

River Fealge (Clonakilty) Drainage Scheme

Environmental Impact Statement Vol. 2 - Main Report

Final Report

December 2014

JBA Project Manager

Declan Egan
24 Grove Island
Corbally
Limerick

Revision History

Revision Ref / Date Issued	Amendments	Issued to
V1.0 / 05 December 2014	Initial Issue	Patrick McAlinney (OPW)
V 2.0 / 08 December 2014	Corrections to formatting	Patrick McAlinney (OPW)

Contract

This report describes work commissioned by Liam Basquille, on behalf of the Office of Public Works, by a letter dated 27th February 2014. The Office of Public Works representative for the contract was Patrick McAlinney. Tom Sampson, Laura Thomas, Matthew Hemsworth, David Mould, Kieran Sheehan, Seb Bentley, Nicholas Allin, Alex Craven and Declan Egan of JBA Consulting, Teresa Bolger of Rubicon Heritage, Craig Bullock of Optimise Consulting and Howard Williams of INIS Environmental carried out this work.

Prepared by Declan Egan BSc. (Env) MSc. CSci. CEnv. CWEM
Project Manager

Reviewed by Jonathan Cooper BEng MSc DipCD CEng MICE
MCIWEM C.WEM MloD
Director

Anne Murray BSc CIEEM
Senior Ecologist

Purpose

This document has been prepared as a Final Report for the Office of Public Works. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to the Office of Public Works.

Copyright

© JBA Consulting Engineers and Scientists Ltd 2014

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 1196g if 100% post-consumer recycled paper is used and 1522g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

Contents

1	Introduction	8
1.1	Introduction to the Environmental Impact Statement	8
1.2	Preliminary Assessment	8
1.3	Brief Description of the Scheme	9
1.4	The Study Area	10
1.5	Need for the Development.....	10
2	Legislative Context of the Environmental Impact Assessment.....	13
2.1	Structure of the EIS	13
2.2	Descriptions of the Impacts	13
2.3	The EIS Project Team	15
2.4	Technical Difficulties	15
3	Policy, Planning and Legislation	16
3.1	Introduction	16
3.2	Strategic Planning Context	16
3.3	European Union Policy on Flooding - EU Flood Directive.....	16
3.4	National Flood Policies and the CFRAM Programme	16
3.5	The Planning System and Flood Risk Management	17
3.6	The National Spatial Strategy 2002-2020.....	17
3.7	The National Development Plan (2207-2013)	17
3.8	Regional Planning Guidelines (2010-2-22).....	18
3.9	Cork County Development Plan (2009-2015)	18
3.10	Clonakilty Town Development Plan (2009-2015)	18
3.11	National Biodiversity Plan, 2002-2006.....	19
3.12	National Climate Change Strategy 2007-2012.....	19
3.13	The Water Framework Directive (2006/60/EC)	20
3.14	Habitats Directive (92/43/EEC).....	20
3.15	The Birds Directive (79/409/EEC)	20
4	Scoping and Consultation	21
4.1	Introduction	21
4.2	Public Information Day- 16th October 2012	21
4.3	Public Information Day - 16th July 2013.....	21
4.4	Constraints Study	22
4.5	Public Consultation Day.....	25
4.6	Scoping during the EIS	26
5	Alternatives Considered	28
5.1	Introduction	28
5.2	Constraints Study	28
5.3	Design Options	33
5.4	Multi-Criteria Analysis (MCA).....	35
6	Project Description.....	43
6.1	Tidal Flood Defences.....	43
6.2	Fluvial Storage and Embankment	51
6.3	Maintenance Works	52
7	Outline Construction Methodology	58
7.1	Duration	58
7.2	Construction Activities	58
7.3	Anticipated Construction Methodology	59
8	Water and Hydrology.....	61

8.1	Introduction	61
8.2	Applicable Legislation	61
8.3	Surface Water in the Existing Environment	62
8.4	Transitional Waters within the Study Area.....	65
8.5	Coastal Waters within the Study Area	69
8.6	Groundwater within the Study Area	69
8.7	Impacts of the Proposed Scheme in the Absence of Mitigation Measures on Water during Construction	71
8.8	The Impacts of the Proposed Scheme on Water during Operation.....	74
8.9	Mitigation Measures.....	74
8.10	Cumulative Impacts	76
8.11	Residual Impacts	77
9	Flora and Fauna	78
9.1	Introduction	78
9.2	Methodology	78
9.3	Existing Baseline	84
9.4	Impacts of the Proposed Scheme	107
9.5	Mitigation Measures.....	114
9.6	Residual Impacts	119
9.7	Possible Enhancement Measures	135
9.8	Conclusions	135
10	Hydromorphology.....	136
10.1	Introduction	136
10.2	Assessment Methodology.....	136
10.3	Baseline Assessment	137
10.4	Hydromorphological Impacts of the Proposed Scheme	139
10.5	Summary of Impacts, Mitigation and Residual Impact Associated to Proposed Works.....	141
11	Soils and Geology	150
11.1	Introduction	150
11.2	Desktop Assessment.....	150
11.3	Baseline Soils and Geology in the Area	150
11.4	Impacts of the Scheme during Construction, without Mitigation Measures on Soils and Geology.....	154
11.5	Impacts of the Scheme during Operation, without Mitigation on Soils and Geology.....	154
11.6	Mitigation Measures.....	155
11.7	Cumulative Impacts	156
11.8	Residual Impacts	156
12	Socio-economic Impact Assessment	157
12.1	Introduction	157
12.2	Methodology	157
12.3	The Proposed Development.....	162
12.4	Baseline Environment.....	163
12.5	Construction Impacts.....	164
12.6	Operational Impacts.....	166
12.7	Mitigation Measures.....	167
12.8	Residual Impacts	168
13	Traffic / Transportation and Roads Impacts	169
13.1	Introduction	169
13.2	Baseline Assessment - Existing Traffic Conditions in Clonakilty.....	169
13.3	Transportation Impact of Proposed Scheme	173

14	Air and Climate	177
14.1	Introduction	177
14.2	Existing Environment	177
14.3	Potential Air Quality And Climate Impacts.....	181
14.4	Mitigation Measures.....	182
14.5	Residual Impact	183
15	Archaeological and Cultural Heritage	184
15.1	Introduction	184
15.2	Proposed Development and Site Location	184
15.3	Legislative and Policy Framework	185
15.4	Study Methodology	186
15.5	Methodology Used for Assessing Baseline Values of Sites, Magnitude of Impacts and Significance of Impacts	188
15.6	Baseline / Receiving Environment	194
15.7	Impact on Baseline Environment Prior to Implementation of Mitigation Measures	204
15.8	Mitigation Measures and Residual Impacts	207
16	Landscape and Visual Assessment.....	215
16.1	Introduction	215
16.2	Description of the Development	215
16.3	Site Survey	217
16.4	Limitations of the Assessment	217
16.5	Methodology	217
16.6	Landscape Policy	218
16.7	Mitigation	223
16.8	Landscape: Baseline and Assessment of Effects	225
16.9	Visual Receptors: Baseline Review and Assessment of Effects	236
17	Noise	260
17.1	Introduction	260
17.2	Overview	260
17.3	Baseline Noise Assessment	261
17.4	Impacts of the Scheme on the Baseline Noise Levels	265
17.5	Characteristics of the Proposed Development	267
17.6	Noise Impact Assessment	268
17.7	Mitigation Measures.....	271
17.8	Monitoring	272
17.9	Residual Impacts	272
18	Material Assets	273
18.1	Introduction	273
18.2	Waste Water Treatment Plant	273
18.3	Foul and Storm Water Sewers	273
18.4	Electricity	274
18.5	Broad Band.....	274
18.6	Agriculture.....	274
18.7	Waste Management.....	274
18.8	Drinking Water	274
18.9	IPPC Licenced Facilities	274
18.10	Car Parks	275
18.11	Impacts of the Proposed Scheme on Material Assets.....	275
18.12	Impacts on the Waste Water Treatment Plant.....	275
18.13	Impacts on Fouls and Storm Sewers.....	275
18.14	Impacts on Electricity.....	275
18.15	Agriculture.....	275

18.16	Waste Management.....	275
18.17	Car Parks.....	276
18.18	Mitigation Measures to Remedy the Impacts	276
18.19	Residual Impacts	276
19	Interaction of the Foregoing.....	277
19.1	Introduction	277
19.2	Potential Interactive Impacts	277

List of Figures

Figure 1-1: Clonakilty and environs study area	12
Figure 5-1: Option 1 - flow diversion and tidal barrage	37
Figure 5-2: Option 2 - flow diversion and tidal flood defences	38
Figure 5-3: Option 3 - fluvial flood defences and tidal barrage.....	39
Figure 5-4: Option 4 - fluvial flood defences and tidal flood defences	40
Figure 5-5: Option 5 - fluvial storage areas and tidal barrage	41
Figure 5-6: Option 6 - fluvial storage areas and tidal flood defences	42
Figure 6-1: Scheme Interference Drawing 1 of 8.....	46
Figure 6-2: Scheme Interference Drawing 2 of 8.....	48
Figure 6-3: Scheme Interference Drawing 3 of 8.....	49
Figure 6-4: Scheme Interference Drawing 4 of 8.....	50
Figure 6-5: Scheme Interference Drawing 5 of 8.....	53
Figure 6-6: Scheme Interference Drawing 6 of 8.....	54
Figure 6-7: Scheme Interference Drawing 7 of 8.....	55
Figure 6-8: Scheme Interference Drawing 8 of 8.....	56
Figure 8-1: Waterbodies within the study area	63
Figure 8-2: WFD risk status of waterbodies	67
Figure 8-3: Surface water sampling locations	68
Figure 8-4: Groundwater vulnerability	70
Figure 9-1 : Surveyed section of the Fealge River and its tributaries.....	80
Figure 9-2 : Designated sites.....	85
Figure 9-3 : Fossitt Habitat Classification	86
Figure 9-4 : The River Fealge in the upstream reaches of the study area	87
Figure 9-5 : The River Fealge in the town of Clonakilty at the Casement Street Bridge (left) and the Seymour Street footbridge (right)	87
Figure 9-6 : Estuarine habitats adjacent to The Croppy Road with the change in embankment vegetation (left).....	88
Figure 9-7 : Drainage ditches in the area to the south of the river, the one of the right stagnant and eutrophic.....	89
Figure 9-8 : Grassland area on the right bank of the river (left) and overview of the upstream, grassland-dominated survey area (right)	89
Figure 9-9 : Amenity grassland (improved) on the left bank of the river	90
Figure 9-10 : Hedgerow and bank field boundaries	90

Figure 9-11 : Conifer plantation	91
Figure 9-12: Evidence of Otter.....	95
Figure 9-13: Footprints (left) and resting place with spraints on rock in the foreground (right)	95
Figure 9-14 : All trees/structures surveyed for bats in the westernmost (rural) part of the study area.....	96
Figure 9-15 All trees/structures surveyed for bats in the central part of the study area ..	97
Figure 9-16: Ivy-covered walls on old brewery building	98
Figure 9-17: All trees/structures surveyed for bats in the Eastern part of the study area ..	98
Figure 9-18: Locations of bat surveyors in West of study area	99
Figure 9-19: Locations of bat surveyors in the centre of the study area	100
Figure 9-20: Locations of bat surveyors in the east of the study area.....	100
Figure 9-21 : Key bat foraging locations in Clonakilty	101
Figure 9-22: Areas of the River Fealge system with good potential to support fish spawning habitat	103
Figure 9-23: European Eel (top left), Atlantic Salmon (top right) and Brown Trout (bottom) caught during the electro fishing survey	104
Figure 10-1 : Gravel deposition in the upper reaches	137
Figure 10-2 : Urban Constrictions and temporary flood defences.....	138
Figure 11-1: Bedrock geology.....	152
Figure 11-2: Subsoils.....	153
Figure 12-1: Clonakilty Town Plan zoning objectives	161
Figure 13-1 : Location of Oct 2014 Traffic Survey.....	170
Figure 13-2 : Hourly Construction Traffic compared with Existing N71 Traffic Conditions	171
Figure 13-3 : Baseline Traffic Data Information, N71	172
Figure 13-4 : Wheel Pump Junction, Clonakilty.....	173
Figure 14-1: Air sampling locations	180
Figure 16-1: Landscape character.....	245
Figure 16-2: Landscape designation	246
Figure 16-3: Principal visual receptors	247
Figure 16-4: Clonakilty photographs.....	248
Figure 16-5: Existing and possible future photomontages	254
Figure 17-1: Noise sampling locations	262

List of Tables

Table 2-1 : JBA Table Caption.....	15
Table 4-1 : 31 consultees	22
Table 4-2 : 31 Replies from Consultees to Consultation Letter	23
Table 6-1: Key to interference drawing 1.....	44
Table 6-2: Key to interference drawing 2.....	45
Table 6-3: Key to interference drawing 3.....	51

Table 6-4: Key to interference drawing 4.....	51
Table 6-5: Key to interference drawing 5.....	57
Table 6-6: Key to interference drawing 6.....	57
Table 6-7: Key to interference drawing 7.....	57
Table 6-8: key to interference drawing 8	57
Table 8-1 : Water Quality Levels for Salmonid Waters	62
Table 8-2 : Classification of Clonakilty Stream (from Clabby et al. 2008)	64
Table 8-3 : EPA Q-Rating System	64
Table 8-4 : -Chemical Results for water samples taken for the River Fealge	65
Table 8-5 : Microbial Monitoring for Inchydoney Beach	69
Table 9-1 : Location of the sampling sites	81
Table 9-2 : Examples of the Criteria used to define the Value of Ecological Receptors	82
Table 9-3 : Definition of Magnitude.....	83
Table 9-4 : Significance of Impacts Matrix.....	84
Table 9-5 : Statutory Nature Conservation Sites. (Information from NPWS, 2014)	84
Table 9-6: Bird results from the desk-based assessment (National Biodiversity Data Centre, 2014)	92
Table 9-7: Bird species recorded during ecological walkover survey and other field surveys	93
Table 9-8: Results from the desk-based assessment (National Biodiversity Data Centre, 2014)	104
Table 9-9: Evaluation of Ecological Receptors.....	105
Table 12-1 : Population Clonakilty	158
Table 12-2 : Private Households Clonakilty.....	159
Table 12-3 : Employment Categories	159
Table 12-4 : Age Categories and Disability	162
Table 12-5 : Social Class.....	162
Table 13-1 : N71 Traffic Survey Results.....	170
Table 13-2 : Construction Traffic Impacts of Scheme Elements	176
Table 14-1 : Description of Dust Monitoring Locations.....	178
Table 14-2 : Ambient Air Quality in the Site of the Proposed Scheme (17/10/14 – 17/11/14)	179
Table 15-1 : Townlands within study area	185
Table 15-2 : Dimensions of Study Area	187
Table 15-3 : Baseline values of sites	188
Table 15-4 : Type of impacts	189
Table 15-5 : Criteria used for rating magnitude of impacts	190
Table 15-6 : Factors to be considered when assessing impacts upon setting (after English Heritage 2005).....	192
Table 15-7 : Guideline criteria for assessment of magnitude of an impact on the setting of a cultural heritage asset	193
Table 15-8 : Criteria for assessing significance level of impacts.....	194

Table 15-9 : Summary of baseline environment.....	195
Table 15-10 : Townland cartographic/toponymy evidence.....	199
Table 15-11 : Townlands within study area	199
Table 15-12 : Direct impacts during construction phase	205
Table 15-13 : Indirect impacts during operation phase	206
Table 15-14 : Residual impacts after implementation of mitigation measures	209
Table 16-1 : Scenic routes, Cork County Development Plan	221
Table 17-1 : Results for Location N1 at rear of houses on Old Timoleague Road.....	263
Table 17-2 : Results for Location N2 Outside Veterinary Hospital on Croppy Road.....	263
Table 17-3 : Results for Location N3 Outside Harte's Spar Shop	264
Table 17-4 : Results for Location N4 at William Houlihan Bridge (near Harte's Courtyard)	264
Table 17-5 : Location N5 at Car Park close to Credit Union	264
Table 17-6 : Location N6 adjacent Post Office	264
Table 17-7 : Location N7 Residence North of Proposed Embankment	265
Table 17-8 : Location N8 Residence West of Proposed Embankment	265
Table 17-9 : Maximum permissible noise levels at the facade of dwellings during construction	265
Table 17-10 : Significance Scale for Changes in Noise Levels (Perceptible to Human Beings)	266
Table 17-11 : Calculated Noise Levels from Expected Noise Sources	268

1 Introduction

1.1 Introduction to the Environmental Impact Statement

The OPW, in partnership with Cork County Council and other local authorities in the South West, have commissioned the South Western Catchment Flood Risk Assessment (SW CFRAM). In summary the objectives of the CFRAM Study are to:

- Identify and map existing and potential flood hazards within the South West
- Assess and map the existing and potential flood hazards within the South West
- Identify systems and measures for the effective and sustainable management of flood risk in the Areas for Further Assessment (AFAs) and within the South West
- Prepare Flood Risk management Plans (FRMPs) for the Study Area, prepare Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) for the plans.

Clonakilty forms one of the 26 AFAs in the SW CFRAM study. Clonakilty town experienced extreme flooding in June 2012 and this prompted the CFRAM work for the town to accelerate to assess the risk and to identify a viable flood relief scheme.

Mott MacDonald Ireland has been retained by the OPW to progress the engineering options and the design of the preferred option and a preliminary design for the preferred option. JBA Consulting has been retained by Office of Public Works to progress the River Fealge (Clonakilty) Drainage Scheme through Constraints Study, Preferred Options Selection and the Environmental Impact Assessment (this report).

This Environmental Impact Statement (EIS) has been prepared by JBA Consulting on behalf of the Office of Public Works (OPW). JBA Consulting was retained by the OPW to carry out an Environmental Impact Assessment (EIA) of the preferred scheme and prepare this EIS. The EIS was prepared using the guidelines set down by the Environmental Protection Agency in their document 'Guidelines on the Information to be contained in Environmental Impact Statements', 2001. This EIS is also cognisant of the requirements of Schedule 6 and Schedule 7 of the Planning and Development Regulations 2001 (as amended).

In accordance with the 1945 Arterial Drainage Act and the 1995 amendment to the Act, this EIS will form part of the Public Exhibition that will be held in Clonakilty in December of this year. The EIS will be on public display for 4 weeks.

1.2 Preliminary Assessment

The Design Engineers for the project conducted a Preliminary Assessment which examined the applicability and viability of a number of Flood Risk Management (FRM) methods for the Clonakilty Drainage Scheme. These methods were considered taking cognisance of:

- The applicability to the area
- Economic - the benefits, impacts and cost of the scheme
- Environmental - the potential impacts and benefits
- Social - impacts on people and communities
- Cultural - the potential impacts on heritage sites and resources.

The viable FRM methods that emerged from this screening assessment are:

- Structural Measures (existing risk)
 - Storage
 - Flow Diversion
 - Increased Conveyancing
 - Flood Defences
 - Localised Protection Works
- Other Works
 - Tidal Barrage

On the environmental front these options were considered and a preferred option which is described in Section 1.3 emerged.

1.3 Brief Description of the Scheme

The design engineers for the scheme (Mott McDonald Ireland) prepared a number of options for the Clonakilty Drainage Scheme. These options will be discussed in greater detail in Section 5 of this document. The options were subject to a Multi Criteria Assessment (MCA). The MCA evaluated the social, economic and environmental benefits of each of the options. The options were ranked based on the findings of the assessment and a preferred option emerged. The full environmental assessment of the options is available at www.clonakiltyfrs.ie.

In summary the preferred option consists of fluvial storage and tidal defences. New tidal flood defences will be constructed along Croppy Road, and some of the existing flood defences in town will be replaced or repaired. A storage embankment will be constructed on agricultural land just west of the Dunne's Stores Site.

1.3.1 Fluvial Storage

The primary element of the drainage scheme is the provision of a storage reservoir that will hold the flood water and allow it to be released at rates that will not over top the river banks in the town. The storage reservoir comprises agricultural land to the west of Dunne's Stores. Based on the modelling it was calculated that the permitted flow through the town would be 6.3 m³/s. For this outflow the top of the flood embankment is 13.9m AOD (i.e. 13.4m contour plus 0.5m allowance for freeboard and settlement of the embankment). An overspill provision is set at a height of 300mm less than the top of the embankment. The height of the embankment over the river is 5.6m. The storage reservoir is calculated at approx. 186,500m².

The Clonakilty Town Development Plan 2009-2015 allows for the construction of a North Ring Road around the town. A section of the proposed bypass would run through the storage area. The volume of the bypass is estimated at 21,500m³. Therefore the required storage volume for the storage reservoir was increased by a similar volume. The storage area of the storage reservoir is now set at 194,900m². The design and layout of the embankment is based on the hydraulic modelling conducted for this scheme. The embankment will have a 3 m wide sluice to control the flow of water from the storage reservoir into the river. The sluice will be situated between two concrete uprights and the height of the sluice will be manually controlled. The sluice control will be operated manually and the operator will be informed by a number of water level metres within the catchment.

Approximately 11,250 m³ of impermeable material will be used to construct the embankment.

This measure does not mitigate upstream fluvial floods risk. Consequently, some minor fluvial defence measures (embankments and flood walls) would be required at Killgarraff Bridge, the Garage Stream and on the Ballyhalwick Stream.

1.3.2 Tidal Defences

The tidal defences are described below.

- 1.1m high flood walls on both banks between Michael Collins Bridge and the Library
- Replace railings with solid parapets on Credit Union pedestrian bridge
- 1.1m high flood walls on both banks between Library and Rossa Street Bridge
- 1.1 to 1.3m high flood walls on both banks between Rossa Street Bridge and Seymour Street Pedestrian Bridge
- Replace railings with solid parapets in Seymour Street Pedestrian Bridge
- 1.3m high flood walls on both banks between Seymour Street Pedestrian Bridge and Clarke Street Bridge
- Strengthen and raise parapets of Clarke's Street Bridge
- 1.1m to 1.3m high flood walls along Croppy Road between Clarke Street and Fracksbridge
- 1.2m high flood walls from Clarke Street along the south bank, through the Waterfront Development to boundary of Waste Water Treatment Plant

- 0.75m high flood defence embankment at boundary of Waterfront Development and Waste Water Treatment Plant. Embankment to run north south tying into existing ground levels
- 1.6m high flood wall and 1.7m raised road level along 220m of the Ring Road from Fracksbridge
- 1.4m high flood embankment behind houses on the Old Timoleague Road
- 1.3m high flood walls behind a number of properties on Convent Road

A number of storm water pipelines will be installed in the town and a number of underground pumping stations will be installed. These will discharge into the river and to the estuary.

In addition to the above mentioned tidal defences a number of sections of the existing flood defence walls along the banks of the River Fealge will be replaced or repaired. Further details are given in Section 6 of the EIS.

A more detailed description of this option is given in Section 6 (Project Description) of this report.

1.4 The Study Area

The proposed scheme is to provide a drainage scheme for Clonakilty Town. Based on historical flooding events and the sources of the floods, a large study area has been selected for this Environmental Impact Statement. The general principle used to select this area was that it should be sufficiently large enough to include all reasonable drainage mechanisms.

The Study Area for the EIA covers the areas outlined in Figure 1-1 and comprises some 16 km². The study area extends from the north of the townlands of Tawnies, extending southwest through the townlands of Aghamilla, southwest to Cloheen Strand, and eastwards to include Inchydoney Island, Clonakilty Harbour, and northwards to include the town of Clonakilty.

The landscape of the study area is a combination of rural, residential/commercial and maritime in nature. Clonakilty Town comprises the built environment. The outskirts of the town and associated ribbon development extend primarily to the Southeast with smaller areas to the north of the town. Clonakilty Harbour forms a large water body within the study area. Riverine landscapes include:

- The main River Feagle Channel
- The Cappeen Stream
- The Garage Stream.

Current road infrastructure is dominated by the N71 – the primary route between Bandon and West Cork. The R558, a secondary road joins Clonakilty and Enniskeane while the R599, also a secondary road, joins Clonakilty and Dunmanway. There are a number of local roads within the study area, linking the main roads described above.

