.99	2590	260.823	108.05	2590	260.823	108.21
			2591	260.997	106.99	2591	260.912	108.05	2591	260.912	108.21
			2592	261.122	106.99	2592	261.001	108.05	2592	261.001	108.21
			2593	261.211	106.99	2593	261.073	108.05	2593	261.073	108.21
			2594	261.3	106.99	2594	261.198	108.05	2594	261.198	108.21
			2595	261.372	106.99	2595	261.323	108.05	2595	261.323	108.21
			2596	261.497	106.99	2596	261.448	108.05	2596	261.448	108.21
			2597	261.622	106.99	2597	261.573	108.05	2597	261.573	108.21
			2598	261.747	106.99	2598	261.698	108.05	2598	261.698	108.21
			2599	261.872	106.99	2599	261.822	108.05	2599	261.822	108.21
			2600	261.997	106.99	2600	261.947	108.05	2600	261.947	108.21
			2601	262.122	106.99	2601	262.072	108.05	2601	262.072	108.21

			2602	262.247	106.99	2602	262.197	108.05	2602	262.197	108.21
			2603	262.372	106.99	2603	262.322	108.05	2603	262.322	108.21
			2604	262.496	106.99	2604	262.447	108.05	2604	262.447	108.21
			2605	262.621	106.99	2605	262.572	108.05	2605	262.572	108.21
			2606	262.746	106.99	2606	262.697	108.05	2606	262.697	108.21
			2607	262.871	106.99	2607	262.822	108.05	2607	262.822	108.21
			2608	262.996	106.99	2608	262.947	108.05	2608	262.947	108.21
			2609	263.121	106.99	2609	263.072	108.05	2609	263.072	108.21
			2610	263.246	106.99	2610	263.196	108.05	2610	263.196	108.21
			2611	263.371	106.99	2611	263.321	108.05	2611	263.321	108.21
			2612	263.496	106.99	2612	263.446	108.05	2612	263.446	108.21
			2613	263.621	106.99	2613	263.571	108.05	2613	263.571	108.21
			2614	263.745	106.99	2614	263.696	108.05	2614	263.696	108.21
			2615	263.87	106.99	2615	263.821	108.05	2615	263.821	108.21
			2616	263.995	106.99	2616	263.946	108.05	2616	263.946	108.21
			2617	264.12	106.99	2617	264.071	108.05	2617	264.071	108.21
			2618	264.245	106.99	2618	264.196	108.05	2618	264.196	108.21
			2619	264.37	106.99	2619	264.321	108.05	2619	264.321	108.21
			2620	264.495	106.99	2620	264.446	108.05	2620	264.446	108.21
			2621	264.62	106.99	2621	264.57	108.05	2621	264.57	108.21
			2622	264.745	106.99	2622	264.695	108.05	2622	264.695	108.21
			2623	264.87	106.99	2623	264.82	108.05	2623	264.82	108.21
			2624	264.995	106.99	2624	264.945	108.05	2624	264.945	108.21
			2625	265.119	106.99	2625	265.07	108.05	2625	265.07	108.21
			2626	265.244	106.99	2626	265.195	108.05	2626	265.195	108.21
			2627	265.369	106.99	2627	265.32	108.05	2627	265.32	108.21
			2628	265.494	106.99	2628	265.445	108.05	2628	265.445	108.21
			2629	265.619	106.99	2629	265.57	108.05	2629	265.57	108.21
			2630	265.744	106.99	2630	265.695	108.05	2630	265.695	108.21
			2631	265.869	106.99	2631	265.819	108.05	2631	265.819	108.21
			2632	265.994	106.99	2632	265.944	108.05	2632	265.944	108.21
			2633	266.119	106.99	2633	266.069	108.05	2633	266.069	108.21
			2634	266.244	106.99	2634	266.194	108.05	2634	266.194	108.21
			2635	266.369	106.99	2635	266.319	108.05	2635	266.319	108.21
			2636	266.493	106.99	2636	266.444	108.05	2636	266.444	108.21
			2637	266.618	106.99	2637	266.569	108.05	2637	266.569	108.21
			2638	266.743	106.99	2638	266.694	108.05	2638	266.694	108.21
			2639	266.868	106.99	2639	266.819	108.05	2639	266.819	108.21
			2640	266.993	106.99	2640	266.944	108.05	2640	266.944	108.21
			2641	267.118	106.99	2641	267.069	108.05	2641	267.069	108.21
			2642	267.243	106.99	2642	267.194	108.05	2642	267.194	108.21
			2643	267.368	106.99	2643	267.318	108.05	2643	267.318	108.21
			2644	267.493	106.99	2644	267.443	108.05	2644	267.443	108.21
			2645	267.618	106.99	2645	267.568	108.05	2645	267.568	108.21
			2646	267.743	106.99	2646	267.693	108.05	2646	267.693	108.21