1.5 Need for the Development

There is a long history of flooding in Clonakilty Town. Flooding in the town was recorded in 1961, 1963, December 1996, 2004, 2006, 2008, three times during 2009, 2010, and five times in 2012. In the vast majority of these cases flooding was attributed to rivers and streams.

A number of studies conducted in the past, for example the MC O'Sullivan's Study in 1992, identified the requirement for a flood alleviation scheme for the town. A planning application for a tidal barrage was submitted to the Cork County Council in 1996 and permission was granted in December 2002. The permission was appealed and upheld by An Bord Pleanala and permission was granted by them in late 2003. However due to funding issues the barrage was never constructed.

The OPW's SW CFRAM study has identified the need for an accelerated programme for Clonakilty Town. This project will ensure that the risk of flooding in Clonakilty Town is reduced to an acceptable level. The EU Directive on the Assessment and Management of Flood Risks (227/60/EC) aims to, reduce the adverse consequences of flooding on human health, the environment, cultural heritage and economic activity. This Directive coupled with the 2004 OPW

Report on the Flood Risk Policy Review Group shifted the emphasis in addressing flood risk towards:

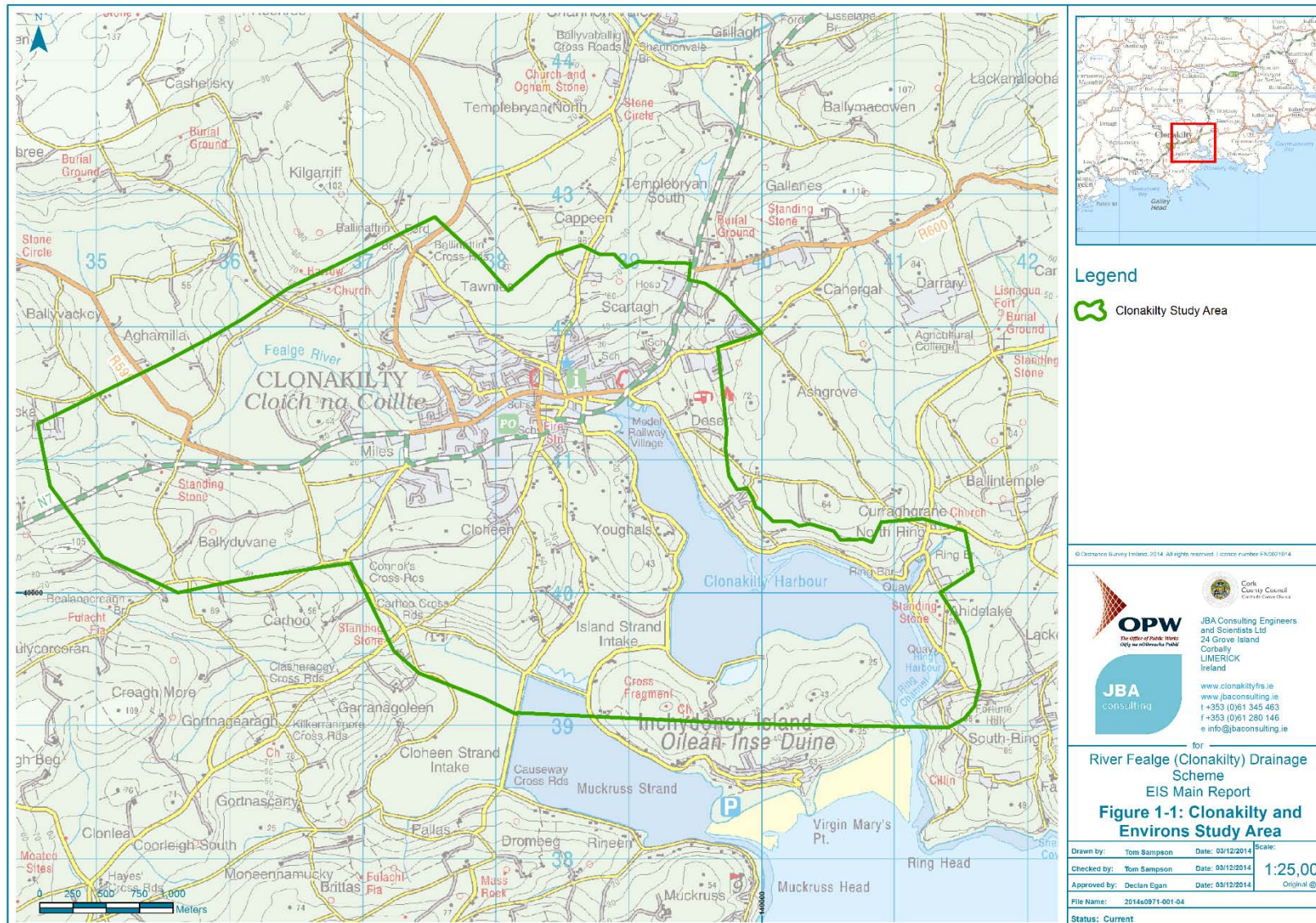
- A catchment-based context for managing risk
- Pro-active risk assessment and management of future spatial development
- Increased use of non-structural and flood impact mitigation measures.

The need for the proposed Clonakilty Drainage Scheme is detailed in a number of Departments of the Environment's Strategic Documents such as the National Spatial Strategy (2002 – 2020), the National Development Plan (2007-2013) and Local Authority Spatial plans such as the Cork County Development Plan and the Clonakilty Town Plan (2009-2015).

The OPW, in partnership with Cork County Council and other local authorities in the South West, have commissioned the South Western Catchment Flood Risk Assessment (SW CFRAM). In summary the objectives of the CFRAM Study are to:

- Identify and map existing and potential flood hazards within the South West
- Assess and map the existing and potential flood hazards within the South West
- Identify systems and measures for the effective and sustainable management of flood risk in the Areas for Further Assessment (AFAs) and within the South West
- Prepare Flood Risk management Plans (FRMPs) for the Study Area, prepare Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) for the plans.

Clonakilty forms one of the 26 AFAs in the SW CFRAM study. Clonakilty town experienced extreme flooding in June 2012 and this prompted the CFRAM work for the town to be accelerated to assess the risk and to identify a viable flood relief scheme



2 Legislative Context of the Environmental Impact Assessment

The purpose of the EIS for the Clonakilty Drainage Scheme is to carry out a systematic evaluation of the likely significant impacts of the scheme on the environment before grant of planning. Where significant impacts are identified mitigation measures are put in place to remedy/reduce these significant impacts.

This EIS has been prepared in accordance with the guidelines prepared by the Environmental Protection Agency namely:

- 'Advise Notes on Current Practice in the Preparation of Environmental Impact Statements', EPA, 2003
- 'Guidelines on the Information to be contained in Environmental Impacts Statements', EPA, 2002.

This document was prepared having regard to European and Irish legislation including:

- The EU (Environmental Impact Assessment) Regulations 1989 to 2001
- The Planning and Development Regulations, 2001 to 2012
- The Planning and Development Acts 2000-2012.

The EIS has been completed as per Schedule 6 and Schedule 7 of the Planning and Development Regulations 2000-2010.

2.1 Structure of the EIS

The EIS is comprised of the following volumes:

- Volume 1: The Non-Technical Summary
- Volume 2: The Main EIS (this section)
- Volume 3: Appendices and Supporting Documents
- Volume 4: Appropriate Assessment.

The assessment follows the 'grouped format' as set out in the EPAs guidance document (2002):

- The baseline conditions for the environmental aspects are described
- The impacts of the drainage scheme on the environmental impacts are described
- Mitigation measures to remedy/reduce the significant impacts given.

2.2 Descriptions of the Impacts

The consistent use of the impacts terminology cited in the EPA's guidance document (2002) allows the reader to clearly understand the impacts of the development on the environment. Impacts are described in terms of quality, significance and duration. Residual impacts are the impacts that will prevail after the mitigation measures are implemented.

2.2.1 Quality of the Impact

The quality of an impact can be described as:

Positive Impact. A change which improves the quality of the environment (for example, by decreasing the risk of flood events to people and property and improving the quality of the environment)

Neutral Impact. A change that does not affect the quality of the environment

Negative Impact. A change which reduces the quality of the environment (for example, lessening species diversity, damaging or removing protected habitats). A negative impact can be sufficiently minimised or eliminated by the adoption of appropriate mitigation measures.

2.2.2 Significance of the Impact

The significance of an impact can be described as follows:

Slight Impact: An impact which causes a change or changes in the character of the environment without affecting its sensitivities

Moderate Impact: An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends.

Significant Impact: An impact which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment or species. These significant impacts are subject to mitigation measures.

2.2.3 The Duration of the Impact

The duration of an impact can be described in terms of the following durations:

Short-term Impact: An impact lasting one to seven years

Medium-term Impact: An Impact lasting seven to fifteen years

Long-term Impact: An Impact lasting fifteen to sixty years.

2.2.4 Descriptions of Impacts

Impacts can be described as the following:

Cumulative Impact: The addition of many small impacts to create one larger, more significant impact.

‘Do Nothing Impact’: The environment as it would be in the future should no development of any kind be carried out.

Uncertain Impact: When the full consequences of a change in the environment cannot be described.

Residual Impact: The degree of environmental change that will occur after the proposed mitigation measures have taken effect.

‘Worst case’ Impact: The impacts arising from a development in the case where mitigation measures substantially fail.

2.3 The EIS Project Team

The following specialists were involved in the preparation of this EIS.

Table 2-1 : JBA Table Caption

Section in EIS	Specialist Area	Specialist
1	Introduction	JBA Consulting
2	Environmental Impact Assessment	JBA Consulting
3	Policy, Planning & Legislation	JBA Consulting
4	Scoping & Consultation	JBA Consulting
5	Alternatives Considered	JBA Consulting
6	Project Description	JBA Consulting
7	Water	JBA Consulting
8	Soils & Geology	JBA Consulting
9	Hydromorphology	JBA Consulting
10	Ecology	JBA Consulting
11	Human Beings	Optimize Consulting
12	Traffic	NRB Consulting Engineers
13	Air & Climate	Glenside Consulting
14	Archaeology & Cultural Heritage	Rubicon Heritage
15	Landscape & Visual Assessment	JBA Consulting
16	Cumulative Impacts	JBA Consulting
17	Summary of Impacts and Mitigation Measures	JBA Consulting

2.4 Technical Difficulties

No technical difficulties were encountered during the preparation of the Environmental Impact Statement.

3 Policy, Planning and Legislation

3.1 Introduction

The purpose of this section of the EIS is to describe where the Clonakilty Drainage Scheme fits into EU policies and National policies and legislation. The importance of the drainage scheme with respect to planning both nationally, regionally and locally is also assessed in this section.

3.2 Strategic Planning Context

The following documents and policies set the proposed Clonakilty Drainage Scheme in its strategic planning policy context:

- The Floods Directive 2007/60/EC
- The 2004 National Flood Policy and Catchment Flood Risk Assessment Programme
- The National Spatial Strategy 2002-2020
- The Regional Planning Guidelines for the South West 2010-2022
- Cork |County Development Plan 2009-2015
- Clonakilty Town Plan 2009-2015
- The Water Framework Directive
- The Habitats Regulations
- The National Climate Change Strategy 2007-2012
- The National Biodiversity Plan 20012-2006
- Our Sustainable Future : A Framework for Sustainable Development for Ireland 2012

3.3 European Union Policy on Flooding - EU Flood Directive

Directive 2007/60/EC on the Assessment and Management of Flood Risk was adapted in November 2007. The aim of the Directive is to reduce and manage the risk that floods pose to humans, the environment, cultural heritage and economic activity. The Directive required Member States *inter alia* to:

- Assess if water courses and coastlines areas are at risk from flooding. Areas identified as potential at risk of flood were required to have flood risk maps and flood risk management plans prepared for them
- To map the flood extent and determine the assets and humans who are at risk from the flooding
- To undertake adequate measures and a co-ordinated approach to reduce the flood risk.

The Directive required Member States to carry out preliminary assessments by 2011, and to identify the river basins and associated coastal areas at risk of flooding. Flood risk maps for each zone were required by 2013 and finally Flood Risk Management Plans are required by 2015.

3.4 National Flood Policies and the CFRAM Programme

The OPW published its Flood Policy Review - Final Report (2004) setting out its National Policy on flooding. The OPW are identified as the lead agency for the co-ordination of flood risk management, the preparation of flood maps and catchment based Flood Risk Management Plans (FRAMS). In summary this document sets out the requirements to protect humans from flooding both currently and in the future. It recommended that flood risk should be assessed on an integrated proactive and catchment based manner. The report set out the determining factors when considering a flood relief scheme such as an assurance that the scheme is technically feasible, cost beneficial and that an EIS of the scheme is prepared to ensure that it is sustainable.

The Flood Directive (2007/60/EU) was transposed into Irish law through the European Communities (Assessment and Management of Flood Risks) Regulations 2010 (S.I. No. 122 of 2010). The Commissioners of Public Works was appointed as the competent authority under

these Regulations. The OPW is responsible for the co-ordination of flood risk management, the development of flood maps and catchment based Flood Risk Management Plans (FRAMS). Other duties and responsibilities regarding flood risk are designated to Local Authorities, the ESB and Waterways Ireland.

3.5 The Planning System and Flood Risk Management

In 2009 the Department of the Environment, Heritage and Local Government published 'The Guidelines for Planning Authorities - The Planning System and Flood Risk Management'. These guidelines were prepared to introduce comprehensive mechanisms for the incorporation of flood risk identification, assessment and management into the planning process. These guidelines examined the impacts of flooding on:

- The environment e.g. drainage to land, damage to vegetation, soil erosion and impacts on water quality and habitats
- The public - the financial implications of flooding on humans and their well-being and quality of life
- Property - damage to houses and their content and services
- Infrastructure - potential impacts to utilities, roads, rail and waste water treatment plants.

At a National level the guidelines set out a comprehensive statement of good planning practice as a step towards a National Climate Change Adaptive Strategy. The guidelines also encourage the use of Sustainable Urban Drainage Systems (SuDS).

At a Regional level the Guidelines require the Regional Authorities to prepare strategically focused flood risk appraisals that will be incorporated into the Regional Planning Guidelines (RPG's). The RPG's will be co-ordinated with the preparation of River Basin Management Plans as required by the Water Framework Directive.

At a city and county level the guidelines require Local Authorities to introduce flood risk assessment as an integral part of their Development Plans for cities or counties. Development Plans are required to establish the flood risk assessment requirements. Planning applications will be assessed to ensure that they comply with the Flooding Guidelines.

3.6 The National Spatial Strategy 2002-2020

The National Spatial Strategy 2002-2020 (NSS) is intended to provide a 20-year strategic planning framework to facilitate the development of a more balanced pattern of social, economic and physical development in Ireland. The NSS was a direct response to the concentration of development in certain areas of Ireland which has tended to occur at the expense of other locations, where economic weakness remains. Its goal is for a more balanced system of regional development, thereby facilitating all areas of the country contributing to their full potential.

The NSS is intended to provide an upper-tier of strategic guidance that feeds into general government policy-making and also into the regional and local Development Planning framework. Acknowledging both the critical influence of and the need for consolidation in the greater Dublin region, the NSS supports the development of regional gateways in Cork, Limerick/Shannon, Galway, Waterford, Dundalk, Sligo, Letterkenny/Derry and Athlone/Tullamore/Mullingar.

3.7 The National Development Plan (2007-2013)

The National Development Plan (NDP) was published in January 2007, replacing the earlier plan for 2000-2006. It proposes investment of some €184 billion in the economic and social infrastructure of Ireland. Unlike the 2000 NDP, which envisaged an extensive contribution from EU funding, the 2006 NDP indicates that this will be raised mainly from domestic sources. A particular emphasis is placed on economic and social infrastructure deficits in areas such as transport, energy, housing, water supply, education and health. The NDP interlinks with the regional development policies in the National Spatial Strategy, being intended to develop the gateway cities and hub towns to achieve the goals of economic growth in the regions and provide for major investment in the rural economy.

3.8 Regional Planning Guidelines (2010-2-22)

The Regional Planning Guidelines for the South West includes Cork Coty, Cork County and Kerry County. The Regional Planning Guidelines gives clear direction on population and housing needs for the counties and cities from data drawn from the National Spatial Strategy. The Guidelines encourage the promotion of sustainable settlements and transportation strategies. Flood protection is highlighted as an important issue for the South West Region.

Flood Risk Management is covered in Section 6.5 of the Guidelines. Climate change is highlighted in the RPG's as a likely cause of increased flooding on human activities. The RPG's stress the need for Local Authorities to be proactive in implementing the Flood Risk Management Guidelines.2009.

3.9 Cork County Development Plan (2009-2015)

The 2009 -2015 Cork County Development Plan sets out to secure consistency and continuity in the framing and execution of the National Spatial Strategy. Section 6 of the Development Plan (Transportation and Infrastructure) and in particular Section 6.5 - Water Supply, Wastewater and Drainage addresses flooding in the county. The Plan has a number of specific objectives to deal with flooding or potential flooding namely:

- Objective INF 5-12
'It is a general objective to manage surface water catchments and the use and development of lands adjoining streams, watercourses and rivers in such a way as to minimise damage to property by instances of flooding and with regards to any conservation objectives of European sites within the relevant catchments and floodplains'.
- Objective INF 5-13
'(a) It is a general objective to implement the policies and guidelines of the Department of the Environment and Local Government and the Office of Public Works in relation to flood plains and areas sensitive to flooding'.

3.10 Clonakilty Town Development Plan (2009-2015)

The Clonakilty Town Development Plan 2009-2015 (the Plan) sets out how the town will develop within the lifetime of the Plan. The Plan will secure consistency and continuity in the framing and execution of the National Spatial Strategy.

Section 4 of Plan sets out the land use and zoning objectives for Clonakilty until 2015. There are specific objectives and land use zoning that are or relevance to the Clonakilty Drainage Scheme. These are discussed in the following section.

3.10.1 Transportation

Section 4.4.1 has specific objectives regarding transportation particularly the development of the Clonakilty Northern Relief road. The Plan states that:

'No new development shall be permitted on the line of the preferred route for the proposed relief road to the south and east of the town, or in a location that would compromise the construction of such a route'

3.10.2 Environment & Heritage

Section 4.6 of the Plan, addresses flood risk management in the town. The Plan seeks to ensure that development proposals, which are at risk from flooding or perform a flood control function, will only be permitted where it can be demonstrated that the risk of inundation is minimised. A hydrological survey and assessment must accompany these proposals.

Map 3 (Zoning Objectives) of the Plan details the spatial planning for the town. A portion of land (C-07), commercial/industrial is zoned just to the north of the proposed fluvial embankment. A number of plots of land close to the River Fealge are zoned for mixed use developments (TC-3). Similarly land at the rear of the houses on the Old Timoleague Road (R-13 on Map 3 in the Plan) is zoned for medium to high density residential development. The Clonakilty drainage

scheme proposes a 1.4 m high, 60 m long tidal defence embankment at the rear of these existing houses.

The proposed Drainage Scheme is in accordance with a number of objectives outlined in the Clonakilty Town Development Plan 2009 -2015 such as:

Section 6.9 of the Town Plan states that:

It is an objective of the Development Plan to implement the recommendations of the 'Clonakilty Flood Study Report', December 2003 including:

- *The combination of the provision of flood walls within Clonakilty to defend against flows up to the 1:25 year event with storage upstream of the town in the form of 2 or more detention basins on the River Fealge and its tributaries*
- *Investigate the possibility of further storm water attenuation areas higher in the catchment*
- *The application of Sustainable Urban Drainage Systems for all new developments*
- *Ongoing maintenance of the river channel*
- *Review the interaction of the water course with sewers and drainage.*

These points are further reinforced in Section 6.10 of the Town Plan:

It will be a strategic objective to progress the development of a tidal barrage across Clonakilty Bay, subject to (as required by law) the project complying with Article 6 of the Habitats Directive. This means that the project will either have no adverse effects on the integrity of the Clonakilty Bay European site (Clonakilty (c)SAC and (p)SPA), or will proceed for imperative reasons of over-riding public interest if there is no alternative solutions and if all compensatory measures necessary are undertaken (to ensure the overall coherence of the Natura 2000 network of European sites is protected). This project is seen as being the fundamental means of alleviating the risk of flooding in the town.

Other policy documents published by the Government in recent years which covers issues relevant to flooding include:

- National Biodiversity Plan, 2002 – 2006
- A Framework for Major Emergency Management, 2006
- National Climate Change Strategy 2007-2012
- The Water Framework Regulations

3.11 National Biodiversity Plan, 2002-2006

Ireland's National Biodiversity Plan was launched in April 2002, being prepared as a response to the UN Convention of Biological Diversity. The plan sets down the framework for conservation and the sustainable use of biodiversity over a five-year period. Its fifteen themes and sectors contain 91 detailed actions that are required to further these objectives. An Interim Review of the National Biodiversity Plan was launched in November 2005. The review documents the progress achieved in respect of the 91 actions of the original National Biodiversity Plan. In total, 23 actions were found to have been implemented, with 60 more where implementation was on-going. Eight actions were found not to have progressed substantially.

3.12 National Climate Change Strategy 2007-2012

This National Climate Change Strategy 2007-2012 develops from the 2000 Climate Change Strategy, taking into account the review contained in Ireland's Pathway to Kyoto Compliance (2006). Its purpose is to demonstrate how Ireland is to meet its 2008-2012 Kyoto commitments and to identify further policy measures needed for the period from 2012 and after 2020.

The Strategy shows, sector by sector, how the 2008-2012 commitment is to be met by a range of existing and additional measures which collectively will cause Ireland's greenhouse gas emissions to reduce by over 17 million tonnes of carbon dioxide equivalent.

For the period from 2012 to 2020, the Strategy describes a number of possible avenues to respond to the EU's commitment to reduce greenhouse gas emissions by at least 20% of the

1990 level. The strategy supports the implementation of the Flood Policy Review Group and notes the increase liaising between the Irish and British Councils on flood research.

3.13 The Water Framework Directive (2000/60/EC)

Directive 2000/60/EC establishing a Framework for Community Action in the Field of Water Policy was agreed in 2000. It rationalised a number of earlier Directives, taking into account nearly 20 years' experience of water-related EU legislation. The Directive is intended to establish a comprehensive framework for the management of water resources in each EU state, covering inland surface waters, the estuarine and coastal environment and groundwater. Key objectives are to maintain good water quality where it already exists, as well as to cause a substantial improvement where water quality has deteriorated. EU states have to ensure that a co-ordinated approach is adopted for the achievement of the objectives of Directive. Besides protecting and enhancing water quality and aquatic ecosystems, the Directive also is intended to promote the sustainable use of high quality water resources. The Directive is transposed into Irish law mainly by the European Communities (Water Policy) Regulations 2003 (S.I. No 722 of 2003).

3.14 Habitats Directive (92/43/EEC)

The Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (92/43/EEC) is the most important EU initiative to support national and international biodiversity. Its purpose is to both protect and restore the conservation status of a list of key habitats. For Ireland, these include raised bogs, active blanket bogs, turloughs, sand dunes, machair (flat sandy plains on the north and west coasts), heaths, lakes, rivers, woodlands, estuaries and sea inlets. The Directive requires Ireland and other EU member states to designate these habitats as special areas of conservation (SACs). In conjunction with the Special Protection Areas (SPAs) under the EU Birds Directive, the SACs make up the so-called Natura 2000 network.

The Directive requires EU states to draw up a preliminary list of proposed SACs and notify these to the European Commission. Once a site's importance has been agreed with the Commission, a system that formalises the designation of the site as an SAC is required to follow. If formally designated, the site must be protected and, where necessary, additional conservation objectives addressed. The effects of any plan or project that may impinge upon a site's conservation status must be formally assessed.

The Directive is transposed into Irish law by the amended European Communities (Natural Habitats) Regulations 1997 (S.I. No 94 of 1997). Clonakilty Bay is a Special Area of Conservation.

3.15 The Birds Directive (79/409/EEC)

The Council Directive on the Conservation of Wild Birds (79/409/EEC) obligates EU states to preserve, maintain and re-establish sufficient areas in order to safeguard the habitat for all bird species. Additional requirements are mandated in relation to a list of key bird species set down in the Directive's Annex 1, with EU states being required to designate special protection areas (SPAs) for them. For Ireland, this causes protection to be conferred on such species such as the whooper swan and migratory species such as ducks and geese.

Key wetland areas, especially those which attract large numbers of migratory birds each year, are required to be designated. In a similar manner to the requirements on SACs under the Habitats Directive, plans or projects which are likely to affect an SPA are required to undergo a formalised assessment of their environmental implications on the designated site. The Directive is transposed into Irish law by the European Communities (Natural Habitats) Regulations 1997.

Clonakilty Bay is a Special Protection Area.

4 Scoping and Consultation

4.1 Introduction

Scoping was continually carried out throughout the various stages in the preparation of this EIS. Consultations took place with the relevant stakeholders at a number of stages including:

- Public Information Day
- The preparation of the Constraints Study
- Public Consultation Day
- The preparation of the Environmental Impact Statement

4.2 Public Information Day- 16th October 2012

A public information day (PID) was held in Clonakilty on the 16th October 2012. The purpose of the PID was to gather local information about the flooding events that had previously occurred in Clonakilty. The programme was divided into a number of sessions:

- A presentation to the Elected Representatives of Cork County Council and Clonakilty Town Council
- A meeting with the town's Chamber of Commerce and Progress Group Members
- A public information session.

A copy of the report on the findings of the PID is presented in Appendix 4A in Volume 3 of this EIS and summarised in the following sections.

Questionnaires were made available to the public to gather information on their experiences with flooding. The public were asked to account their experiences with flooding and they were requested to rank their preferred flood control measures. A stamped addressed envelope accompanied the questionnaires. A total of 76 submissions were received from the public. Of these 76 submissions, 38 of them were related to domestic flooding, 24 related to experiences with commercial flooding and 10 related to experiences with both domestic and commercial flooding.

4.2.1 History of flooding in Clonakilty

When asked about their experiences with flooding in the town the public responded thus.

53 of the submissions received recalled the most recent flood event in Clonakilty in June 2012. August and October of the same year received 13 and 10 submissions respectively.

1 flooding event during 2010 was reported in the submissions received.

3 flood events occurred in 2009, in September, November and December. The submissions received for these events were 1,,2 and 2 respectively.

2 flood events in 2008 were reported in the submissions, and 1 flood event was reported in the public submissions in 1196, 2004 and 2006. Historically flooding was reported in 1961 and 1963.

4.2.2 Ranking of Measures to Control Flooding

The questionnaire also requested the public to rank effective/preferred measures to control flooding. Based on the rankings assigned in the questionnaires returned, flood warning, dredging and a barrage received the most first ranks. However when combined with 2nd and 3rd rankings walls and embankments were the most popular. River widening measures also ranked highly.

4.3 Public Information Day - 16th July 2013

A second public consultation event was held by the Office of Public Works (OPW) on the 16th July 2103 in Clonakilty. The purpose of the public consultation day (PCD) was to get feedback from the public on the Draft Flood Maps and the Preferred Flood Risk Management Options for Clonakilty. The findings of the consultation are discussed and detailed in the Consultation Report prepared by Mott MC Donald Consulting Engineers and the OPW. In summary the fluvial

storage and the tidal defences option was the preferred option. This was followed by the fluvial flow diversion and the tidal defence option.

The respondents were also asked to indicate how important they felt certain flood risk management objectives were in respect of the town. Risk to the local economy, risk to human health, risk to vulnerable properties and risk to employment were all considered very important. Risks considered important to the residents included water bodies, the environment, protected sites and habitats, endangered species, fish, visual amenity, architectural features, archaeology and climate change. Risks that were considered fairly important included transport infrastructure, utility infrastructure, agriculture, social infrastructure, flood sensitive amenity sites and soil erosion.

The full PCD report is included in Appendix 4B in Volume 3 of this EIS.

4.4 Constraints Study

The design options for the flood relief measures for Clonakilty were a combination of engineering design and environmental input. In summary a Constraints Report was prepared by JBA Consulting.

The Constraints Study is the first step in the preparation of an environmental impact statement (EIS) for the River Fealge (Clonakilty) Drainage Scheme. The purpose of the Constraints Study was to determine what constraints (physical, procedural, legal, environmental etc.) exist that could affect the design of the scheme, could delay the progress of the scheme and could influence the cost of the scheme.

The scope of the Constraints Study has followed the headings prescribed in the Environmental Protection Agency's Guidelines 'Advice Notes on the Current Practice in the Preparation of Environmental Impact Statements', 2003. The prescribed headings were as follows:

- Human Beings
- Air Quality
- Noise and Vibration
- Traffic
- Landscape
- Soils & Geology
- Archaeology & Cultural Heritage
- Water
- Ecology
- Material Assets.

A part of the Constraints Study involved sending a consultation letter to a number of statutory and non-statutory consultees. A copy of the letter and the accompanying map is given in Appendix 4C of Volume 3 of this EIS. A list of the consultees is shown in Table 4-1 : 31 consultees. A second consultation letter with an updated map showing an extended study area was re-issued to the consultees. Submissions were received from a number of the consultees (see Appendix 4D in Volume 3 of this EIS) and Table 4-2 provides a summary of the issues raised by the consultees. In addition meetings were held with the Clonakilty Chamber of Commerce, The National Parks and Wildlife Services, and the Inland Fisheries Ireland. All issues raised by the consultees have been considered in the preparation of this Environmental Impact Statement. Meetings were held with National Parks and Wildlife Services and the Inland Fisheries Ireland.

Table 4-1 : 31 consultees

Consultees	Consultees (cont.)
Irish Aviation Authority	Irish Peatland Conservation
Geological Survey of Ireland	An Bord Iascaigh Mhara
Bord Failte	Clonakilty Chamber of Commerce
Birdwatch Ireland	Dept. of Agriculture and Food

Consultees	Consultees (cont.)
Bat Conservation Ireland	Landscape Alliance Ireland
Irish Coast Guard	Mining Heritage Trust of Ireland
Environmental Protection Agency	Teagasc
The Heritage Council	Dept. of Community, Equality and Gaeltacht
Irish Wildlife Trust	National Roads Authority
ESB	Dept. of Arts, Sports and Tourism
Irish Farmers Association	Tourism Ireland
Irish Heritage Trust	Coastal Zone Management Division
National Monuments Service	An Taisce
Dept. of the Environment, Heritage & Local Government	Water Services Section, Cork County Council
Inland Fisheries Ireland	National Parks and Wildlife Services

Table 4-2 : 31 Replies from Consultees to Consultation Letter

Respondent	Issues Raised	Response
National Roads Authority	Consultation with the Local Authority and the NRA.	Already initiated with consultation letters sent to both parties. Will be in continual discussions with these bodies during the preparation of the EIS for the preferred option.
	Assessment of the impact on existing roads.	Addressed in Section 11 of this report and consultation will be undertaken with these bodies during the preparation of the EIS for the preferred option.
	Damage to existing roads during construction of the flood relief scheme.	Addressed as a possible constraint in Section 11 of this report. All work practices close to roads will be agreed with Cork County Council and the NRA prior to commencement.
	Adherence to any conditions in a grant of planning for roads in the area.	All work practices will be undertaken and agreed with in advance with Cork County Council and the NRA.
	Requirement for a traffic and transport assessment if the appropriate thresholds are reached.	A traffic and transport assessment will be conducted as part of the EIS if the additional traffic for the construction of the preferred option for the flood relief scheme exceeds the appropriate thresholds.
	Consult with the NRA Road Safety Audit (NRA HD 19/12) re. requirement for a road safety audit.	It is unlikely that a road safety audit will be required for this work.
Department of Art, Heritage and the Gaeltacht	Plan needs to comply with the legislation relating to the Special Protection Area and the Special Conservation Area designations for Clonakilty Bay	These concerns are addressed in Section 7, Ecology & Fisheries and Section 5, Water of the Constraints Report.
Inland Fisheries Ireland	Flood alleviation measures must be sustainable and comply with the requirements of the Fisheries Acts, Habitats Regulations and Water Framework Directive.	These concerns are addressed in Section 7, Ecology & Fisheries and Section 5, Water, of the Constraints Report.
	Mapping of aquatic habitats in the river	This has been completed as part of the hydro morphological study (refer to

Respondent	Issues Raised	Response
		Section 6 of this Constraints Report). Macroinvertebrate surveys to be undertaken.
	Redd Counting upstream of any proposed flood alleviation scheme	This has been completed as part of the hydro morphological study (refer to Section 6 of this Constraints Report). Data will be extracted for redds.
	Mapping areas of riverbank liable to erosion.	This has been completed as part of the hydro morphological study (refer to Section 6 of this Constraints Report). A vegetation survey has been conducted along the banks of the River Fealge (refer to Section 4, Ecology, of this report)
	Stock surveys of all fish species.	Surveys will be undertaken at locations that may be impacted upon by the chosen works and preferred scheme.
	Quantification of habitat losses, impact on fish stocks, changes in flow dynamic on the river from the preferred option.	The impacts of the preferred option on water quality, habitats and species will be addressed in the relevant section of the EIS. Mitigation measures to reduce/ remedy the impacts, if any, will be detailed.
	Consideration of an off line storage option.	This has been reviewed by the engineers and it is not a viable option
	In the event that the creation of a storage area is an option then consideration of habitat loss and requirement for a fish passes should be examined.	If this is a preferred option then the EIS will assess the impacts of the storage area on the habitats and species in the area. A suitable fish pass will be engineered.
	In the event that a tidal barrage is the preferred option then consideration to the impacts on the passage of fish and water quality should be considered.	If this is a preferred option then the EIS will assess the impacts of the tidal barrage on the habitats and species in the area. A suitable fish pass will be engineered.
National Park And Wildlife Services	If the works require some channel sealing or canalization then the effective replacement/recreation of a suitable habitat would need to be undertaken.	All in-river works will be carried out to ensure that the damage to the surrounding environment and fish is kept to a minimum. We will liaise with IFI regarding the design of the pre-cast structures if required.
	Requested strict controls over the excavation, removal and disposal of waste soil	All in-river material is subject to testing and a full waste acceptance characterisation analysis carried out on the material. The requirement of the Waste Management Act (as amended) will be adhered to.
	Requested an otter survey and a derogation licence for any otter before the planning is lodged.	This is fully addressed in Section 7, Ecology & Fisheries,, of this report.
	Requirement for a bat survey.	A bat survey will be conducted in the areas where trees may be impacted upon or felled.
	In the event that the tidal barrage is the preferred option there is a requirement to model flow regimes and sediment movement, to compare it to a similar site and to do a macro-invertebrate study in the area of the barrage.	This work will be undertaken if the tidal barrage is a preferred option.

Respondent	Issues Raised	Response
	Consider re-locating the barrage closer to the town.	This option was considered by the consulting engineers and the calculations show that there would not be sufficient fluvial storage at this location.
	Care need to be taken with any coastal defence works particularly for the otter.	A standard operating procedure for the construction of any coastal defence works will be required from the contractor.
	Requested a curlew and black tailed godwit winter feeding survey in the lands of the proposed flood plain.	BirdWatch Ireland and Cork County Council Environment Department will be contacted for this data.
Faite Ireland	None raised	
An Taisce	Sustainable flood risk management approach	The engineering team is currently looking at flood alleviation options for the town.
	Concerns about the potential impact of a tidal barrage on the Clonakilty Bay SAC and SPA	These concerns and constraints are addressed in Section 7, Ecology & Fisheries and Section 5, Water of this Constraints Report. An Appropriate Assessment will be carried out on the preferred flood alleviation management option.
Geological Survey of Ireland	None raised	
Department of Agriculture Food and the Marine	Supports the construction of a barrage with the provision of an amenity walk	The engineering team is currently looking at flood alleviation options for the town. Each of the options will be assessed to determine which option will provide the best flood relief for the town taking into consideration the environmental, archaeological and social constraints identified in this report.

4.5 Public Consultation Day

As part of the consultation at the Preferred Option Stage of the project, stakeholders and the public were invited to attend a consultation meeting in the Parish Centre, Clonakilty on the 2nd July, 2014.

Notice of the Public Consultation Day (PCD) was advertised on local radio and in the local newspapers.

The purpose of the PCD was to:

- Inform the Elected Representatives of Cork County Council and Clonakilty Town Council of the emerging preferred option
- Present drawings and an artist's impressions of the emerging preferred option
- Present the findings of the environmental assessment on the options considered.

JBA Consulting and MMI gave a presentation to the Elected Representatives on the emerging preferred option.

Feedback forms were made available for comment by the public. A copy of the feedback form is given in Appendix 4E. Members of the public were invited to comment either at the event or by return of their comment in a stamped, addressed envelope. Comments could also be submitted electronically.

58 people attended the PCD and a total of 9 no. completed feedback forms were received. Two other submissions were received by letter or email.

A copy of the PCD report is given Appendix 4E in Volume 3 of the EIS, and is summarised below. The responses to the questions asked in the feedback form are discussed below.

4.5.1 Comments on the emerging Preferred Option

- 3 of the 9 submissions commented that a tidal barrage would be a better option

- 2 replies agreed with the emerging preferred option
- 2 respondents were concerned about flooding at Weston Lodge due to the flood walls across from the church
- 1 respondent requested more details about the operation of the sluice gate on the fluvial embankment.

4.5.2 Comments on the Tidal Defence Walls

- 2 respondents were concerned about the visual impact of the tidal defence walls
- 1 respondent concerned about the strength of the foundations
- 2 respondents concerned about flooding at Weston Lodge

4.5.3 Comments on the Fluvial Embankment and Storage

- 3 respondents favoured the fluvial embankment while one was concerned about the stability of this type of structure
- 1 respondent suggested smaller holding areas further upstream.

4.5.4 Comments on River Walls through the town

- 1 respondent agreed with the walls and 1 respondent felt that the walls would lessen the amenity value of the river
- 1 respondent requested that the walls at the western end of the town be repaired or reinforced.
- 1 respondent requested that the walls alongside the church be removed or other surrounding walls raised to its level
- 1 respondent requested more information about the walls and bridges around the Credit Union.

4.5.5 Additional Information Requested

- 2 respondents requested a copy of the engineers report prepared prior to the construction of the defence wall beside the church
- 1 respondent asked if the river could be dredged
- 1 respondent requested the council to lay a drain through the archway into Hartes Courtyard

4.5.6 How useful was the Public Information Day

- 5 respondents said that it was about right
- 2 respondents said that it was OK
- 1 respondent requested more information.

4.6 Scoping during the EIS

Consultations with the Statutory Bodies found that they wanted particular surveys to be conducted for the EIS. The Inland Fisheries Ireland (IFI) requested an electro-fishing survey of the river to estimate the numbers and species of fish in the River Fealge. A white-clawed crayfish survey was also requested.

The National Parks and Wildlife Services (NPWS) requested information on bats and otters within the study area. They also requested specific ecological assessment to be carried out in the estuary if the tidal barrage was one of the emerging preferred measures.

In addition the OPW were in constant communications with the landowners in the areas that would be impacted by the emerging preferred option.

The Cork County Council Roads Section was updated on the location of the proposed storage embankment because of its proximity to the proposed Clonakilty bypass.

Consultation meetings were held between the JBA ecologists and the Project Manager and IFI and the NPWS. The IFI were kept informed of the findings of the surveys and INIS Consultancy provided the findings of the salmon, trout, eels, lamprey and white claw fish surveys to the IFI.

Optimize Consultants who are responsible for conducting the socio-economic assessment for the EIS met with members of the Clonakilty Chamber of Commerce and had discussions with the members of the public who were impacted upon by the June 2012 flood event.

The Lord Mayor of Clonakilty attended some of the monthly Steering Group meetings.

The archaeologist consultancy (Rubicon Heritage) was in communication with the Department of Art, Heritage and the Gaeltacht regarding the licence to conduct investigative work at Miles and at a site close to the Old Timoleague Road.

5 Alternatives Considered

5.1 Introduction

The Constraints Study undertaken by JBA Consulting identified a number of environmental constraints that needed to be considered by the design engineers when examining the drainage scheme options. The Constraints Report was used by the engineers to inform their selection of a flood risk management option. The range of options considered includes:

- Storage of water
- Flow diversion
- River conveyancing
- River re-grading
- Tidal barrage
- Flood defence walls

5.2 Constraints Study

This study set out the key environmental constraints that could affect the design, delay the progress of or the cost of the Clonakilty Drainage Scheme. This study was conducted by carrying out a desk top assessment of all the existing current environmental, archaeological, geotechnical, socio-economic and landscape data within the Study Area and conducting site visits to verify this data. A portion of the study involved liaising with the engineering consultants for the design of the scheme.

The environmental constraints were assessed under the following headings:

- Human Beings including socio-economic
- Material Assets
- Water
- Hydro Morphology
- Ecology and Fisheries
- Geology and Soils
- Landscape and Visuals
- Cultural Heritage and Archaeology
- Traffic
- Air and Noise.

The Constraints Study formed the first stage in the preparation of an Environmental Impact Statement (EIS) for the chosen Clonakilty Drainage Scheme option. This process was run in parallel with the options prepared by the engineering consultants - Mott McDonald Ireland. These options were later subject to a Multi Criteria Assessment that looked at *inter alia* the environmental impacts of the options, the cost and the engineering feasibility of the options. A preferred option emerged from this process and this EIS is for this option.

A copy of the Constraints Report is available at www.clonakiltyfrs.ie and its findings are summarised in the following tables.

5.2.1 Key Constraints

A summary of the key constraints identified for each of the headings above is described in the following section.

Human Beings

The zoning objectives given in Map 3 of the Clonakilty Town Development Plan 2009-2015 must be considered in the design of the flood alleviation scheme.

The value of the landscape, architecture and views in the town and the environs should be considered in the design of the flood alleviation scheme.

Human Beings

The impact of the scheme during construction on sensitive receptors such as hospitals, schools and nursing homes should be considered in the design of the scheme

The flood alleviation scheme should seek to enhance the character of the town and ensure that the development of the town is not hindered either commercially or residentially

Access to walkways, walking routes etc. should not be hindered by the scheme

Construction work on the scheme should not affect tourism in the area

Time to the completion of the scheme will be important to allow businesses in the area to get flood insurance cover.

Material Assets

The presence of the underground and underwater cables should be clearly identified before any excavations on land or in-river works are commenced.

Cork County Council and the National Roads Authority should be consulted with in relation to the potential impact of a flood relief scheme on the existing or future road networks.

Any flood relief scheme should examine the likelihood of flooding of the waste water treatment plant.

Water

Clonakilty Harbour is eutrophic and the current water quality is described as moderate. Any flood alleviation scheme that would impound water in the harbour would also impound effluent from the treatment plant. The effluent may increase the levels of nutrients in the harbour and may add to its trophic status. Depending on the design and operation of a tidal barrage, this may result in lower water quality in the harbour and may hinder the requirement of the Water Framework Directive to achieve good water quality by 2015.

Clonakilty Harbour and Bay is sensitive to any alterations in water movement or water quality. Depending on the design and operation of a barrage the sediments entering the harbour may cause scouring at the openings in the barrage. Depending on the velocities of the water flowing through the sluices in the barrage the channels in the estuary may cause erosion of the channels and increase the suspension of solid material into the water. In addition increased flows through the sluices may impede the movement of migratory fish.

The design and operation of the proposed scheme should be cognisant of the existing water quality within the Study Area and the need to maintain same. The flora and fauna associated with the aquatic environment must be maintained.

The design and operation of any flood alleviation scheme must not compromise the requirements of the Habitats Directive or the Birds Directive and an Appropriate Assessment will need to be carried out. In the event that the Appropriate Assessment identifies adverse impacts on the harbour/bay then an alternative option(s) will need to be considered. If these options also have an adverse impact then the scheme can progress in the interest of overriding public interest. If this scenario is realised then compensatory measure will need to be put in place and approved before construction can commence. The process of identifying and characterising the adverse impacts will have a significant time constraints associated with it and this will significantly slow down the start of the construction works.

The design and operation of the proposed scheme should not impact on the salmonid species found in the rivers, estuary or sea. Similarly the scheme should not significantly impact on the eels and lamprey within the study area.

The design and operation of the proposed scheme must not conflict with the objectives of the Water Framework Directive and in particular the South Western River Basin Management Plan and the objectives of the Skibereen Clonakilty Water Management Unit

Action Plan. A barrage that will operate as an impoundment of water in the upper harbour will cause a build-up of nutrients in the water body that currently is eutrophic.

The design and operation of the proposed scheme should be cognisant of the aquatic mammals inhabiting the study area such as otter.

The removal and disposal of any river/estuarine sediment should follow the guidelines for handling waste under the Waste Management Acts as amended. A strict chain of custody must accompany all excavated materials taken off site for disposal.

Hydro Morphology

Any future scheme should not alter the morphology of the river or estuary in a way that means it is unable to achieve the WFD objectives by 2021.

The river throughout contains a good gravel substrate which can provide good places for fish spawning and a diverse hydromorphology characteristic of this river type. Any in channel works or permanent modifications to the channel bed or banks could have an adverse impact upon in channel habitats and morphological features / processes.

Improved upstream storage and flood plain reconnection would be beneficial in areas where the channel is currently disconnected from its floodplain, as this will act to reduce fine sediment within the channel and also benefit spawning habitats.

Further investigation is required to assess the scheme proposals against any impact on flow, channel dimensions and existing morphology. Any change of these factors risks impacting existing depositional processes and good gravel morphology / habitat.

Ecology and Fisheries

Clonakilty Bay, into which the River Fealge discharges, is designated as a SAC, SPA and pNHA. This site is protected under the EU Habitats Directive and is of international importance for its intertidal and estuarine habitats and wader and wildfowl populations.

The flood relief scheme options will need to be subject to an Appropriate Assessment screening exercise to determine if any significant adverse impacts on the interest features of the SAC and SPA are likely.

Potential impacts, depending on the option selected, may include damage to mudflat habitats, changes to sediment movements within the estuary, water quality changes and impacts on macroinvertebrate, fish and bird populations using the bay.

Tidal mudflats and upper saltmarsh habitats have been identified within the most inland subsites of Clonakilty Bay SPA and SAC, which is a recognised important foraging and roosting site for a variety of waterbird species. Measures to be implemented as part of the flood alleviation scheme will need to consider the potential negative impacts on these waterbirds, particularly those species that assemble in numbers of international and national importance over winter (e.g. Black-tailed Godwit).

Works directly adjacent to the estuary should be programmed outside of the critical period for overwintering birds (November to February) to limit disturbance.

If works are undertaken during the winter appropriate mitigation measures will need to be implemented. For example, screening off works where possible to limit disturbance and stopping works if a significant drop in temperature is experienced. It will also be necessary to consider the impact of works on interest features (i.e. bird species) outside of the site boundary, for example possible feeding or roosting areas for wading birds on agricultural land that may be some distance from the site boundary itself.

Once the exact nature and scale of the works is determined, the areas to be affected should be surveyed to determine the level of Otter activity and if any resting places/holts are present. Appropriate licences may also be required in relation to any works on or around breeding or resting places.

Options that require the removal of mature trees with the potential to support roosting bats, such as the potential embankment associated with the flood storage area, should be reassessed, with surveys conducted on any features with medium or high potential for

Ecology and Fisheries

roosting bats.

If possible to protect Grey Wagtails and Dippers, the works, including vegetation clearance and any works to existing walls and bridges, should be conducted outside of the breeding bird season (March to September inclusive) to protect any nests that may be present.

Timing constraints should apply to any in-channel working to avoid the salmonid spawning season (usually between November and March) and appropriate measures to prevent pollution incidents and silt mobilisation should also be applied.

Appropriate measures also need to be included in the design of any scheme to ensure fish passage is maintained, fish do not get stranded in any storage areas created and habitat value within the existing channel is not reduced

Appropriate measures should be taken to ensure that the spread of invasive species such as Japanese Knotweed are not accelerated during any works.