			2647	267.867	106.99	2647	267.818	108.05	2647	267.818	108.21
			2648	267.992	106.99	2648	267.943	108.05	2648	267.943	108.21
			2649	268.117	106.99	2649	268.068	108.05	2649	268.068	108.21
			2650	268.242	106.99	2650	268.193	108.05	2650	268.193	108.21
			2651	268.367	106.99	2651	268.318	108.05	2651	268.318	108.21
			2652	268.492	106.99	2652	268.443	108.05	2652	268.443	108.21
			2653	268.617	106.99	2653	268.568	108.05	2653	268.568	108.21
			2654	268.742	106.99	2654	268.692	108.05	2654	268.692	108.21
			2655	268.867	106.99	2655	268.817	108.05	2655	268.817	108.21
			2656	268.992	106.99	2656	268.942	108.05	2656	268.942	108.21
			2657	269.117	106.99	2657	269.067	108.05	2657	269.067	108.21
			2658	269.241	106.99	2658	269.192	108.05	2658	269.192	108.21
			2659	269.366	106.99	2659	269.317	108.05	2659	269.317	108.21
			2660	269.491	106.99	2660	269.442	108.05	2660	269.442	108.21
			2661	269.616	106.99	2661	269.567	108.05	2661	269.567	108.21
			2662	269.741	106.99	2662	269.692	108.05	2662	269.692	108.21
			2663	269.866	106.99	2663	269.817	108.05	2663	269.817	108.21
			2664	269.991	106.99	2664	269.941	108.05	2664	269.941	108.21
			2665	270.116	106.99	2665	270.066	108.05	2665	270.066	108.21
			2666	270.241	106.99	2666	270.191	108.05	2666	270.191	108.21
			2667	270.366	106.99	2667	270.317	108.05	2667	270.317	108.21
			2668	270.491	106.99	2668	270.44	108.05	2668	270.44	108.21
			2669	270.616	106.99	2669	270.564	108.05	2669	270.564	108.21
			2670	270.74	106.99	2670	270.655	108.05	2670	270.655	108.21
			2671	270.863	106.99	2671	270.821	108.05	2671	270.821	108.21
			2672	270.955	106.99	2672	270.85	108.05	2672	270.85	108.21
			2673	271.12	106.99	2673	270.954	108.05	2673	270.954	108.21
			2674	271.149	106.99	2674	271.059	108.05	2674	271.059	108.21
			2675	271.254	106.99	2675	271.164	108.05	2675	271.164	108.21
			2676	271.358	106.99	2676	271.269	108.05	2676	271.269	108.21
			2677	271.463	106.99	2677	271.322	108.05	2677	271.322	108.21
			2678	271.568	106.99	2678	271.478	108.05	2678	271.478	108.21
			2679	271.621	106.99	2679	271.558	108.05	2679	271.558	108.21
			2680	271.777	106.98	2680	271.688	108.05	2680	271.688	108.21
			2681	271.857	106.98	2681	271.822	108.05	2681	271.822	108.21
			2682	271.987	106.98	2682	271.897	108.05	2682	271.897	108.21
			2683	272.121	106.98	2683	272.053	108.05	2683	272.053	108.21
			2684	272.196	106.98	2684	272.107	108.05	2684	272.107	108.21
			2685	272.353	106.98	2685	272.211	108.05	2685	272.211	108.21
			2686	272.406	106.98	2686	272.316	108.05	2686	272.316	108.21
			2687	272.511	106.98	2687	272.424	108.05	2687	272.424	108.21
			2688	272.615	106.98	2688	272.525	108.05	2688	272.525	108.21
			2689	272.723	106.98	2689	272.633	108.05	2689	272.633	108.21
			2690	272.825	106.98	2690	272.735	108.05	2690	272.735	108.21
			2691	272.932	106.98	2691	272.814	108.05	2691	272.814	108.21