Geology and Soils

The bedrock geology and soil types are suitable for the type of flood alleviation measures being proposed, however it is essential that local geotechnical investigations are carried out to confirm the suitability of the proposed scheme options. This is the responsibility of the designer.

The scheme should look to further reduce soil erosion from agricultural land as a sediment source to the River Fealge.

Any proposed options within Clonakilty Harbour and Clonakilty Bay have the potential to significantly alter the sediments. This impact has the potential to compromise the status of the Clonakilty Bay SPA, SAC and pNHA.

Landscape and Visual

Protection of Elevated Scenic Landscapes (Clonakilty Development Plan, Section 9 and Scenic Landscape (Cork County Development Plan) to East of harbour, particularly from designated Amenity Walk to south side of The Croppy Road (CDP).

Clonakilty Harbour Special Protection Area (SPA), designated as a site for overwintering birds and resulting amenity/landscape value.

Protection of scenic Routes (CCDP) S72 and S73 from Clonakilty town centre; S72 runs along Deasy's Quay with S73 along Convent Road.

Protection of areas designated for Tree and Hedgerow Protection (CDP).

Protection of setting and views from Conservation Areas (CDP, particularly within town centre.

Protection of key pedestrian routes within town, including Kent Street, Fealge Riverwalk and William A. Houlihan Bridge.

Protection of Historical Walking Trail within town centre (CDP).

Protection of views indicated in CDP as 'amenity routes' (but not yet in place) e.g. between cemetery and Lower Tawnies.

Presence of rolling, agricultural landscape to N and W of town, which is noted as being of medium sensitivity and value (CCLS).

Presence of indented coastal landscape around harbour, which is noted as being of high sensitivity and value (CCLS).

Residential views from properties along river through town centre.

Residential views from properties within open countryside to west of town centre, such as Kilgarraffe, Lower Tawnies and Miles.

Landscape and Visual

Recreational views from terrace and gardens at Fernhill House Hotel.

Archaeology and Cultural Heritage

There are 42 Record of Monument and Places (RMPs) incorporated by the study area. This includes the Zone of Archaeological Protection (ZAP) for Clonakilty historic town (CO135-052). None are designated as National Monuments or have Preservation Orders placed on them.

There are 207 listed structures in the Record of Protected Structures (RPS) within the study area of Clonakilty.

Clonakilty has been designated an Architectural Conservation Area, avoidance and minimisation of any potential visual impacts or impacts on setting should be one of the guiding principles adopted in developing and finalising the design of the proposed scheme.

There are 187 structures that are listed in the NIAH for Co. Cork incorporated by the study area.

Many heritage sites are situated immediately adjacent to or within the river channel. Archaeological deposits or artefacts may also survive below the ground surface and river bed in the vicinity of these monuments.

Given the provisions of the National Monuments Acts, no disturbance or interference to any known archaeological sites can take place without first consulting the National Monuments Service of the Department of Arts, Heritage and the Gaeltacht (DAHG).

It is recommended that if possible all impacts on identified cultural heritage sites, and their immediate vicinities, should be avoided in the design of the proposed scheme.

There is also the potential for the presence of unrecorded archaeological features and artefacts within the river channel, such as fords, bridges, wrecks, landing features, etc. These have potential to be impacted upon by flood relief works such as dredging. It is, therefore, recommended that the Underwater Archaeological Unit (DAHG) be consulted during the design of the proposed scheme in order to agree appropriate underwater archaeological assessment and mitigation strategies.

The requirements of the DAHG may consist of river bank and underwater archaeological survey pre-works, possible testing around the bridges and other sites along the river course, depending on proposed impacts by the flood scheme and full monitoring of all works.

All Record of Protected Structures sites have statutory protection and avoidance of these features is recommended.

Traffic

The N71 National Secondary Road plays a key traffic role locally for Clonakilty, and for the whole of West Cork. In this regard, it is recommended that Cork County Council and the National Roads Authority be consulted in relation to any effects on the existing and proposed roads infrastructure in the Study Area from any proposed Option identified.

A key constraint will be to avoid any negative impact upon traffic progression on the N71, particularly during the busy tourist season. The selected Option(s) will likely require the preparation of a Transportation Assessment Report or Statement to identify Traffic and Transportation impact associated with any individual scheme.

Any proposals should ensure that the key existing and proposed local and strategic links are maintained so that temporary or permanent disruption on local and national routes is minimised.

Air and Noise

Prior to the selection of a preferred flood relief scheme, it is recommended that the short listed flood alleviation measure be assessed in relation to the impact of noise and vibration during the construction phase of the project.

It is recommended that a full noise and air quality impact assessment of the preferred flood alleviation option be undertaken.

It is recommended that mitigation measures be put in place to reduce the impacts on air quality and the noise environment during the construction phase of any proposed flood relief scheme where deemed necessary.

5.3 Design Options

5.3.1 Screening of Possible Flood Risk Management Methods

A preliminary assessment was carried out to identify which Flood Risk Management (FRM) methods were applicable to the Clonakilty area.

A number of non-viable methods were identified including,

- do nothing
- do minimum
- non-structural methods such as planning control, building Regulations, public awareness, flood forecasting, and land use management
- relocate properties
- channel or flood defence maintenance works
- improvement of the existing defences
- localised protection works.

Viable Flood Risk Management options investigated included:

- Structural Measures (existing risk)
 - Storage
 - Flood Defences
 - Flow Diversion
 - Increased Conveyance
- Other Relevant Works
 - Tidal Barrage

5.3.2 Design Options Considered

Six design options were considered by the design engineers. The options were based on a number of measures that would reduce the risk of flooding in Clonakilty. A flood management option consists of one or more commonly, a combination of flood risk management methods/measures. In order to provide a viable flood risk management option for Clonakilty that would mitigate both fluvial and tidal flood risk, a combination of structures were required. These options are summarised below:

- **Option 1 – Flow Diversion and a Tidal Barrage** (Figure 5-1). It comprises a flow diversion channel to capture excessive fluvial water and a tidal barrage to reduce tidal flooding. The culvert will be excavated at the junction of the N71 road and the Western Road upstream of Dunne's Sores. From here it will follow the route of the bypass as far as Casement Street where it continues along the boundary of the former GAA pitch and discharge into the estuary.
The tidal barrage will be located at the shortest crossing point approximately 950 m downstream of the town at Desert Strand on the Ring Road. The tidal barrage will be approximately 3.34m AOD and a width of approximately 25 m and a manually operated sluice gate of 10 m wide.

- **Option 2 – Flow Diversion and Tidal Flood Defences** (Figure 5-2) The flood diversion is as described for Option 1. The tidal flood defences will consist of a number of defence walls and embankments along Croppy Road, an embankment at the houses on the Old Timoleague Road, flood walls behind a number of properties on Convent Road, walls on both banks between Seymour Street bridge and Clarkes Street Bridge, and raising the parapets on Clarkes Street Bridge
- **Option 3 – Fluvial Flood Defences and Tidal Barrage** (Figure 5-3) The fluvial flood defences would comprise a number of embankments upstream of Killgarraff Bridge, upstream of Dunne's Stores and a 3.2 m high embankment between Dunne's Stores and Fernhill on the left bank of the Fealge. A 3.0 m high wall between Dunne's Stores and Fernhill Road on the right bank of the river behind the houses on Western Road, a 4.2 m high flood wall on both sides of the river between Bridge Street and Rossa Street would be required. Other walls that would need to be constructed are a 3.9 m high flood wall between Bushmount and Bridge Street on the right hand side of the river and a 3.9 m high walls on the left bank of the river between Tobin's Bridge and Bridge Street. The tidal barrage would be positioned at a narrow section of the estuary at Desert Strand on the Ring Road. It would have a crest height of 3.34 m AOD and an opening 10 m wide. The barrage would tie into the high ground via embankments constructed at each end of the structure. When a high storm surge or tide level is predicted a sluice gate will close at low tide and prevent surge levels reaching Clonakilty. This will ensure that there is sufficient fluvial storage behind the barrage. The area behind the barrage is approximately 312,400m² and can accommodate a fluvial of 8m³/s for a period of 26 hours.
- **Option 4 – Fluvial Flood Defences and Tidal Flood Defences** (Figure 5-4) The fluvial flood defences have been described in Option 3 above. The tidal flood defences have been described in Option 2 above.
- **Option 5 – Fluvial Storage Areas and Tidal Barrage** (Figure 5-5). The fluvial storage measure will mitigate downstream fluvial flood risk. The embankment will be constructed of impermeable clay and will have a height of approximately 5.6 m above the base of the river. An overspill provision is also included in the design. The embankment will be constructed north of Miles close to Dunne's Stores. The tidal barrage has been described in Option 3. Pumping stations will be constructed to ensure that rainwater falling behind these structures. These will be located at Croppy Road (Cork County Council), Rossa Street, Kent Street and at the former GAA grounds (Cork County Council)
- **Option 6 – Fluvial Storage and Tidal Defences** (Figure 5-6). The fluvial storage measure is described in Option 5 above. The tidal flood defences are described in Option 2 above.

These options were assessed using the standardised Office of Public Work's Multi-Criteria Analysis (MCA). The MCA evaluates the options on a number of core criteria namely technical, social, environmental and economic bases. This is the standard approach used by the OPW for CFRAM projects. In the MCA a number of objectives and sub-objectives are assigned to the core criteria. Each option was scored against these objectives.

JBA Consulting conducted an environmental assessment of the options. The options were assessed against a number of strategic environmental objectives. The short-term, long term, significance, temporary and permanent nature of these impacts on the environmental objectives were assigned for each option. The environmental assessment found that:

- The environmental impacts during the construction of the scheme would be greater than the environmental impacts of the operation of the scheme
- The environmental impacts during construction can be mitigated by the installation of a number of mitigation measures such as a Traffic Management Plan, Method Statements for in-river works to be agreed in advance with Inland Fisheries Ireland, noise control measures, and dust control measures etc.
- The River Fealge holds populations of salmonid, eels and lamprey and any work in or close to the river will need strict environmental controls

- Clonakilty Bay is a Special Protection Area (SPA), a Special Area of Conservation (SAC) and a proposed Natural Heritage Area (pNHA). It is protected by European and national legislation and any work in or close to the estuary needs to be cognisant of the National Park and Wildlife Services (NPWS) Conservation Objectives for the Bay. All options will potentially have an adverse impact on Clonakilty Bay during construction. These impacts can however be mitigated. A tidal barrage (Options 1, 3 and 5) has the potential to have a long-term adverse impact on the habitats and birds of Clonakilty Bay both during construction and operation.
- Clonakilty is designated as an Architectural Conservation Area in the Clonakilty Town Development Plan (2009-2015). There are 207 listed structures in the Record of Protected Structures (RPS) within the study area of Clonakilty. There are 187 structures that are listed in the NIAH for Co. Cork incorporated by the study area. There are 42 Record of Monument and Places (RMPs) incorporated by the study area. This includes the Zone of Archaeological Protection (ZAP) for Clonakilty historic town (CO135-052). A number of archaeological features are located along the route of the flow diversion (Options 1 and 2).
- There are 3 fulachta fiadh located close to the site of the fluvial embankment (Options 5 and 6). There is a holy well and a mill located in the fluvial storage area. A Recorded Monument of an enclosure is located close to the proposed flood embankment at the Old Timoleague Road. Where possible, every reasonable effort should be made to preserve in situ, or reduce the impact on any identified archaeological material. If preservation in situ cannot be achieved, either in whole or in part, then a programme of full archaeological excavation must be implemented to ensure the preservation by record of the portion of the site that will be directly impacted upon. This work should be carried out by a suitably qualified archaeologist under license and in accordance with the provisions of the National Monuments Acts 1930-2004.
- The fluvial and defence options located in the town will extend into the Architectural Conservation Areas at Bridge Street, Kent Street and Rossa Street (Options 2, 3, 4 and 5). The heights of the walls for the tidal defences will be much lower (1.1 m tall) than some of the fluvial walls (for example 3.9 m high between Tobin's Bridge and Bridge Street). Consequently in the majority of cases the visual impacts of the fluvial flood defences will be greater than the impacts of the tidal defences.
- The installation of a drainage scheme in the town will allow Clonakilty to develop and prosper.

The full Environmental Options Appraisal Report is available on www.clonakiltyfrs.ie.

5.4 Multi-Criteria Analysis (MCA)

The effectiveness and potential impacts of each of the options was assessed using a Multi-Criteria Assessment. The MCA process assigns a score for each option that relates to how effective that option will be in terms of achieving set goals under a set of objectives.

These objectives were divided into a number of categories namely:

- Technical
- Economic
- Social
- Environmental

Some of these high level categories for example, environment, were further sub-divided in sub-objectives such as:

- Support the objectives of the Water Framework Directive
- Minimise the risk to potential sources of environmental pollution
- Avoid damage to the flora and fauna in the area

There were similar sub-objectives for the other categories of technical, economic and social. The full MCA is available on www.clonakiltyfrs.ie and its findings are summaries below.

Any of the options that had a tidal barrage as a measure scored very low on the environmental objectives because this measure would have an adverse long term impact on Clonakilty Bay. Consequently all options involving a tidal barrage were effectively ruled out.

Two options achieved the highest score are different stages of the MCA process. On the technical scores the Fluvial Defences and Tidal Defences option scored highest. When cost is considered; the Storage and Tidal Defences scored the highest. Similarly this option scores highest for the Economic-Benefit Cost Ratio objective.

When all the options were assessed and scored the Storage and Tidal Defences Option emerged the preferred option. This option is discussed in more detail in the following section.

Figure 5-1: Option 1 - flow diversion and tidal barrage

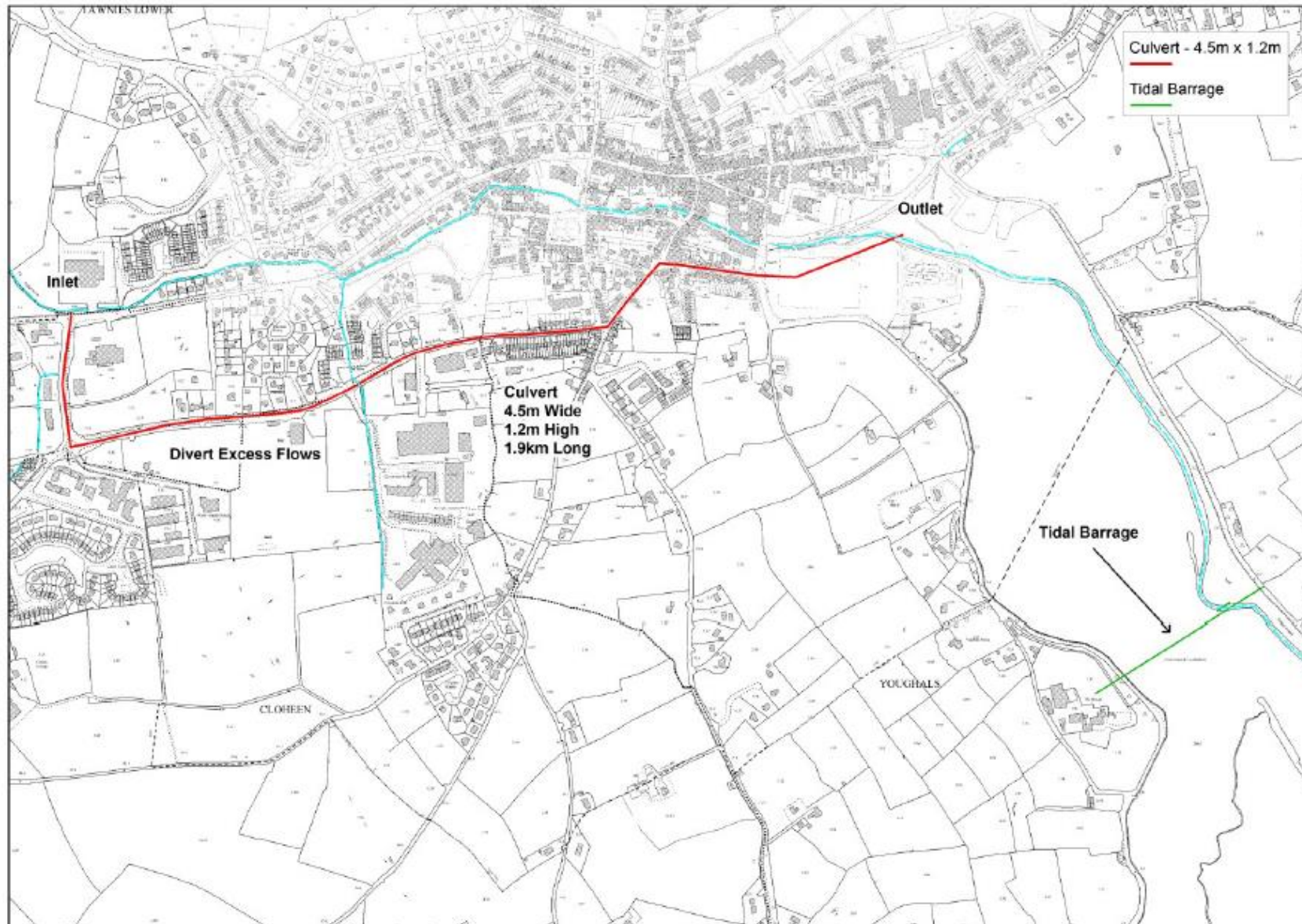


Figure 5-2: Option 2 - flow diversion and tidal flood defences

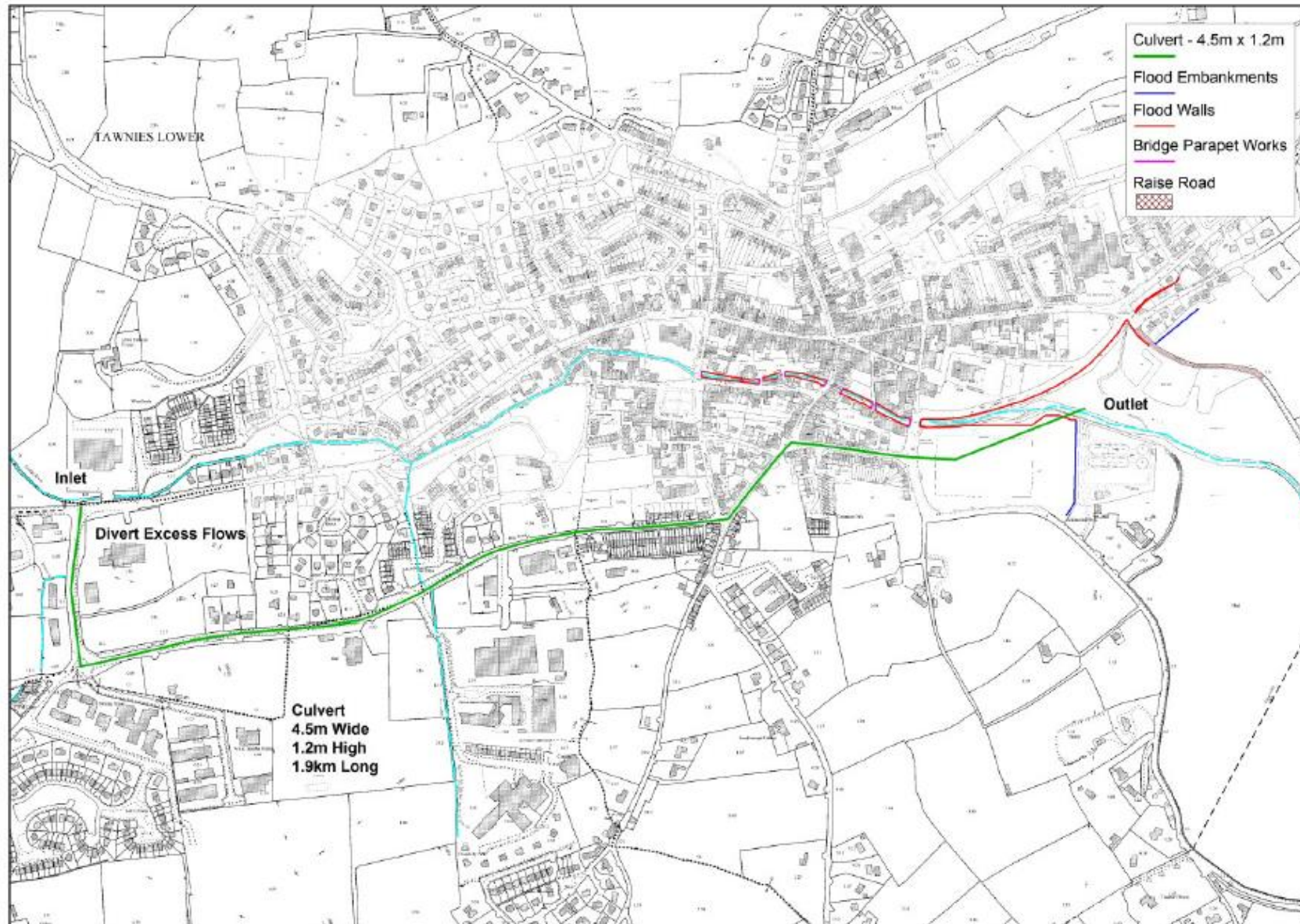


Figure 5-3: Option 3 - fluvial flood defences and tidal barrage

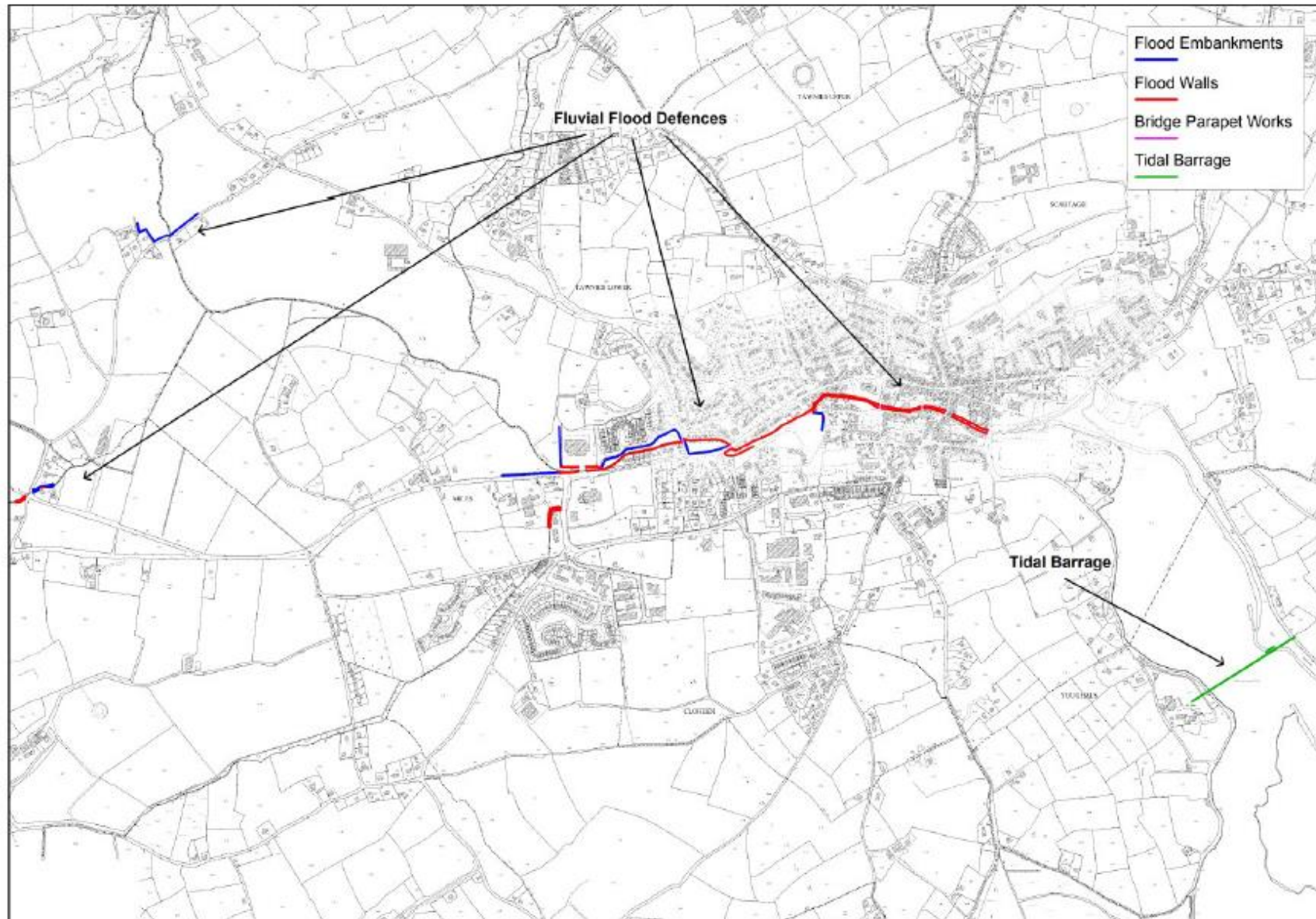


Figure 5-4: Option 4 - fluvial flood defences and tidal flood defences

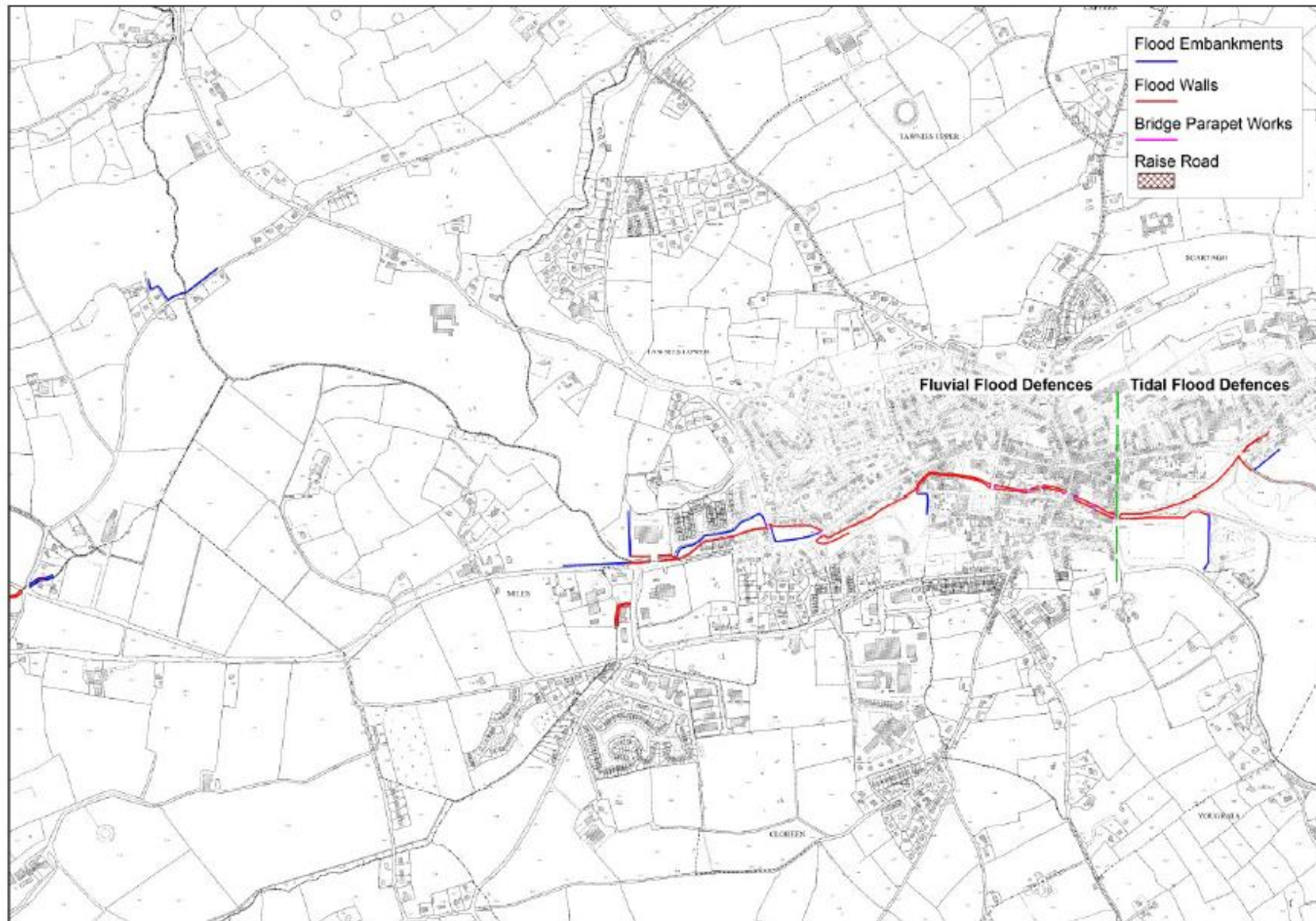


Figure 5-5: Option 5 - fluvial storage areas and tidal barrage

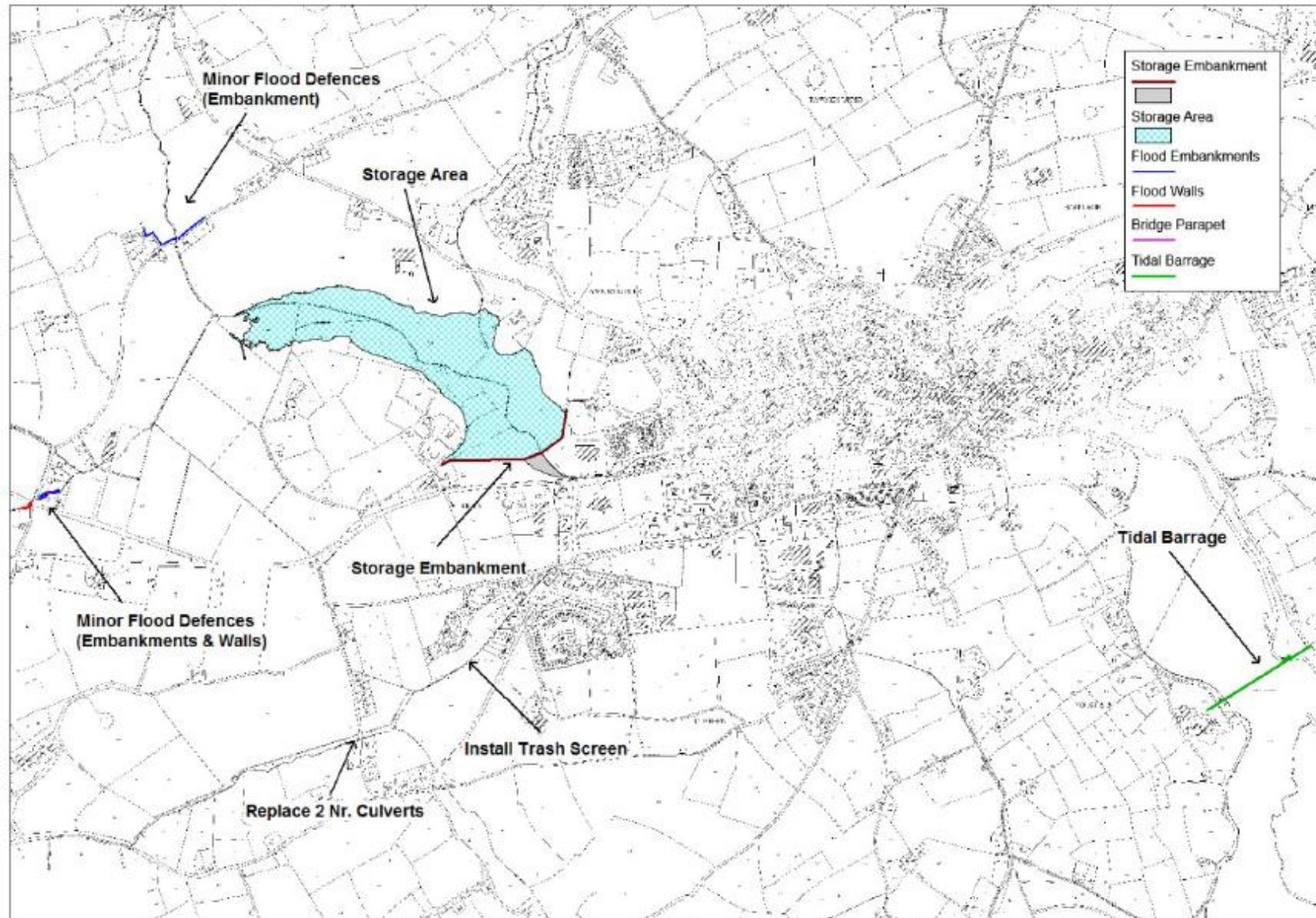
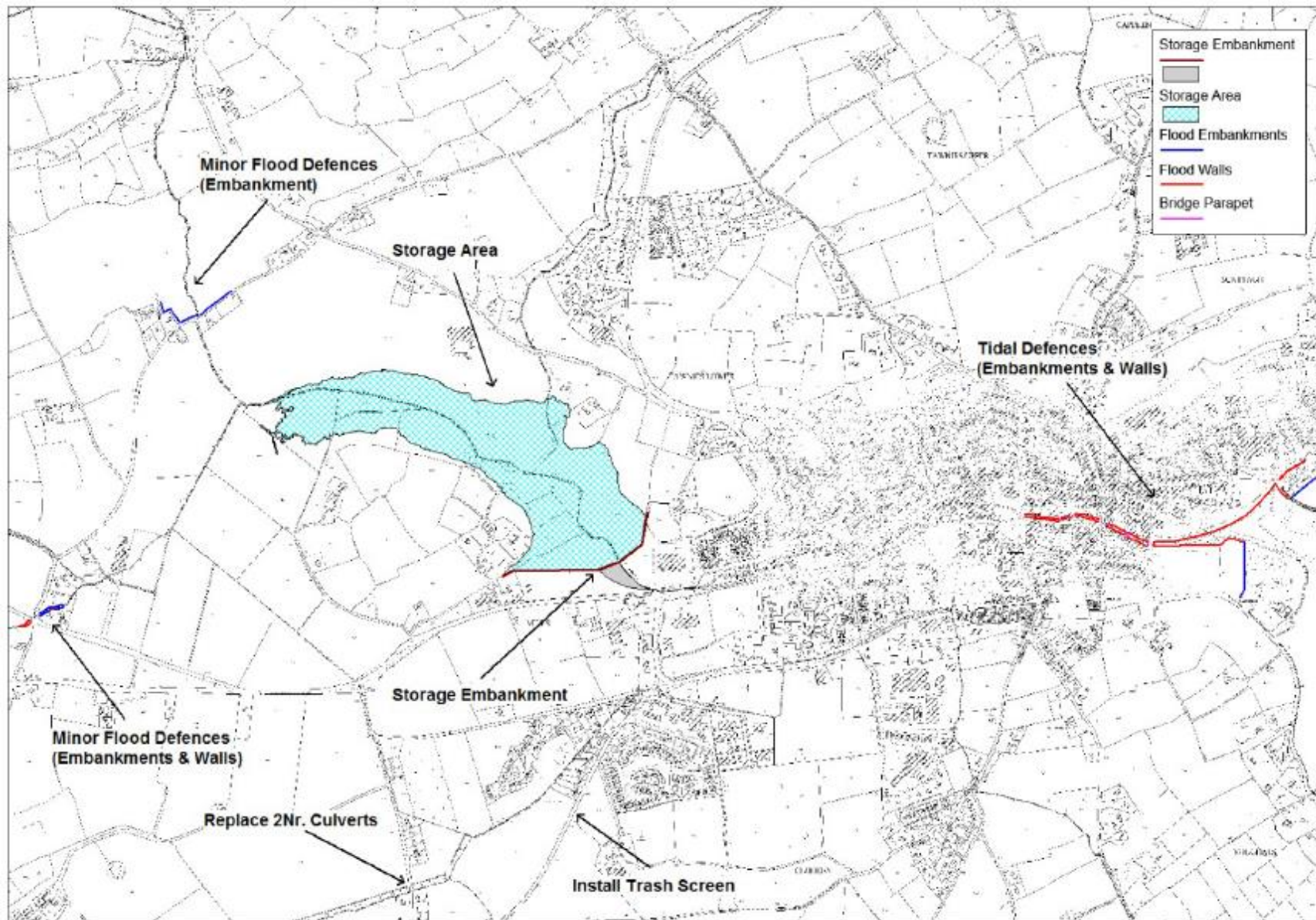


Figure 5-6: Option 6 - fluvial storage areas and tidal flood defences



6 Project Description

The South West CFRAM study identified the study area for the Clonakilty Drainage Scheme to include:

- The upper reaches of the Garage Stream.
- The Cappeen Stream.
- The River Fealge including its tributaries, the Ahagilla Stream, Ballyhalwick Stream and Ballyvackey Stream.

A full description of the scheme is shown in Figures Figure 6-1 to Figure 6-8. The work that will be undertaken to construct the scheme is described in Table 6-1 to Table 6-7.

The scheme includes:

- The storage of fluvial flood waters in an artificial embanked storage area upstream of the town to reduce fluvial flood risk
- On-land tidal defences to reduce coastal flood risk.

The hydraulic modelling used to determine the permitted outflow from the storage area was based on a joint probability of the fluvial dominated event where fluvial and tidal events are deemed to be strongly correlated as shown below.

Fluvial Design Event = Fluvial 1.0% AEP + 0.7 year tide plus surge (2.13 m OD Malin)

Based on the above calculations it was calculated that the permitted flow through the town would be 6.3 m³/s. For this outflow the top of the flood embankment is 13.9m AOD (i.e. 13.4m contour plus 0.5m allowance for freeboard and settlement of the embankment). An overspill provision is set at a height of 300mm less than the top of the embankment. The height of the embankment over the river is 5.6m. The storage reservoir is calculated to hold approximately 186,500m³. The Clonakilty Town Development Plan 2009-2015 allows for the construction of a North Ring Road around the town. A section of the proposed bypass would run through the storage area. The volume of the bypass is estimated at 21,500m³. Therefore the required storage volume for the storage reservoir was increased by a similar volume. The storage area of the storage reservoir is now set at 194,900m³.

6.1 Tidal Flood Defences

The River Fealge is tidally influenced up to Bushmount Nursing Home. To protect the town from tidal flooding a number of tidal defences will be constructed. A number of existing flood defence walls within the town will either be repaired or replaced.

Table 6-1 to Table 6-3 illustrates the locations of the tidal defence works. The tidal defences will comprise either walls or embankments.

6.1.1 Tidal defence works at the Eastern end of the Town

The tidal defences from Rossa Street Bridge to the Ring Road are shown in Figure 6-1 and described in Table 6-1. This figure shows a section of the tidal flood defences at various locations

- 1.3m high flood walls behind a number of properties on Convent Road. (L38-L42 on Figure 6-1). Work will involve excavating for foundations and constructing walls
- 1.4m high flood embankment behind houses on the Old Timoleague Road (E10 on Figure 6-1). The construction of this embankment will involve stripping the topsoil and constructing a 1.4 m, 60 m long embankment. It is estimated that approximately 150m³ of material (equivalent to approximately 300 tonnes) will be required to construct the embankment.
- 1.6m high flood wall and 1.7m raised road level along 220m of the Ring Road from Fracksbridge (L37 and R1 in Figure 6-1). The construction of the 1.6 m high wall will involve the excavation for foundation and the construction of a reinforced concrete wall. The road will be raised by 1.7 m over a 200 m stretch

- Construct embankment along the western site boundary of the waste water treatment plant (E9 on Figure 6-1)
- 1.1m to 1.3m high flood walls along Croppy Road between Clarke Street and Fracksbridge (L36 on Figure 6-1). This will involve the excavation for foundations and the construction of a reinforced concrete wall
- 1.3m high flood walls on both banks between Rossa Street Bridge and Seymour Street Pedestrian Bridge (L30-L31 on Figure 6-1). The work will involve excavating for foundation and the construction of a reinforced concrete wall 1.3m high
- 1.3m high flood walls on both banks between Seymour Street Pedestrian Bridge and Clarke Street Bridge (L32-L34 on Figure 6-1). The work will involve excavating for foundation and the construction of a reinforced concrete wall 1.3m high
- 1.3m high flood walls from Clarke Street along the south bank of the estuary, through the Waterfront Development to boundary of western boundary of the Waste Water Treatment Plant (L35 on Figure 6-1). The work will involve excavating for foundation and the construction of a reinforced concrete wall 1.3m high
- Replace railings with solid parapets in Seymour Street Pedestrian Bridge (B7 on Figure 6-1). This will involve replacing the parapets with reinforced concrete walls
- Replace railings with solid parapets on Credit Union pedestrian bridge (B6 on Figure 6-1). The parapets will be 1.1m high
- Construct storm water discharge pipelines along Asthna Street, Long Quay and Croppy Road (D8, D9, D10 respectively in Figure 6-1)
- Construct underground pump stations at Croppy Road and outfall to the bay and at Waterfront and outfall to the bay (D11 and D12 respectively in Figure 6-1).

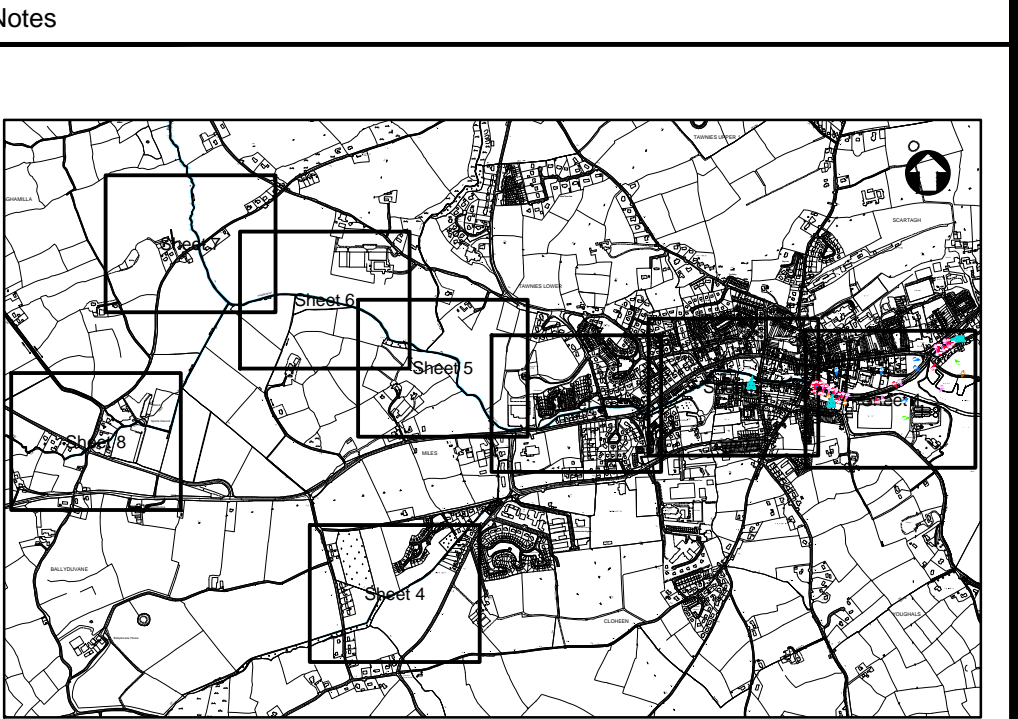
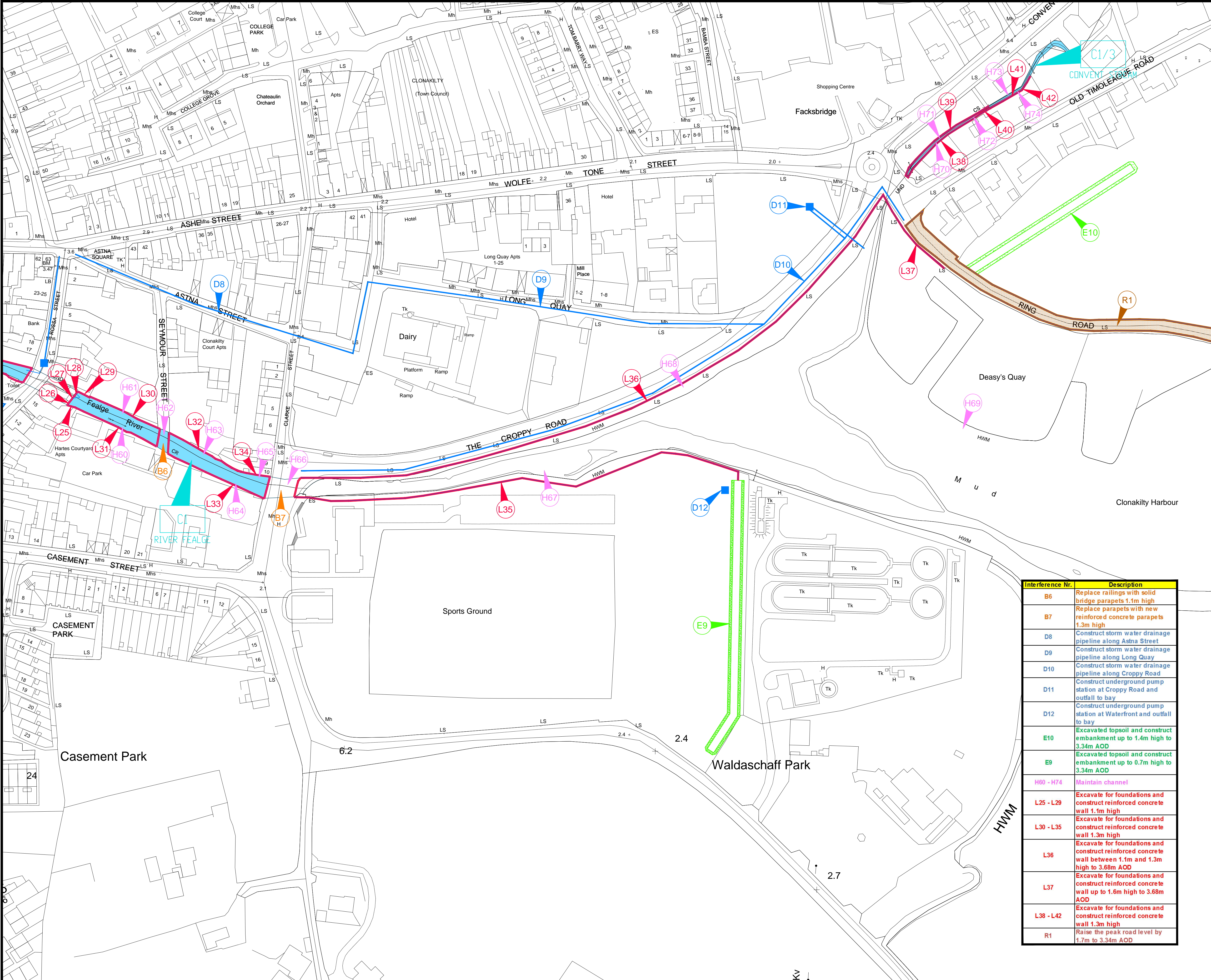
Table 6-1: Key to interference drawing 1

Interference No. 1 (Refer to Figure 6-1)	Description of Works
L38-L42	1.3 m high flood walls behind a number of properties on Convent Road. Excavate for foundations and construct walls.
E10	1.4 m high embankment behind the houses on the Old Timoleague Road. The embankment will be 60 m long and 3.34 m AOD
R1	Raise the peak road level of the Ring Road by 1.7 m to 3.34 m AOD
L37	Excavate for foundations and construct reinforced concrete wall up to 1.6 m high to 3.68 m AOD.
L36	Excavate for foundations and construct reinforced concrete wall between 1.1 m and 1.3 m high to 3.68 m AOD at Croppy Road
L30-L35	Excavate for foundation and construct reinforced concrete wall 1.3 m high on the Southern Bank of the estuary.
L25-L29	Excavate for foundation and construct reinforced concrete walls to a high of 1.1 m
E9	Excavate topsoil and construct embankment up to 0.7 m high, 3.34 m AOD
D8	Construct storm water discharge pipeline along Asthna Street
D9	Construct storm water discharge pipeline along Long Quay
D10	Construct storm water discharge pipeline along Croppy Road
D11	Construct underground pump station at Croppy Road and outfall to the bay
D12	Construct underground pump station at Waterfront and outfall to the bay
H60-H74	Maintain channel

Interference No. 1 (Refer to Figure 6-1)	Description of Works
B6	Replace railings on Seymour Pedestrian Bridge with solid bridge parapets 1.1 m high
B7	Replace parapets on Clarkes Street Bridge with new reinforced concrete parapets

Table 6-2: Key to interference drawing 2

Interference No. 2 (Refer to Figure 6-2)	Description of Works
B1,B4,B5	Repair/replace existing bridge parapets 1.1 m high
B2,B3	Replace railings with solid bridge parapets 1.1 m high
D1	Construct storm water drainage pipeline along Kent Street
D2	Construct storm water drainage pipeline along Connelly Street
D3	Construct underground pumping station on Kent Street with outfall to river
D4	Construct storm water drainage pipeline in Kent Street car park
D5	Construct underground pumping station in Kent Street car park with outfall to river
D6	Construct storm water drainage pipeline along Rossa Street
D7	Construct underground pumping station on Rossa Street with outfall to river
H29-H59	Maintain Channel
L8-L15	Repair/replace existing channel walls
L16-L24	Excavate for foundations and construct reinforced concrete wall 1.1 m high.



KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

- Legend:
- EMBANKMENT
 - REPAIR / REPLACE CHANEL WALL
 - MAINTAIN CHANNEL
 - BRIDGE REPAIR
 - SURFACE WATER SEWER
 - PUMP STATION
 - ROAD LEVEL ADJUSTED

Figure 6-1

1:1000 0 50m 100m

P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd

5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath



Title
River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (1 of 8)

Designed	-	Eng check	T Donovan
Drawn	D Gallagher	Coordination	-
Dwg check	-	Approved	B O'Connor
Scale at A1	1:1000	Status	PRE
		Rev	P1
		Security	STD

Drawing Number
MMD-332149-N-DR-00-XX-0004

6.1.2 Tidal Defences between Rossa Street Bridge and Woodbrook

The location of the works for the scheme is shown in Figure 6-2 and details are provided in Table 6-2. The proposed works are briefly described below.

- The repair/replacement of the bridge parapets on the Michael Collins Bridge (B1), the two pedestrian bridges down river of the Credit Union (B4) and at the Rossa Street Bridge (B5) as shown in Figure 6-2
- The replacement of the railings with concrete parapets on the pedestrian bridge at the Credit Union to a height of 1.1m (B2,B3 on Figure 6-2)
- The excavation and foundation and construct a reinforced concrete wall 1.1m between the Rossa Street Bridge and Michael Collins Bridge ((L16- L24 on Figure 6-2)
- Repair/replace a number of walls between Michael Collins Bridge and Woodbrook (L8-L15 on Figure 6-2 for location of the works)
- The construction of storm water drainage pipelines along Kent Street, Connelly Street, Kent Street car park, and Rossa Street (D1, D2, D4 and D6 on Figure 6-2)
- The construction of underground pumping stations with outfall to the river from Kent Street, Kent Street Car Park, and Rossa Street (D3, D5 and D7 respectively on Figure 6-2).

6.1.3 Tidal Defences between Woodbrook and Dunne's Stores

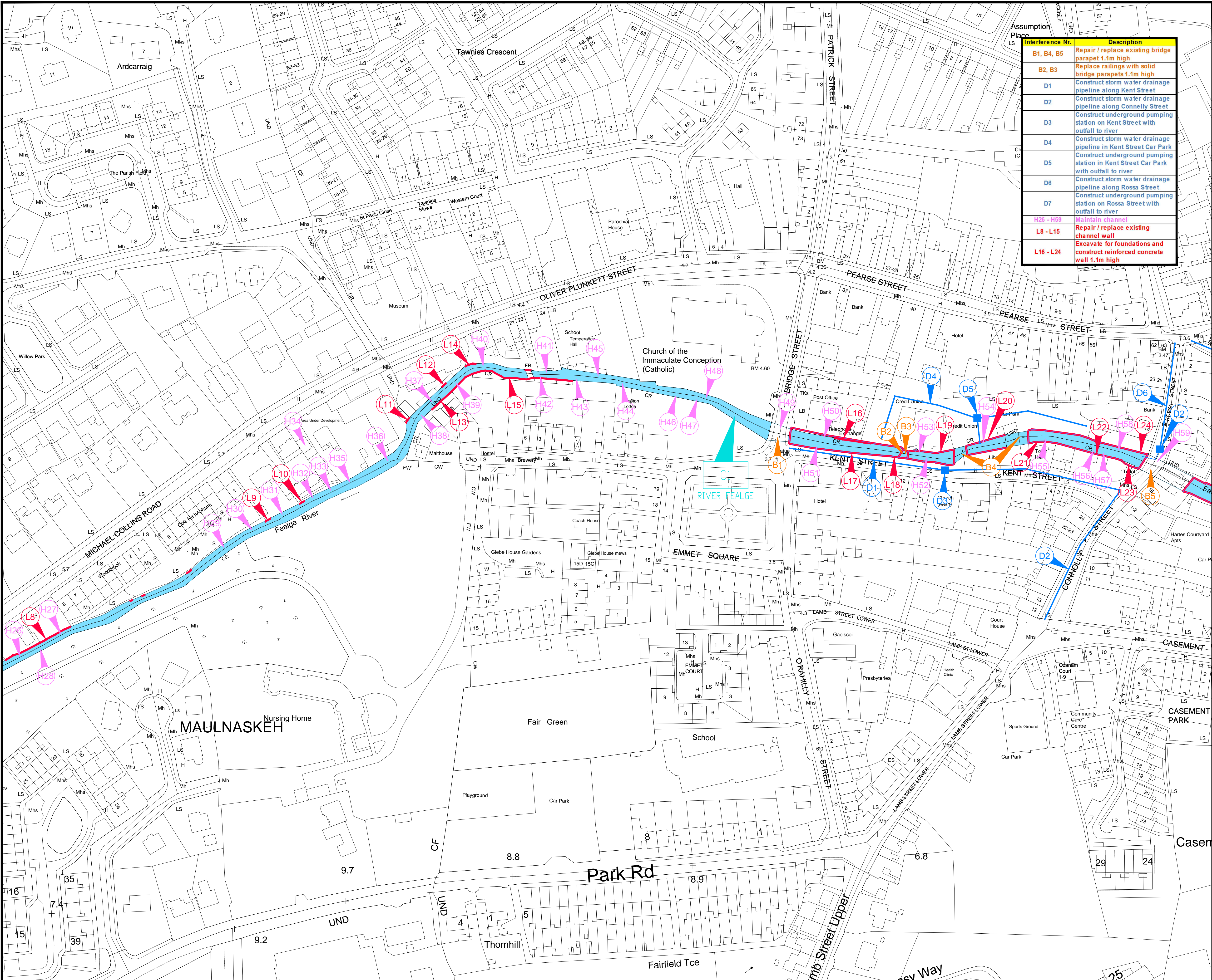
The location of the works is shown in Figure 6-3 and details are provided in Table 6-3. The works for the scheme in this section of the town are described briefly below.

- Replace/repair a number of existing flood defence walls between Woodbrook and Dunne's Stores. The locations are shown as L4-L8 in Figure 6-3.
- Regrading of the river west of Dunne's Stores for the construction of the spillway for the fluvial storage embankment (H4 on Figure 6-3.)

6.1.4 The Garage Stream

The location of the works is shown in Figure 6-4 and details are provided in Table 6-4. The works for the scheme in this section of the town are described briefly below.

- The installation of trash screens on the Garage Stream (G10 and G11 on Figure 6-4)
- Replacing 2Nr. Existing culverts under the road with a single culvert (G8,G9 on Figure 6-4).



Notes

KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

- REPAIR / REPLACE CHANEL WALL
- MAINTAIN CHANNEL
- BRIDGE REPAIR
- SURFACE WATER SEWER
- PUMP STATION

Figure 6-2

1:1000 0 50m 100m

P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd

5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

Title

River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (2 of 8)

Designed	-	Eng check	T Donovan
Drawn	D Gallagher	Coordination	-
Dwg check	-	Approved	B O'Connor

Scale at A1

1:1000

Status

PRE

Rev

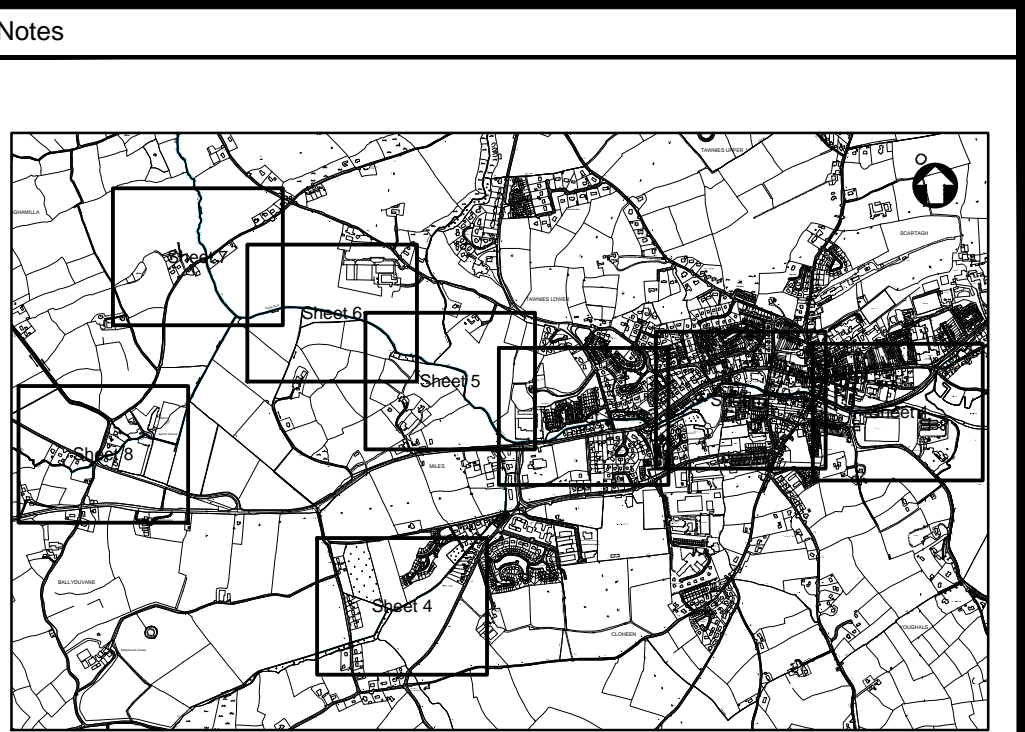
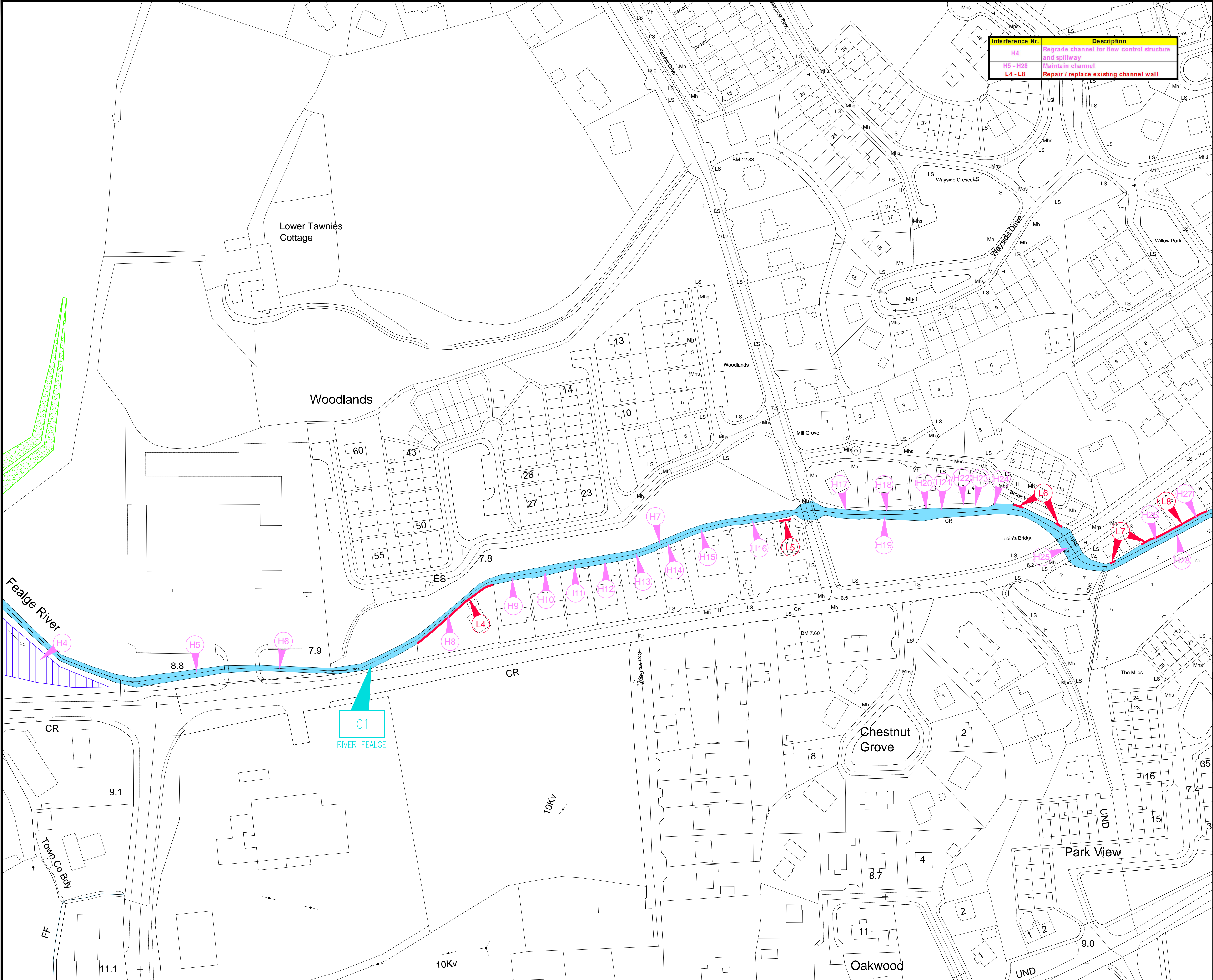
P1

Security

STD

Drawing Number

MMD-332149-N-DR-00-XX-0005



KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:


REPAIR / REPLACE WALLS —

MAINTAIN CHANNEL —

Figure 6-3

1:1000 0 50m 100m

P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd




Mott MacDonald

5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client

The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath



Title

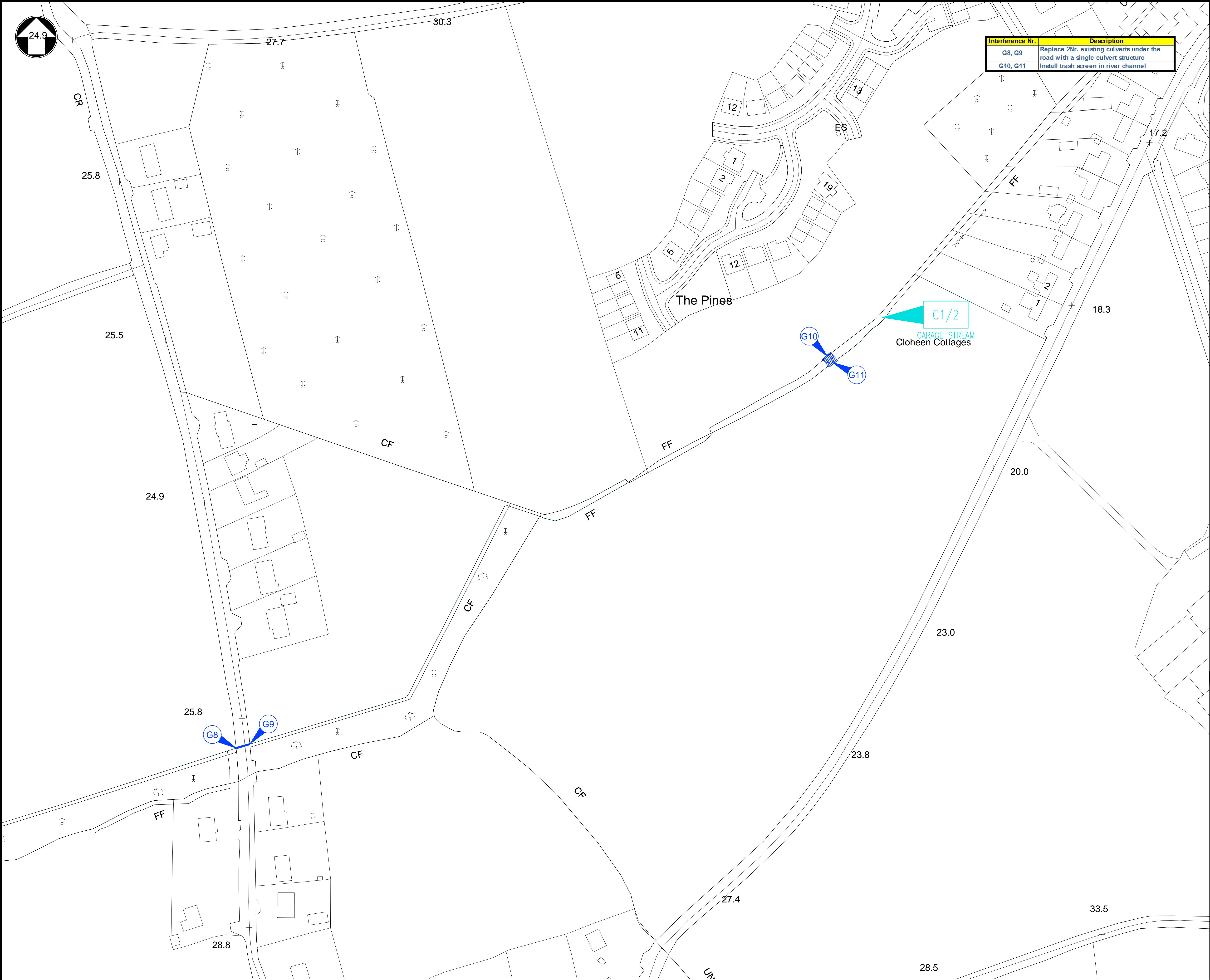
River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (3 of 8)

Designed	-	Eng check	T Donovan	
Drawn	D Gallagher	Coordination	-	
Dwg check	-	Approved	B O'Connor	
Scale at A1	1:1000	Status	PRE	Rev P1
		Security	STD	

Drawing Number

MMD-332149-N-DR-00-XX-0006



Interference Nr.	Description
G8, G9	Replace 2Nr. existing culverts under the road with a single culvert structure
G10, G11	Install trash screen in river channel



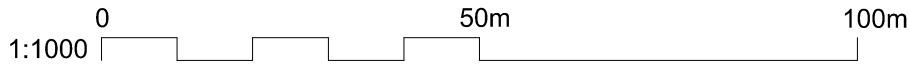
KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

- REPLACE CULVERT
- TRASH SCREEN

Figure 6-4



P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd



5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath



Title
River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (4 of 8)

Designed	-	Eng check	T Donovan
Drawn	D Gallagher	Coordination	-
Dwg check	-	Approved	B O'Connor

Scale at A1	Status	Rev	Security
1:1000	PRE	P1	STD

Drawing Number
MMD-332149-N-DR-00-XX-0007

Table 6-3: Key to interference drawing 3

Interference No. 3 (Refer to Figure 6-3)	Description of Works
H4	Regrade channel for flow control structure and spillway
H5-H28	Maintain channel
L4-L8	Repair/replace existing walls

Table 6-4: Key to interference drawing 4

Interference No. 4 (Refer to Figure 6-4)	Description of Works
G8,G9	Replace 2Nr. Existing culverts under the road with a single culvert section
G10, G11	Install trash screen in river channel

6.2 Fluvial Storage and Embankment

The location of the storage embankment and the storage area is shown in Figure 6-5. The works that will be undertake for the construction of the embankment and the flow control structure is described in Table 6-5. Based on the modelling it was calculated that the permitted flow through the town would be 6.3 m³/s. For this outflow the top of the flood embankment is 13.9m AOD (ie. 13.4m contour plus 0.5m allowance for freeboard and settlement of the embankment). An overspill provision is set at a height of 300mm less than the top of the embankment. The height of the embankment over the river is 5.6m. The storage reservoir is calculated at approx. 186,500m². The Clonakilty Town Development Plan 2009-2015 allows for the construction of a North Ring Road around the town. A section of the proposed bypass would run through the storage area. The volume of the bypass is estimated at 21,500m³. Therefore the required storage volume for the storage reservoir was increased by a similar volume. The storage area of the storage reservoir is now set at 194,900m². The design and layout of the embankment is based on the hydraulic modelling conducted for this scheme. The embankment will have a 3 m wide sluice to control the flow of water from the storage reservoir into the river. The sluice will be situated between two concrete uprights and the height of the sluice will be manually controlled. Approximately 11,250 m³ of impermeable material will be used to construct the embankment.

A description of the work is described below.

- The excavation of topsoil and the construction of an embankment up to 5.7m high to 14.0m AOD (E6 in Figure 6-5)
- The excavation of topsoil and the construction of an embankment up to 1.5m high to 14.0m AOD (E7 in Figure 6-5)
- The excavation of topsoil and the construction of an embankment up to 5.7m high to 14.0m AOD (E8 in Figure 6-5)
- A naturally forming storage reservoir that will flood during a flood event. The extent and depth of the flooding will be dependent on the extent of the flood event (G1-G7 in Figure 6-5 and Figure 6-6))
- A regrading of the channel for the flow control structure and the spillway (H1,H2 and H4 respectively in Figure 6-5)
- The construction of 2Nr. Reinforced concrete flow control structures for the sluice gates (SI1, SI2 in Figure 6-5).

The hydraulic modelling prepared by the Design Engineers has estimated that the maximum outflow from the storage area is 6.2m³/s. This is based on a tidal design event with a 143% AEP (ie. a high frequency event equivalent to a 0.7 year tide plus surge). This is based on the joint probability of the fluvially dominated event where the fluvial and tidal events are deemed to be strongly correlated. Based on this scenario and with the tidal defences in place the flow rate of water through Clonakilty town can be 6.2m³/s. This will mean that a storage area of 185,500m²

will be sufficient to store the maximum amount of flood water. In the future, the presence of the Clonakilty North Ring Road will increase this area to 194,900m².

The key parameters for the sluice gate for the fluvial design event (1% AEP) are as follows:

- Maximum design water level : 13.5m
- Maximum permitted outflow: 6.2m³/s

The dimensions for the sluice gate are as follows:

- Top level of embankment structure = 14.0m OD Malin
- Top level of overspill weir = 13.7m OD Malin
- Orifice invert level of sluice gate = 7.1m OD Malin
- Orifice width of sluice gate = 3.0m

6.2.1 Flood control measures Ballyhalwick Stream and Killgariff Bridge

The location of the works for the scheme is shown in Figure 6-7 and Figure 6-8 and details are provided in Table 6-7 and Table 6-8. The proposed works are briefly described below.