			2692	273.034	106.98	2692	272.944	108.05	2692	272.944	108.21
			2693	273.113	106.98	2693	273.04	108.05	2693	273.04	108.21
			2694	273.244	106.98	2694	273.136	108.05	2694	273.136	108.21
			2695	273.34	106.98	2695	273.154	108.05	2695	273.154	108.21
			2696	273.436	106.98	2696	273.307	108.05	2696	273.307	108.21
			2697	273.453	106.98	2697	273.363	108.05	2697	273.363	108.21
			2698	273.607	106.98	2698	273.468	108.05	2698	273.468	108.21
			2699	273.662	106.98	2699	273.573	108.05	2699	273.573	108.21
			2700	273.767	106.98	2700	273.68	108.05	2700	273.68	108.21
			2701	273.872	106.98	2701	273.782	108.05	2701	273.782	108.21
			2702	273.979	106.98	2702	273.807	108.05	2702	273.807	108.21
			2703	274.081	106.98	2703	273.899	108.05	2703	273.899	108.21
			2704	274.106	106.98	2704	273.991	108.05	2704	273.991	108.21
			2705	274.199	106.98	2705	274.071	108.05	2705	274.071	108.21
			2706	274.291	106.98	2706	274.201	108.05	2706	274.201	108.21
			2707	274.371	106.98	2707	274.307	108.05	2707	274.307	108.21
			2708	274.5	106.98	2708	274.41	108.05	2708	274.41	108.21
			2709	274.606	106.98	2709	274.57	108.05	2709	274.57	108.21
			2710	274.71	106.98	2710	274.62	108.05	2710	274.62	108.21
			2711	274.869	106.98	2711	274.713	108.05	2711	274.713	108.21
			2712	274.919	106.98	2712	274.807	108.05	2712	274.807	108.21
			2713	275.013	106.98	2713	274.829	108.05	2713	274.829	108.21
			2714	275.106	106.98	2714	274.934	108.05	2714	274.934	108.21
			2715	275.128	106.98	2715	275.039	108.05	2715	275.039	108.21
			2716	275.233	106.98	2716	275.069	108.05	2716	275.069	108.21
			2717	275.338	106.98	2717	275.158	108.05	2717	275.158	108.21
			2718	275.368	106.98	2718	275.248	108.05	2718	275.248	108.21
			2719	275.458	106.98	2719	275.307	108.05	2719	275.307	108.21
			2720	275.547	106.98	2720	275.457	108.05	2720	275.457	108.21
			2721	275.606	106.98	2721	275.567	108.05	2721	275.567	108.21
			2722	275.757	106.98	2722	275.667	108.05	2722	275.667	108.21
			2723	275.867	106.98	2723	275.807	108.05	2723	275.807	108.21
			2724	275.966	106.98	2724	275.876	108.05	2724	275.876	108.21
			2725	276.106	106.98	2725	275.972	108.05	2725	275.972	108.21
			2726	276.176	106.98	2726	276.068	108.05	2726	276.068	108.21
			2727	276.271	106.98	2727	276.086	108.05	2727	276.086	108.21
			2728	276.367	106.98	2728	276.19	108.05	2728	276.19	108.21
			2729	276.385	106.98	2729	276.295	108.05	2729	276.295	108.21
			2730	276.49	106.98	2730	276.307	108.05	2730	276.307	108.21
			2731	276.594	106.98	2731	276.406	108.05	2731	276.406	108.21
			2732	276.606	106.98	2732	276.505	108.05	2732	276.505	108.21
			2733	276.705	106.98	2733	276.567	108.05	2733	276.567	108.21
			2734	276.804	106.98	2734	276.714	108.05	2734	276.714	108.21
			2735	276.866	106.98	2735	276.806	108.05	2735	276.806	108.21
			2736	277.013	106.98	2736	276.923	108.05	2736	276.923	108.21

			2737	277.106	106.98	2737	277.067	108.05	2737	277.067	108.21
			2738	277.223	106.98	2738	277.133	108.05	2738	277.133	108.21
			2739	277.366	106.98	2739	277.22	108.05	2739	277.22	108.21
			2740	277.432	106.98	2740	277.306	108.05	2740	277.306	108.21
			2741	277.519	106.98	2741	277.342	108.05	2741	277.342	108.21
			2742	277.605	106.98	2742	277.447	108.05	2742	277.447	108.21
			2743	277.642	106.98	2743	277.552	108.05	2743	277.552	108.21
			2744	277.746	106.98	2744	277.566	108.05	2744	277.566	108.21
			2745	277.851	106.98	2745	277.664	108.05	2745	277.664	108.21
			2746	277.866	106.98	2746	277.761	108.05	2746	277.761	108.21
			2747	277.963	106.98	2747	277.806	108.05	2747	277.806	108.21
			2748	278.06	106.98	2748	277.971	108.05	2748	277.971	108.21
			2749	278.105	106.98	2749	278.066	108.05	2749	278.066	108.21
			2750	278.27	106.98	2750	278.18	108.05	2750	278.18	108.21
			2751	278.366	106.98	2751	278.306	108.05	2751	278.306	108.21
			2752	278.479	106.98	2752	278.389	108.05	2752	278.389	108.21
			2753	278.605	106.98	2753	278.478	108.05	2753	278.478	108.21
			2754	278.689	106.98	2754	278.566	108.05	2754	278.566	108.21
			2755	278.777	106.98	2755	278.599	108.05	2755	278.599	108.21
			2756	278.865	106.98	2756	278.702	108.05	2756	278.702	108.21
			2757	278.898	106.98	2757	278.805	108.05	2757	278.805	108.21
			2758	279.001	106.98	2758	278.913	108.05	2758	278.913	108.21
			2759	279.104	106.98	2759	279.018	108.05	2759	279.018	108.21
			2760	279.212	106.98	2760	279.066	108.05	2760	279.066	108.21
			2761	279.317	106.98	2761	279.227	108.05	2761	279.227	108.21
			2762	279.365	106.98	2762	279.305	108.05	2762	279.305	108.21
			2763	279.526	106.98	2763	279.437	108.05	2763	279.437	108.21
			2764	279.604	106.98	2764	279.566	108.05	2764	279.566	108.21
			2765	279.736	106.98	2765	279.646	108.05	2765	279.646	108.21
			2766	279.865	106.98	2766	279.803	108.05	2766	279.803	108.21
			2767	279.945	106.98	2767	279.855	108.05	2767	279.855	108.21
			2768	280.102	106.98	2768	279.96	108.05	2768	279.96	108.21
			2769	280.155	106.98	2769	280.065	108.05	2769	280.065	108.21
			2770	280.259	106.98	2770	280.17	108.05	2770	280.17	108.21
			2771	280.364	106.98	2771	280.274	108.05	2771	280.274	108.21
			2772	280.469	106.98	2772	280.3	108.05	2772	280.3	108.21
			2773	280.574	106.98	2773	280.392	108.05	2773	280.392	108.21
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			2775	280.691	106.98	2775	280.566	108.05	2775	280.566	108.21
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			2780	281.202	106.98	2780	281.066	108.05	2780	281.066	108.21
			2781	281.309	106.98	2781	281.112	108.05	2781	281.112	108.21