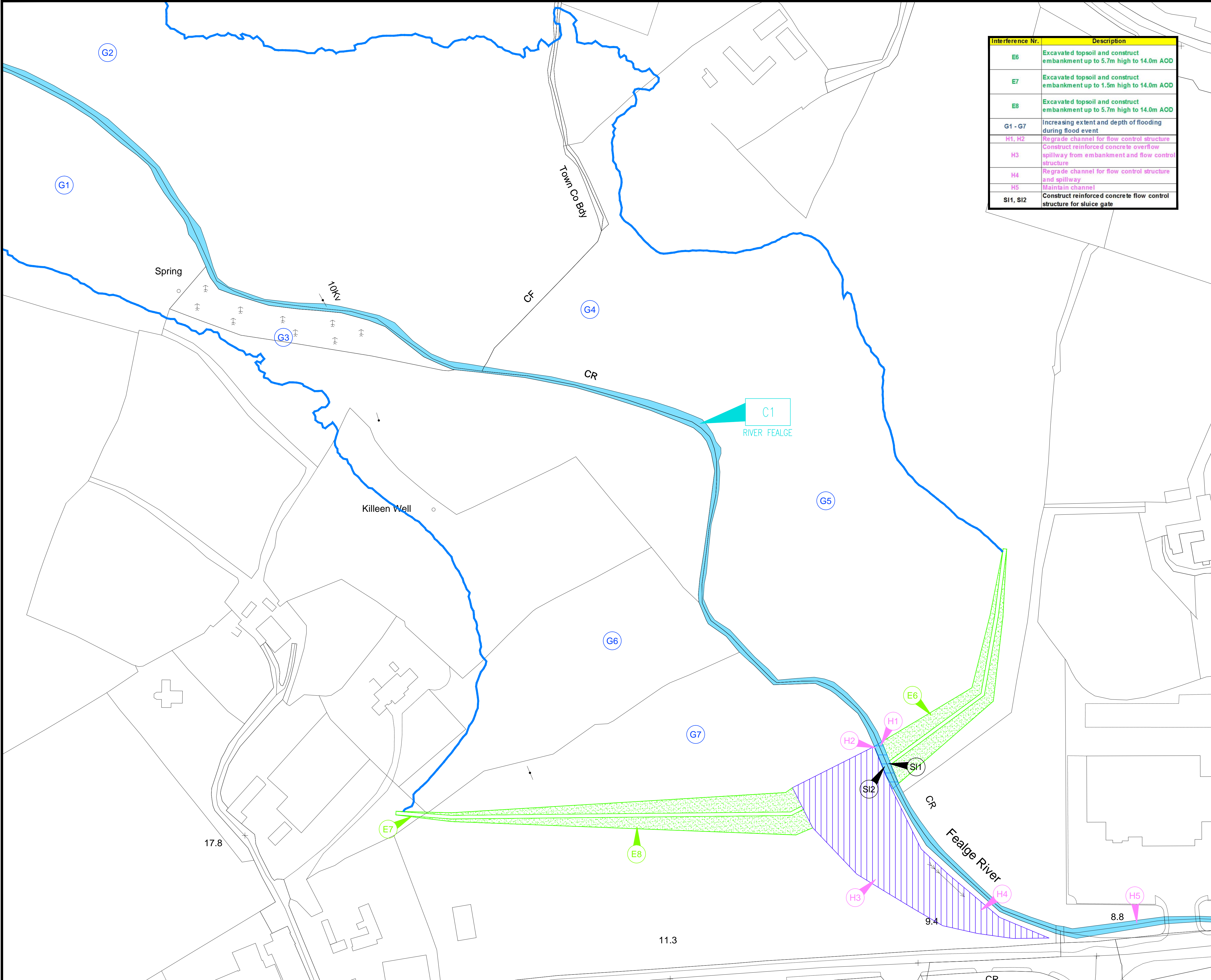
- At Killgariff Bridge it is proposed to excavate and construct embankments 1.6m high to 18m AOD (see E1 and E2 on Figure 6-7)
- At the Ballyhalwick Stream it is proposed to construct 0.7m high embankments around a dwelling ((E3, E4 and E5 on Figure 6-8). And it is proposed to construct a 1.1m high reinforced concrete wall upstream of the road (L1 and L2 in Figure 6-8)

6.3 Maintenance Works

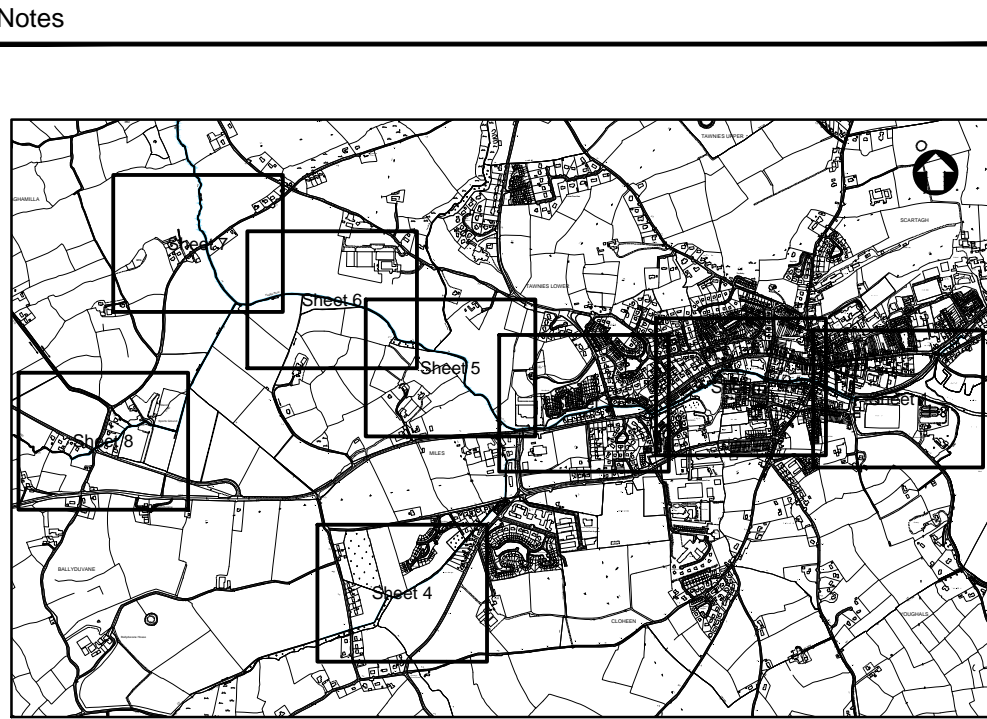
The Office of Public Works are obliged under the Arterial Drainage Act, 1945 and 1995 to maintain completed drainage schemes similar to this scheme. The maintenance is to ensure that the scheme is kept in proper repair. This means:

- The clearing and removal of obstructions, for example fallen trees etc.
- On-going maintenance and repair of walls and embankments
- The prevention of erosion/underpinning of the structures in the scheme
- On-going inspections, maintenance, cleaning and testing of mechanical equipment (the sluice) and water level meters and sensors within the scheme.

These are labelled as H, for example H7, H69 etc. in the attached figures. However this maintenance will not be part of this project.



Interference Nr.	Description
E6	Excavated topsoil and construct embankment up to 5.7m high to 14.0m AOD
E7	Excavated topsoil and construct embankment up to 1.5m high to 14.0m AOD
E8	Excavated topsoil and construct embankment up to 5.7m high to 14.0m AOD
G1 - G7	Increasing extent and depth of flooding during flood event
H1, H2	Regrade channel for flow control structure
H3	Construct reinforced concrete overflow spillway from embankment and flow control structure
H4	Regrade channel for flow control structure and spillway
H5	Maintain channel
SI1, SI2	Construct reinforced concrete flow control structure for sluice gate



KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

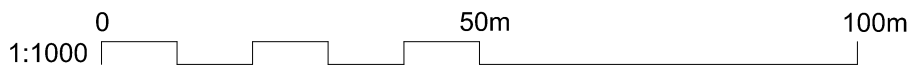
EMBANKMENT

SLUICE GATE

SPILLWAY

1% AEP STORAGE AREA OUTLINE

Figure 6-5



P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd



5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

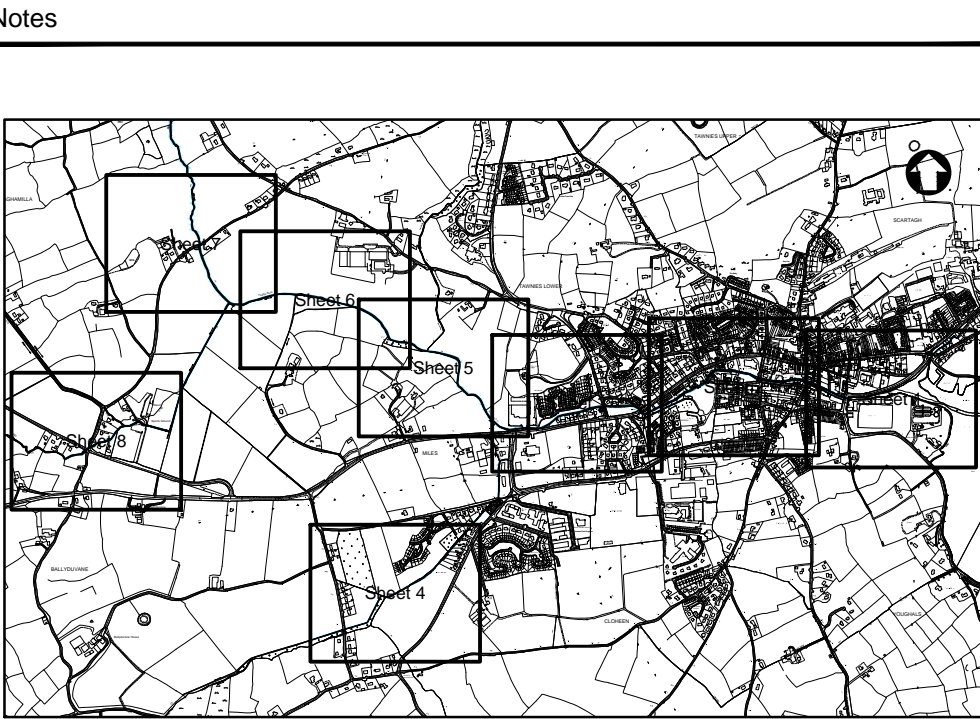
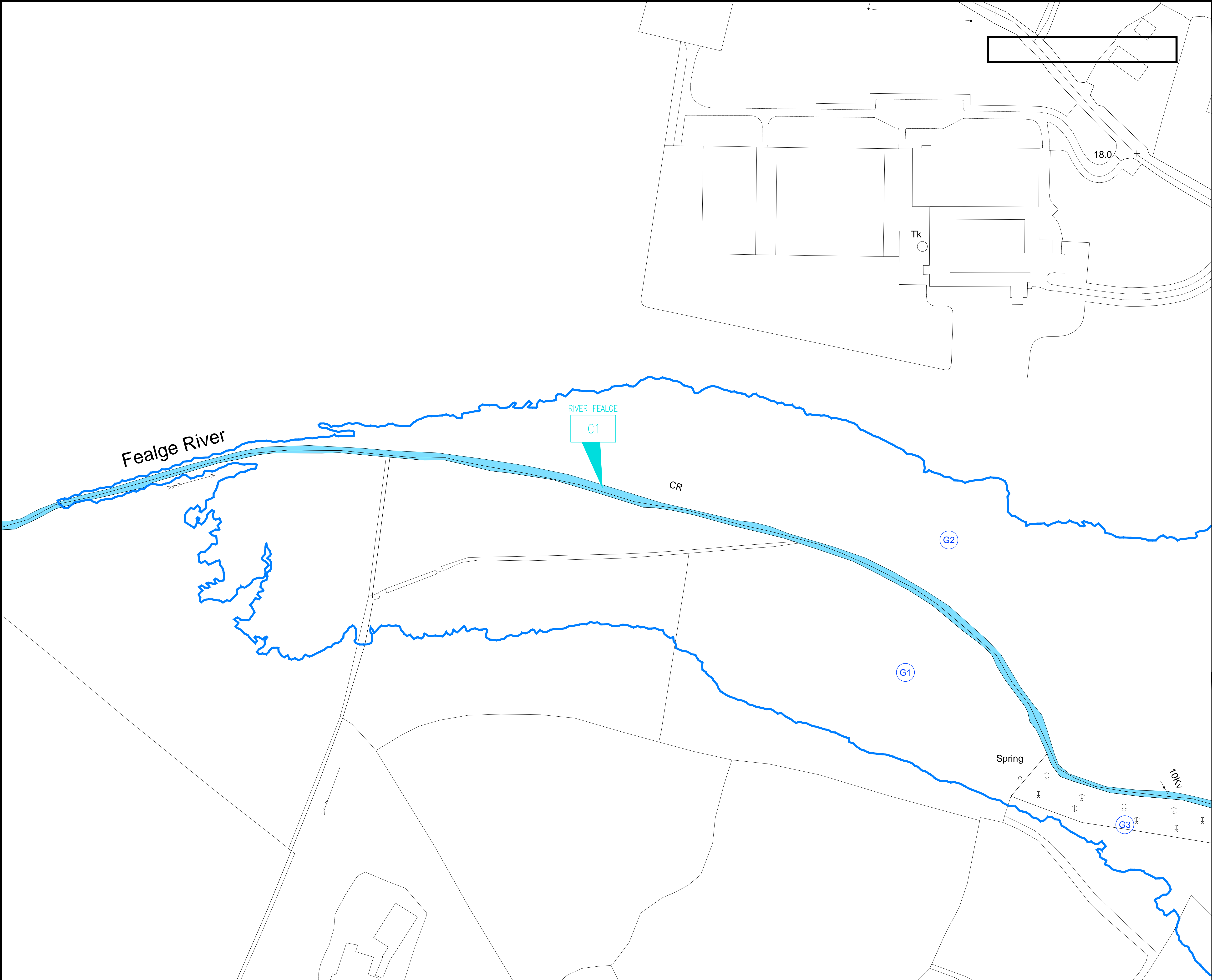


Title
River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (5 of 8)

Designed	-	Eng check	T Donovan
Drawn	D Gallagher	Coordination	-
Dwg check	-	Approved	B O'Connor
Scale at A1	1:1000	Status	PRE
		Rev	P1
		Security	STD

Drawing Number
MMD-332149-N-DR-00-XX-0008



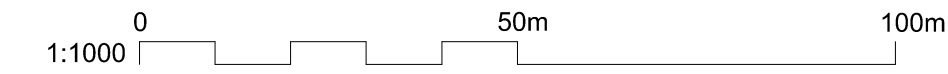
KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

1% AEP STORAGE AREA OUTLINE

Figure 6-6



P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd



5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T: +353 (0) 21 4809800
F: +353 (0) 21 4809801
W: www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

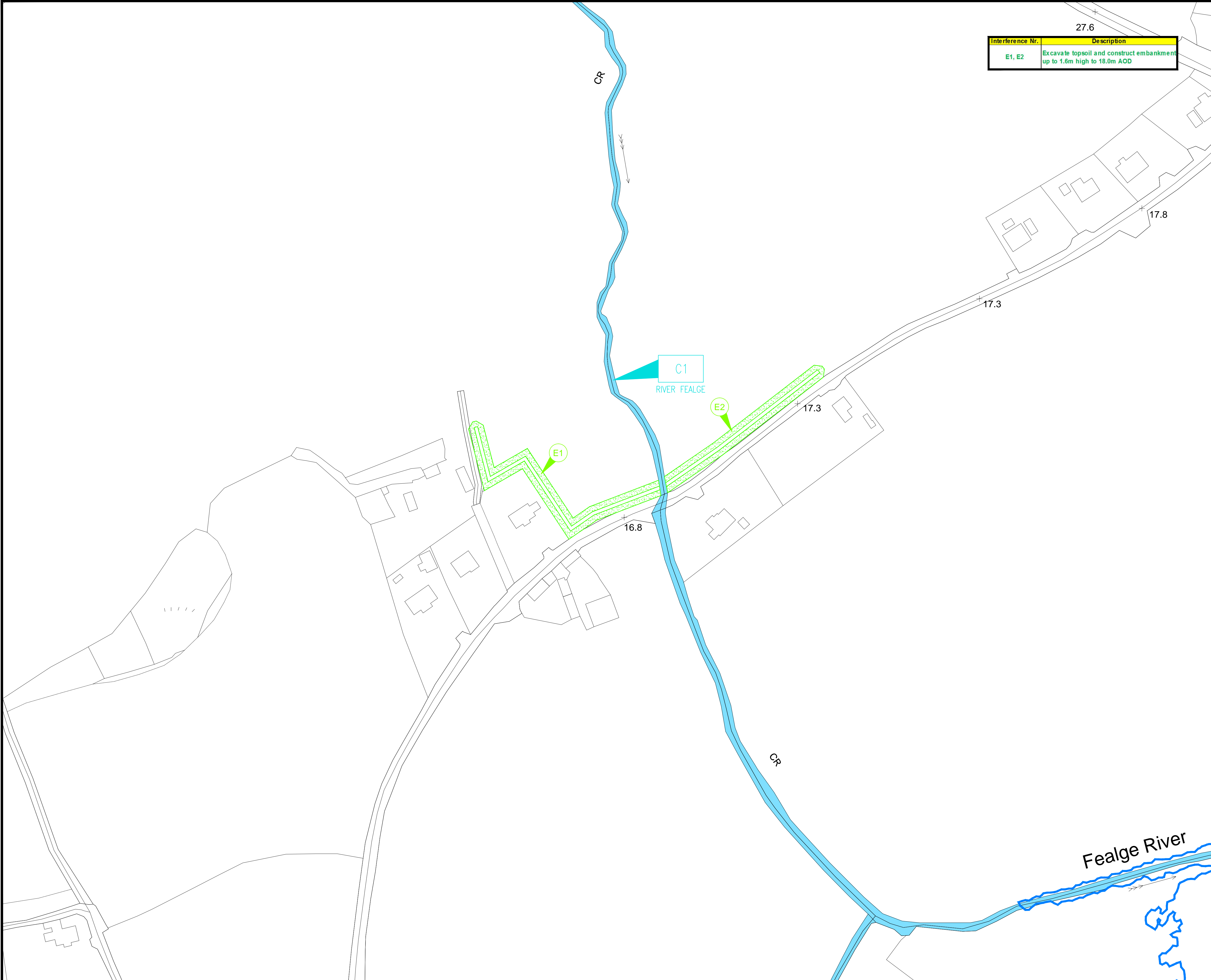


Title
River Fealge (Clonakilty)
Certified Drainage Scheme

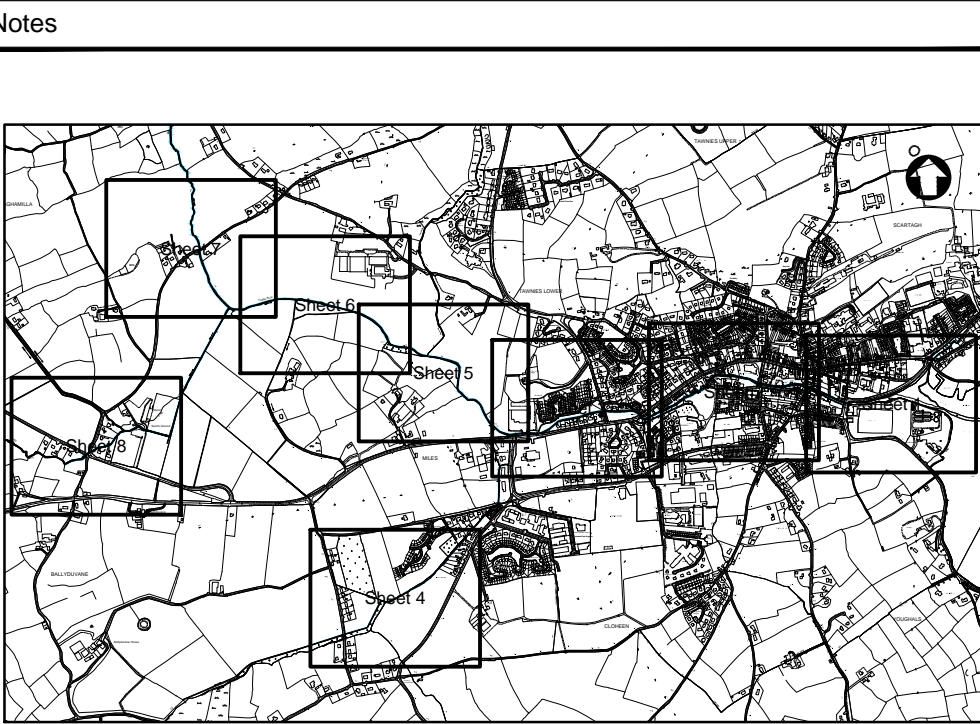
Interference Drawing (6 of 8)

Designed	-	Eng check	T Donovan	
Drawn	D Gallagher	Coordination	-	
Dwg check	-	Approved	B O'Connor	
Scale at A1	1:1000	Status	PRE	Rev P1
		Security	STD	

Drawing Number
MMD-332149-N-DR-00-XX-0009



Interference Nr.	Description
E1, E2	Excavate topsoil and construct embankment up to 1.6m high to 18.0m AOD



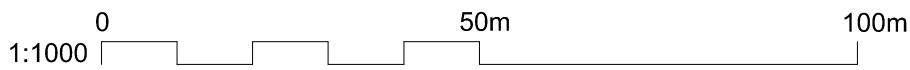
KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