			2782	281.365	106.98	2782	281.266	108.05	2782	281.266	108.21
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			2784	281.565	106.98	2784	281.426	108.05	2784	281.426	108.21
			2785	281.621	106.98	2785	281.531	108.05	2785	281.531	108.21
			2786	281.726	106.98	2786	281.553	108.05	2786	281.553	108.21
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			2789	281.946	106.98	2789	281.876	108.05	2789	281.876	108.21
			2790	282.04	106.98	2790	281.95	108.05	2790	281.95	108.21
			2791	282.175	106.98	2791	282.034	108.05	2791	282.034	108.21
			2792	282.249	106.98	2792	282.171	108.05	2792	282.171	108.21
			2793	282.333	106.98	2793	282.308	108.05	2793	282.308	108.21
			2794	282.47	106.98	2794	282.433	108.05	2794	282.433	108.21
			2795	282.607	106.98	2795	282.558	108.05	2795	282.558	108.21
			2796	282.732	106.98	2796	282.683	108.05	2796	282.683	108.21
			2797	282.857	106.98	2797	282.808	108.05	2797	282.808	108.21
			2798	282.982	106.98	2798	282.932	108.05	2798	282.932	108.21
			2799	283.107	106.98	2799	283.057	108.05	2799	283.057	108.21
			2800	283.232	106.98	2800	283.182	108.05	2800	283.182	108.21
			2801	283.357	106.98	2801	283.307	108.05	2801	283.307	108.21
			2802	283.482	106.98	2802	283.432	108.05	2802	283.432	108.21
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			2820	285.73	106.98	2820	285.68	108.05	2820	285.68	108.21
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			2824	286.23	106.98	2824	286.18	108.05	2824	286.18	108.21
			2825	286.354	106.98	2825	286.305	108.05	2825	286.305	108.21
			2826	286.479	106.98	2826	286.407	108.05	2826	286.407	108.21

			2827	286.604	106.98	2827	286.509	108.05	2827	286.509	108.21
			2828	286.706	106.98	2828	286.615	108.05	2828	286.615	108.21
			2829	286.808	106.97	2829	286.721	108.05	2829	286.721	108.21
			2830	286.914	106.97	2830	286.866	108.05	2830	286.866	108.21
			2831	287.02	106.98	2831	286.956	108.05	2831	286.956	108.21
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			2833	287.256	106.97	2833	287.175	108.05	2833	287.175	108.21
			2834	287.346	106.97	2834	287.304	108.05	2834	287.304	108.21
			2835	287.475	106.97	2835	287.429	108.05	2835	287.429	108.21
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			2837	287.728	106.97	2837	287.679	108.05	2837	287.679	108.21
			2838	287.853	106.97	2838	287.804	108.05	2838	287.804	108.21
			2839	287.978	106.97	2839	287.929	108.05	2839	287.929	108.21
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			2842	288.353	106.97	2842	288.304	108.05	2842	288.304	108.21
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			2850	289.352	106.97	2850	289.303	108.04	2850	289.303	108.21
			2851	289.477	106.97	2851	289.428	108.04	2851	289.428	108.21
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			2854	289.852	106.97	2854	289.802	108.04	2854	289.802	108.21
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			2856	290.102	106.97	2856	290.052	108.04	2856	290.052	108.21
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			2866	291.351	106.97	2866	291.301	108.04	2866	291.301	108.21
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			2868	291.601	106.97	2868	291.551	108.04	2868	291.551	108.21
			2869	291.726	106.97	2869	291.676	108.04	2869	291.676	108.21
			2870	291.85	106.97	2870	291.801	108.04	2870	291.801	108.21
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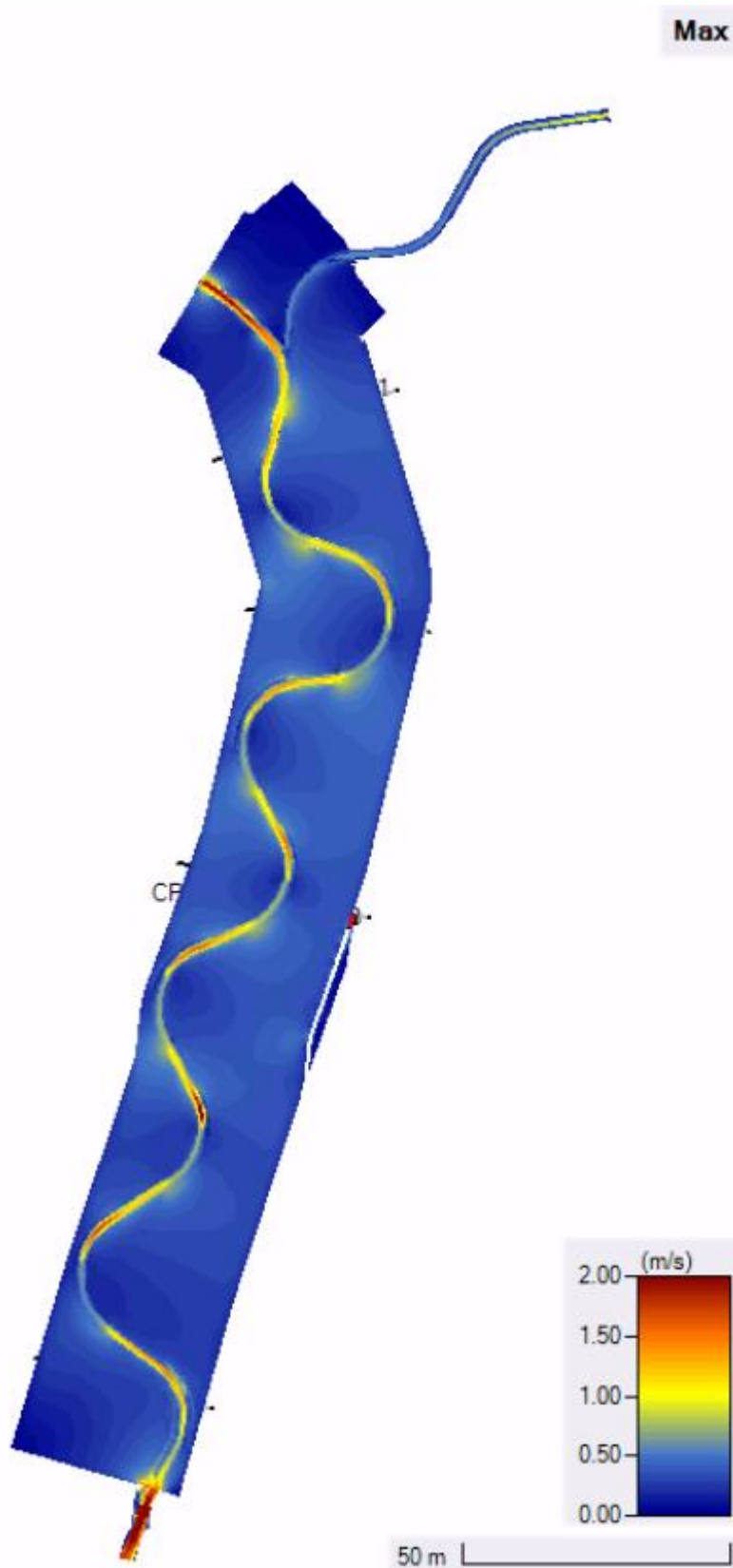


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			2880	293.1	106.96	2880	293.05	108.04	2880	293.05	108.21
			2881	293.224	106.96	2881	293.175	108.04	2881	293.175	108.21
			2882	293.349	106.96	2882	293.3	108.04	2882	293.3	108.21
			2883	293.474	106.96	2883	293.425	108.04	2883	293.425	108.21
			2884	293.599	106.96	2884	293.55	108.04	2884	293.55	108.21
			2885	293.724	106.96	2885	293.671	108.04	2885	293.671	108.21
			2886	293.849	106.96	2886	293.793	108.04	2886	293.793	108.21
			2887	293.971	106.96	2887	293.936	108.04	2887	293.936	108.21
			2888	294.092	106.96	2888	294.078	108.04	2888	294.078	108.21
			2889	294.235	106.96	2889	294.106	108.04	2889	294.106	108.21
			2890	294.377	106.96	2890	294.196	108.04	2890	294.196	108.21
			2891	294.405	106.96	2891	294.286	108.04	2891	294.286	108.21
			2892	294.495	106.96	2892	294.418	108.04	2892	294.418	108.21
			2893	294.585	106.96	2893	294.549	108.04	2893	294.549	108.21
			2894	294.717	106.95	2894	294.674	108.04	2894	294.674	108.21
			2895	294.849	106.95	2895	294.799	108.04	2895	294.799	108.21
			2896	294.973	106.95	2896	294.924	108.04	2896	294.924	108.21
			2897	295.098	106.95	2897	295.049	108.04	2897	295.049	108.21
			2898	295.223	106.95	2898	295.174	108.04	2898	295.174	108.21
			2899	295.349	106.95	2899	295.299	108.04	2899	295.299	108.21
			2900	295.473	106.94	2900	295.424	108.04	2900	295.424	108.21
			2901	295.598	106.94	2901	295.549	108.04	2901	295.549	108.21
			2902	295.723	106.94	2902	295.674	108.04	2902	295.674	108.21
			2903	295.848	106.94	2903	295.798	108.04	2903	295.798	108.21
			2904	295.973	106.94	2904	295.924	108.04	2904	295.924	108.21
			2905	296.097	106.93	2905	296.049	108.04	2905	296.049	108.21
			2906	296.223	106.93	2906	296.173	108.04	2906	296.173	108.21
			2907	296.348	106.92	2907	296.298	108.04	2907	296.298	108.21
			2908	296.473	106.92	2908	296.423	108.04	2908	296.423	108.21
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			2910	296.722	106.91	2910	296.673	108.04	2910	296.673	108.21
			2911	296.848	106.90	2911	296.797	108.04	2911	296.797	108.21
			2912	296.972	106.90	2912	296.925	108.04	2912	296.925	108.21
			2913	297.097	106.89	2913	297.048	108.04	2913	297.048	108.20
			2914	297.224	106.88	2914	297.136	108.04	2914	297.136	108.20
			2915	297.348	106.86	2915	297.224	108.04	2915	297.224	108.20
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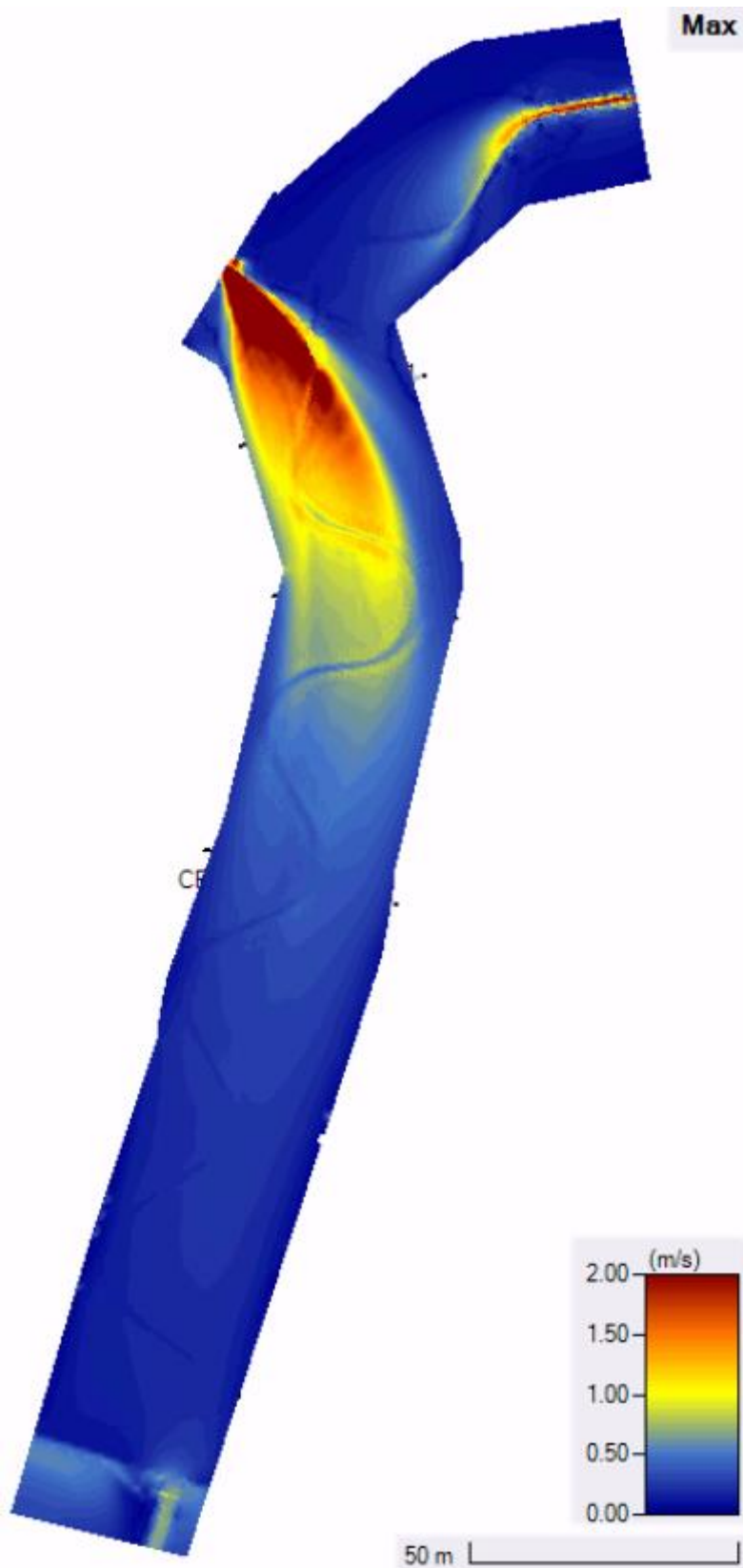
			2917	297.524	106.86	2917	297.297	108.04	2917	297.297	108.20
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			2919	297.596	106.85	2919	297.548	108.04	2919	297.548	108.20
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			2923	298.044	106.82	2923	297.92	108.04	2923	297.92	108.20
			2924	298.096	106.81	2924	298.044	108.04	2924	298.044	108.20
			2925	298.219	106.81	2925	298.172	108.04	2925	298.172	108.20
			2926	298.343	106.79	2926	298.296	108.04	2926	298.296	108.20
			2927	298.471	106.79	2927	298.425	108.04	2927	298.425	108.20
			2928	298.595	106.78	2928	298.554	108.04	2928	298.554	108.20
			2929	298.724	106.77	2929	298.679	108.04	2929	298.679	108.20
			2930	298.853	106.76						
			2931	298.978	NaN						

## 7.2 ANNEX B - FLOW VELOCITY MAPS

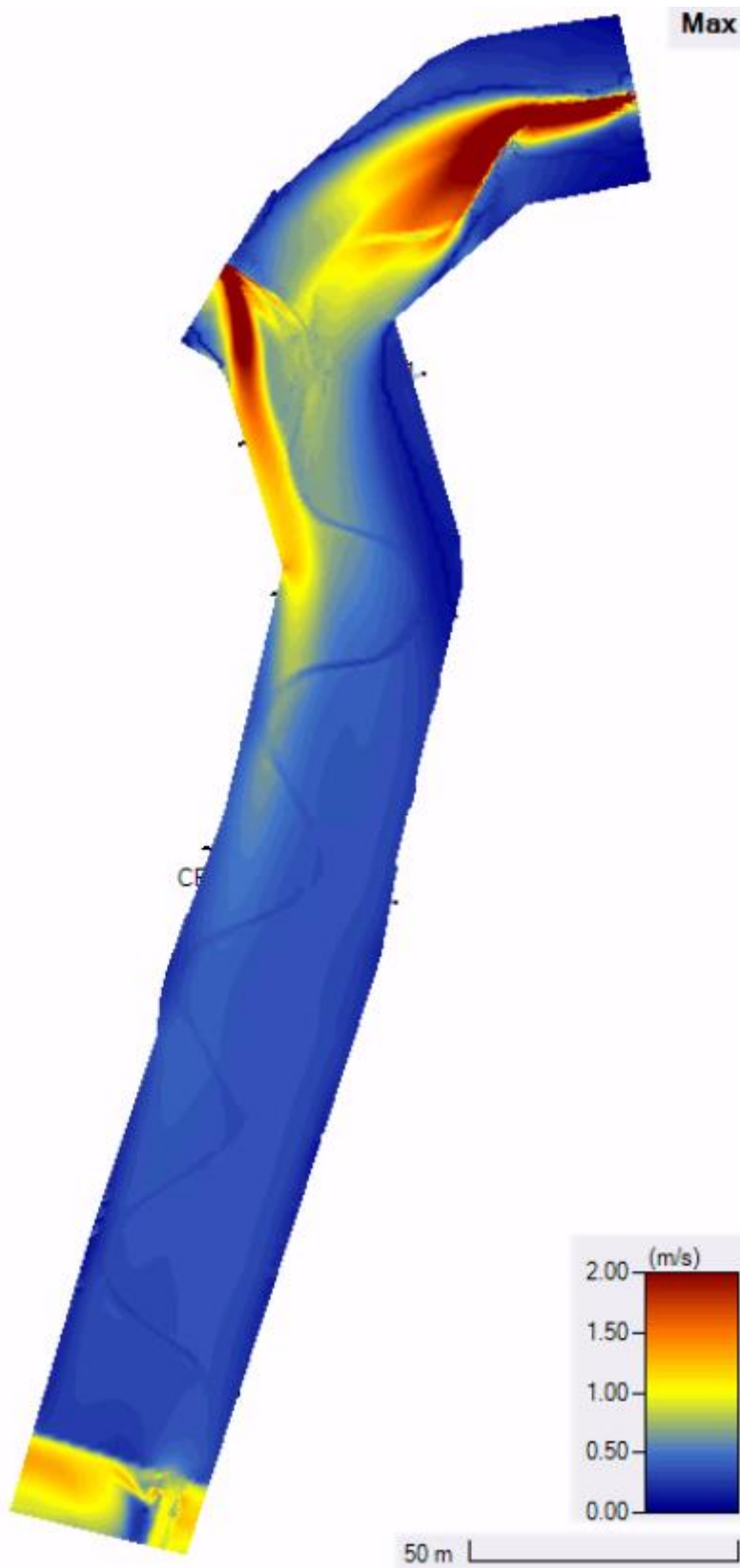
**7.2.1 Velocity distribution for  $Q_{med}$**



### 7.2.2 Velocity distribution for $Q_{100cc}$



**7.2.3 Velocity distribution for  $Q_{1000cc}$**

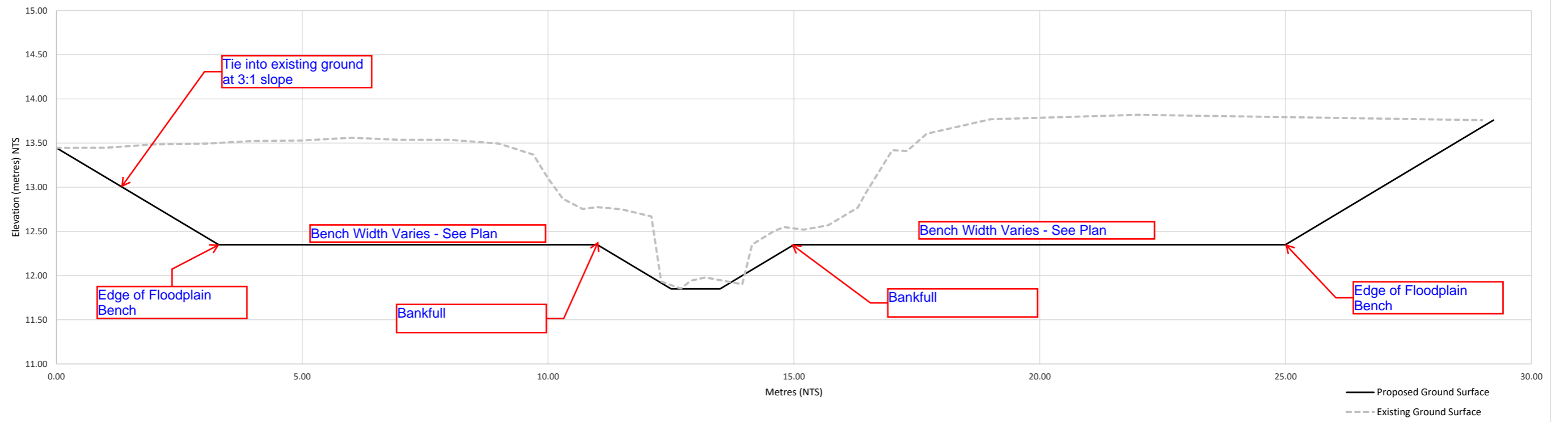


## 7.3 ANNEX C – TYPICAL RIFFLE AND POOL CROSS SECTIONS AND DESIGN LONGITUDINAL PROFILE

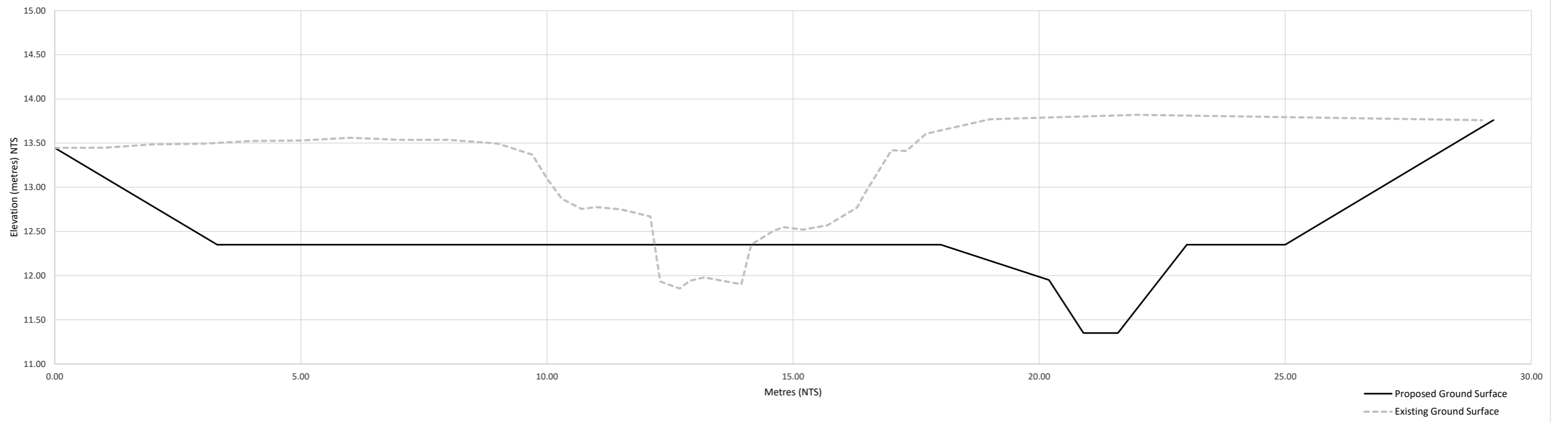




Typical Riffle Cross Section



Typical Pool Cross Section





Map Legend

- Stream Concept
- Proposed Centreline of Stream
  - Bankfull
  - Edge of Floodplain Bench
  - Existing Stream Location
  - Proposed Riffles

Chainage: 0.0 m  
Thalweg Elevation: 107m OD

Chainage: 299 m  
Thalweg Elevation: 106.32m  
OD

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Drawing Title  
**Stream Restoration Plan**

Project Title  
**Project**

Drawn By  
Checked By

Project No. **220310** Drawing No. **fig 1**

Scale **1:750** Date **2023-10-25**

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