EMBANKMENT

Figure 6-7



P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd



5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath

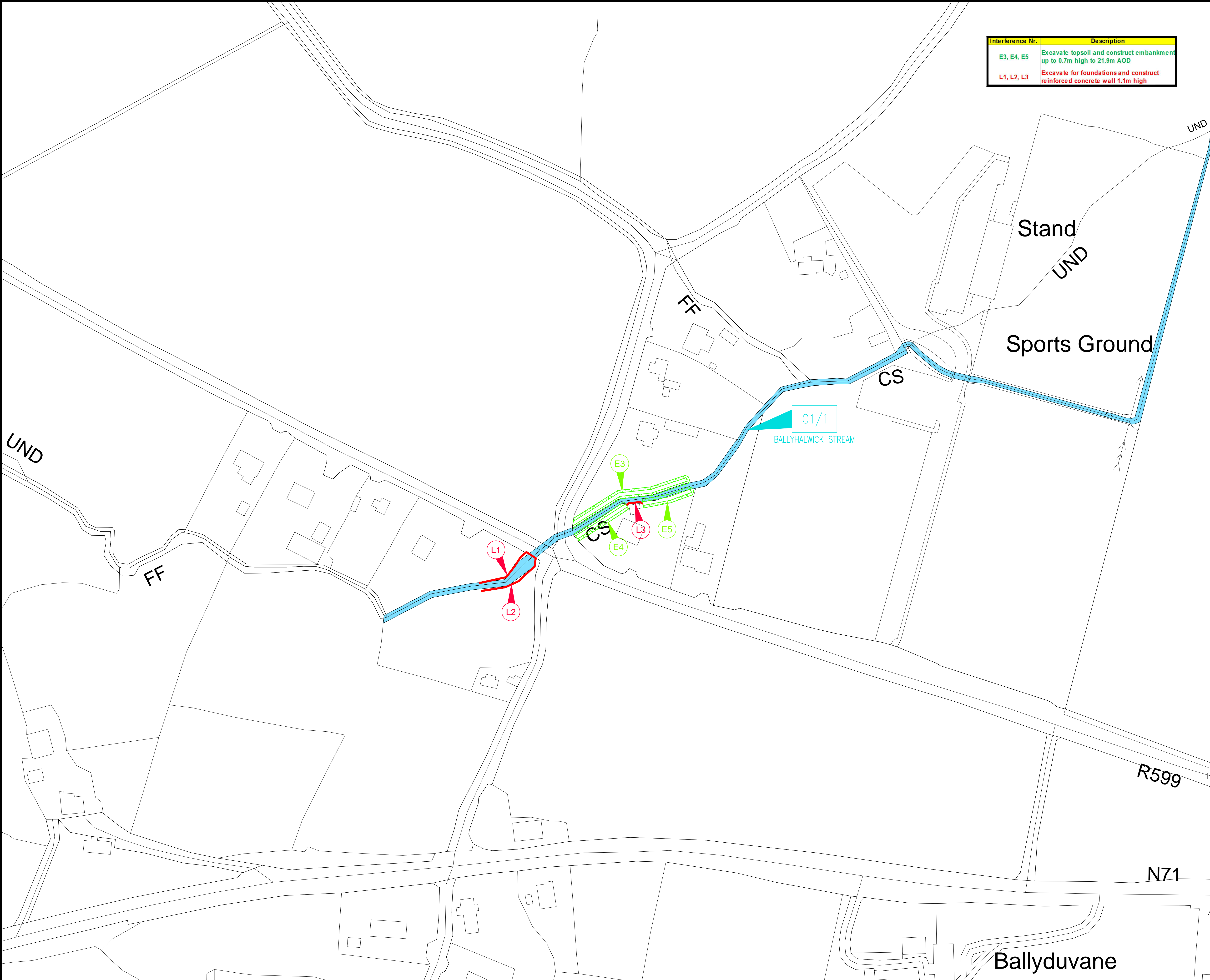


Title
River Fealge (Clonakilty)
Certified Drainage Scheme

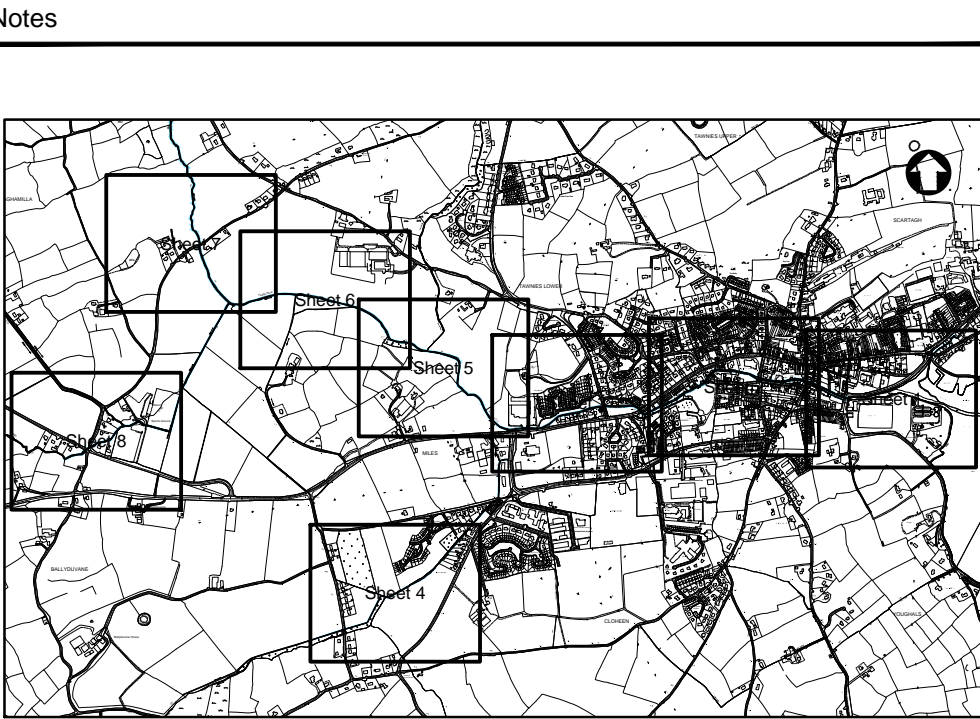
Interference Drawing (7 of 8)

Designed	-	Eng check	T Donovan	
Drawn	D Gallagher	Coordination	-	
Dwg check	-	Approved	B O'Connor	
Scale at A1	1:1000	Status	PRE	Rev P1
		Security	STD	

Drawing Number
MMD-332149-N-DR-00-XX-0010



Interference Nr.	Description
E3, E4, E5	Excavate topsoil and construct embankment up to 0.7m high to 21.9m AOD
L1, L2, L3	Excavate for foundations and construct reinforced concrete wall 1.1m high



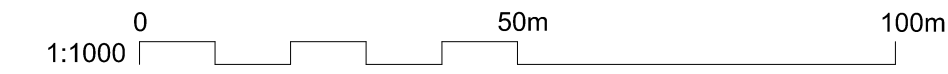
KEY PLAN
Scale NTS

Ordnance Survey Ireland Licence No. EN 0034514
©Ordnance Survey Ireland/Government of Ireland

Legend:

- EMBANKMENT
- REINFORCED CONCRETE WALL

Figure 6-8



P1	26.11.2014	DGal	For Information	TDon	BOC
Rev	Date	Drawn	Description	Ch'k'd	App'd



5 Eastgate Avenue
Eastgate
Little Island
Cork
Ireland
T +353 (0) 21 4809800
F +353 (0) 21 4809801
W www.mottmac.com

Client
The Office of Public Works
Jonathan Swift Street
Trim
Co. Meath



Title
River Fealge (Clonakilty)
Certified Drainage Scheme

Interference Drawing (8 of 8)

Designed	-	Eng check	T Donovan
Drawn	D Gallagher	Coordination	-
Dwg check	-	Approved	B O'Connor
Scale at A1	1:1000	Status	PRE
		Rev	P1
		Security	STD

Drawing Number
MMD-332149-N-DR-00-XX-0011

Table 6-5: Key to interference drawing 5

Interference No. 5 (Refer to Figure 6-5)	Description of Works
E6	Excavate topsoil and construct embankment up to 5.7m high to 14.0m AOD
E7	Excavate topsoil and construct embankment up to 1.5m high to 14.0m AOD
E8	Excavate topsoil and construct embankment up to 5.7m high to 14.0m AOD
G1-G7	Increasing extent and depth of flooding during flood event
H1,H2	Regrade channel for flow control structure
H3	Construct reinforced concrete overflow spillway from embankment and flow control structure
H4	Regrade channel for flow control structure and spillway
H5	Maintain channel
SI1,SI2	Construct reinforced concrete flow control structure for sluice gates

Table 6-6: Key to interference drawing 6

Interference No. 6 (Refer to Figure 6-6)	Description of Works
G1,G2,G3	Increasing the extent and depth of flooding during flood event

Table 6-7: Key to interference drawing 7

Interference No. 7 (Refer to Figure 6-7)	Description of Works
E1,E2	Excavate topsoil and construct embankments 1.6 m high to 18.0m AOD

Table 6-8: key to interference drawing 8

Interference No. 8 (Refer to Figure 6-8)	Description of Works
E3,E4,E5	Excavate topsoil and construct embankments 0.7m high to 21.9m AOD
L1,L2,L3	Excavate for the foundations and construct reinforced concrete wall, 1.1m high

7 Outline Construction Methodology

This section of the EIS looks at the duration and construction methodology for the scheme.

7.1 Duration

It is anticipated that all of the required statutory permits and Contractors will be in place by October 2015. The timeline for the completion of the scheme will be determined by the Contractor but it is anticipated that the scheme will be completed by early 2017 (approximately 18 month duration). The typical working hours will be 8.00 am to 6.00 pm Monday to Friday and 8.00 am to 4.00 pm on Saturday. Working will be restricted around Christmas. Other environmental factors such as in-river works will be restricted to outside the salmon breeding season (May to September inclusive). Work in the rivers in the evening will be restricted because of bats and lights should not be used during in-river works.

7.2 Construction Activities

7.2.1 Access Roads

Access roads to the site of the proposed storage embankment will be required to facilitate the haulage of construction and other materials to and from the site. Due to the physical constraint of the River Fealge, a temporary access road of the N71 and off the Fernhill road will probably be required. The Contractor will agree access points to the embankment from both sides of the river with Cork County Council prior to commencement of the work.

If the material is sourced from the Skibbereen side of the town then material can be transported along the N71 and access to the site can be before the roundabout at Dunne's Stores. In the event that the material is won from the Bandon/Cork side of the town then the material can be transported along Croppy Road and follow the N71 road to the roundabout at Dunne's Stores. It can access the site from this road. Access to the northern portion of the embankment will be off the Fernhill Road. The site entrances will be adequately signed.

Full details on the access requirements will be determined during the detailed design stage for each of the locations.

7.2.2 Contractors Compounds

The location of the Contractors compounds will be decided at the design stage. However it is anticipated that one site compound will be located close to the proposed storage embankment. Possibility a second site compound will be located close to Croppy Road. The site compounds will be located a minimum of 10 m from the edge of any water body to protect both water quality and the species that inhabit the water bodies. Specific site compound operating procedures will be developed by the contractor and agreed with by the Inland Fisheries Ireland, Cork County Council and the National Parks and Wildlife Services.

The main contractor will ensure that all sub-contractors are familiar with the environmental protection procedures. Weekly environmental audits of the compounds will be conducted by an independent environmental consultant.

7.2.3 Equipment and Machinery

The construction of the storage embankment will require the use of heavy goods vehicles (HGV's) to transport the material to the site and a JCB excavator to place and form the embankment. Ready mix concrete trucks and possibly a concrete pump will be required for the construction of the wing walls for the sluice. Supplementary equipment that will be used for the construction of the sluice will include form work, scaffolding, excavator, dumper trucks, diesel for re-fuelling plant, and a contractors hut for dining. Skips for storing waste will also be contained within the compound.

A similar range of equipment will be used to construct the defence walls in the town. It is anticipated that Ready Mix concrete trucks, a concrete pump, JCB excavator, portable cement mixers, diesel, blocks, shuttering, braces, scaffolding, dewatering pumps will be the main pieces of equipment used for the construction of the tidal defence walls.

7.2.4 Existing Trees, Hedgerows and Vegetation

The construction of the southern section of the storage embankment will require the removal of a number of mature trees and hedgerows on the banks of the River Fealge. The tress consists mainly of Alder and Hawthorn. The Contractor will to minimise the damage to nearby trees when constructing the embankment. The removal of the tress and hedgerows will be carried out outside of the bird nesting season.

7.2.5 Invasive Species

Japanese Knotweed, which is an invasive species, has been identified on site. There is a potential for the imported impermeable material for the embankment to contain the seeds of invasive species. The Contractor will source certified material which will confirm that the material is free of non-native or invasive species. Any work that is carried out close to invasive species will be strictly controlled by a Standard Operating Procedure. An ecologist will prepare this procedure and will provide training to the main Contractor on how to operate in areas where invasive species are present. All plant will be sufficiently cleaned between work areas to ensure that there is no carryover of invasive species on the tracks or wheels of trucks/excavators.

7.3 Anticipated Construction Methodology

The final construction methodology will be dependent upon the chosen Contractor, but for the purposes of this EIS, anticipated traditional construction methodologies will be considered.

7.3.1 Fluvial Storage Embankment

The construction of the fluvial storage embankment and sluice will be the most significant part of the construction activity. The topsoil underneath the footprint of the embankment will be removed and stored on site in dedicated storage areas. The storage areas should be remote from the river.

Access routes to the site are discussed in Section 7.2.1 above. The volume of impermeable material required for the construction of the embankment is estimated to be 11,250m³ (22,500 tonnes). The source of the material has yet to be finalised but it is assumed that the material will be transported to the site in 20 tonnes heavy goods vehicles. The material will be paced using an excavator. It is anticipated that both the northern section and the southern section of the embankments will be built concurrently. The extent of the embankment will be marked on the ground and the trucks transporting the material will be directed to dump the material in a sequential basis.

The construction of the wing walls to support the sluice will require the excavation for foundations, placement of formwork and reinforced steel, pumping of concrete and striking of the formwork when the concrete has gone off. It is anticipated that the contractor will need full access to the riverbed when constructing the wing walls. This can either be by over pumping or diverting the river around the construction area. Whichever method is chosen by the contractor will require agreement with the Inland Fisheries Ireland.

7.3.2 Tidal Defence walls

Depending on its location the construction of the tidal defence walls will take place either on the ground, in-river or in the estuary.

For the walls that will be constructed on dry land, for example along Croppy Road (L36 on Figure 6-1) it is expected that the contractor will use typical construction techniques i.e. excavate for foundations, erection of formwork, placement of reinforced steel, and pumping of concrete. The finishes to the walls will be completed when the entire wall is constructed. A number of control measures such as sheet piling will be installed to protect nearby water courses and provide a safe working area.

A number of the walls, for example, the construction of the section of wall downstream from Seymour Pedestrian Bridge (L32, L33 and L34 on Figure 6-1) will be completed using in-river works. This will involve the construction of a cofferdam, pumping of the water, excavation of foundations using a mini excavator, placing the formwork and reinforced steel, pumping concrete and finally removal of the formwork when the concrete has gone off. The contractor will be required to have strict environmental controls in place for in-river work and the Method Statements will need to be agreed in advance with the Inland Fisheries Board. The contractor

will be required to organise and track the disposal of any excavated material from the riverbed. The contractor will be required to ensure that the passage of fish is not hindered and will need to provide access to the fish in the areas of the cofferdams.

The replacement/strengthening of the parapets on the bridges, for example at the Credit Union (B2 and B3 on Figure 6-2) will be carried out at ground level. Because the contractor will be working over the river, Method Statements for the work will be agreed in advance of any works with the Inland Fisheries Ireland.

7.3.3 Storm Water drainage Pipelines and Underground Pumping Stations

The scheme has been designed to gain maximum efficiency from the fluvial storage embankments and the tidal defences. However, surface water has in the past been a contributory factor to flooding within the town, and with the construction of the river and tidal defences it is important that any surface water is captured and discharged to a nearby water courses i.e. the River Fealge and the estuary. A number of storm water drainage pipelines will be constructed along Kent Street, Kent Street car park, and along Rossa Street (D1-D7 on Figure 6-2). The work will involve excavation and placement of the pipe and fill material. Similarly a storm water pipeline will be constructed along Croppy Road and the outfall will discharge to the estuary. Where the discharge of this surface water is constrained by the tide it will be assisted by a pumping station.

8 Water and Hydrology

8.1 Introduction

The section of the environmental impact statement covers the topic of water. This section describes the existing aquatic environment within the Study Area and it describes the impacts of the proposed Clonakilty Drainage Scheme on the aquatic environment. There are 3 types of aquatic habitats within the Study Area namely:

- Freshwater
- Estuarine/marine
- Groundwater

The water bodies within the Study Area are shown in Figure 8-1.

Readers are also referred to other sections in this EIS, for example Flora and Fauna (Section 9), and Hydrogeomorphology (Section 10) because of their interaction with the water environment.

As described in Section 6 (Description of the Scheme) the Clonakilty Drainage Scheme will in summary consist of:

- Site preparation works including, contractors compound, temporary fencing and hoarding
- The construction/replacement/raising of a number of fluvial defence walls along the banks of the River Fealge
- The construction of a reinforced concrete tidal defence walls along Croppy Road on the north and south side of the estuary
- The construction of earthen embankments
- The construction of a sluice valve, upright supports and control gear over the River Fealge
- The installation of a number of water level monitoring equipment in the River Fealge
- The construction of temporary roads
- The installation of 2 no. underground pumping stations.

8.2 Applicable Legislation

The area a number of pieces of legislation that is applicable to the aquatic environment. These are discussed in the following sections.

8.2.1 The Water Framework Directive

The EU Water Framework Directive (WFD) 2006/60/EC was adopted in 2003 and implemented in Ireland in 2003. The WFD requires that all water bodies achieve good water quality status by 2021. The study area forms part of the South Western River Basin District (SW RBD).

The Water Framework Directive (WFD) is a key initiative aimed at improving water quality throughout the EU. It applies to rivers, lakes, groundwater, and coastal waters. The Directive requires an integrated approach to managing water quality on a river basin basis; with the aim of maintaining and improving water quality. The Directive requires that management plans be prepared on a river basin basis and specifies a structured approach to developing those plans.

8.2.2 European Communities Environmental Objectives (Surface Water), Regulations, 2009. S.I. No. 272 of 2009.

The Directive requires that all waters must be maintained at or improved to 'good status'. The 'good status' is indicative of the ecological and hydrochemical data of a water body.

8.2.3 European Communities Environmental Objectives (Surface Water) (Amendment) Regulations 2012. S.I. No. 327 of 2012.

The purpose of these Regulations is to set standards for a range of pesticides, herbicides and heavy metals in surface water. It assigns the responsibilities for preparing an inventory of priority

substances to the local authorities and the inventory must be completed by December 2013. The Regulations revoke the European Communities (Quality of Water intended for Human Consumption) Regulations 1989 (S.I. No. 294 of 1989).

8.2.4 The Salmonid Water Regulations, 1988. S.I. No. 293 of 1998.

While these Regulations are specific to salmonid waters in Ireland, as listed in the First Schedule of the Regulations, the recommended water quality levels are indicative of clean water. The Second Schedule of the Regulations sets out the required water quality levels required to support salmonids. These levels are given in the table below.

Table 8-1 : Water Quality Levels for Salmonid Waters

Parameter	Units	Level
Dissolved Oxygen	% Sat.	50
pH	pH units	$\geq 6 \leq 9$
Suspended Solids	mg/l	≤ 25
Biochemical Oxygen Demand	mg/l	< 5
Non-ionized ammonia	mg/l NH_3	< 0.02
Total Ammonium	mg/l NH_4	< 1.0
Total Zinc	mg/l	≤ 0.5
Dissolved Copper	mg/l	≤ 0.112

8.3 Surface Water in the Existing Environment

8.3.1 Desktop Assessment for the River Fealge

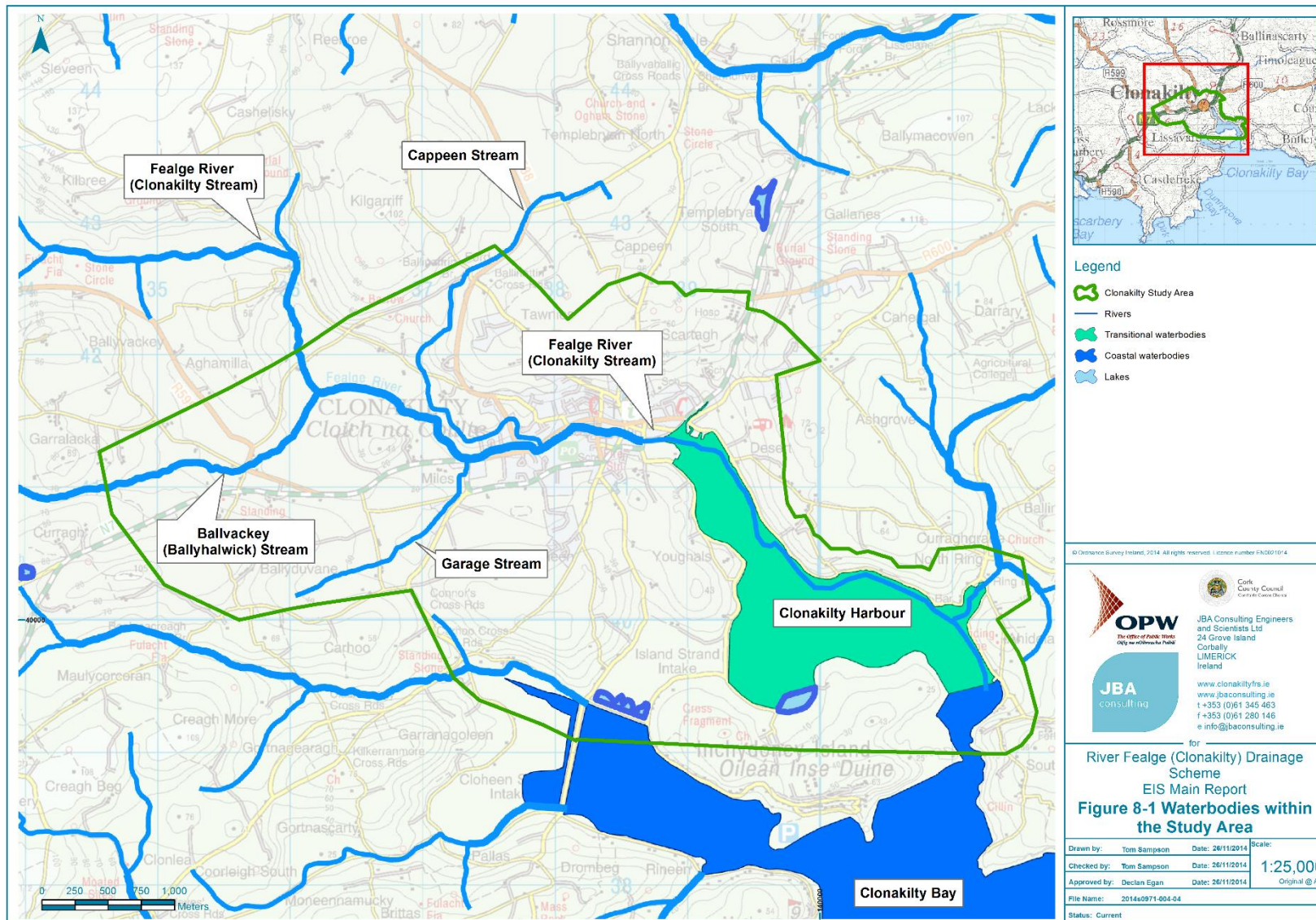
The River Fealge is a major source of freshwater within the Study Area. The catchment consists of moderately sloping hills and valleys rising to a height of approximately 150 m in the western side of the catchment. A review of the Teagasc soil maps for the area revealed that the catchment consists of mostly dry grassland area with some wetland areas. A number of smaller streams feed into this river at various locations along its route. The width of the river ranges from less than 1 metre at its source to greater than 10 metres at its final discharge into the estuary. Before reaching Clonakilty Town the river flows through mainly agricultural land. Intensive dairy farming and dry stock and tillage are the main agricultural practices in the catchment. A hydrogeomorphology assessment of the river (see Section 10 of the EIS) found that the existing morphology throughout the Fealge River system is diverse and the bed of the channel is predominantly gravel based, operating naturally to move coarse sediment.

A desk top assessment of the study area was undertaken to gather data on the quality of freshwater and estuarine water. Recent publications (referenced at the end of this section) were reviewed and data and consultations were undertaken with the following bodies:

- South Western River Basin Project Office
- Cork County Council Environment Department
- The Environmental Protection Agency
- Inland Fisheries Ireland.

The desk top assessment also involved a review of the following documents:

- EPA water quality Envision data base
- Geological and borehole information on the Geological Survey of Ireland's data base
- South Western River Basin District Management Plan
- Skibereen/Clonakilty Water Management Unit Action Plan.



Although it is not a designated salmonid river under the European Communities (Quality of Salmonid Water) Regulations, 1988 it does hold populations of salmon, sea trout, brown trout, lamprey and eels (IFI, Per. Comm). This is further discussed in Section 8, Ecology & Fisheries, of this report. The presence of these species was further verified by an electro-fishing survey undertaken as part of this Environmental Impact Assessment. The report is presented in Appendix 9A in Volume 3 of the EIS.

A review of Water Quality in Ireland 2004-2006 (Appendix II.1) – Biological Surveys of Rivers (Clabby et al. 2008) found that the water quality of the river was unpolluted to slightly polluted in parts. Table 8-2 below is data from the 2006 survey of the Clonakilty Stream. The total length of the channel is 3.5 km and the length of the channel is classified as A: Unpolluted; B: Slightly Polluted/Eutrophic; C: Moderately Polluted; D: Seriously Polluted.

Table 8-2 : Classification of Clonakilty Stream (from Clabby et al. 2008)

River Name	Code	Year	A (km)	B (km)	C km)	D (km)	Total (km)
Clonakilty Stream	20C05	2006	2.5	1.0	-	-	3.5

The EPA uses the Q-Rating system for the biological classification of freshwater systems. The presence or absence and the abundance of specific organisms are used as an indicator of water quality. The Q Rating system condenses the biological information into a simple 5 point biotic index (the Q value). Table 8-3 below illustrates the rating system and water quality.

Table 8-3 : EPA Q-Rating System

Q Value	WFD Status	Pollution Status	Condition
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously Polluted	Unsatisfactory

Information on the water quality for the Clonakilty Stream supplied by the EPA shows that the Q - Rating for the stream (Station Code: RS20C050300) for 2006, 2009 and 2012 is 4; which indicates clean unpolluted water.

Chemical analysis of the water is not undertaken by the EPA under the Water Framework Directive (WFD) but a review of the WFD Risk Score for the Clonakilty Stream (SW Coastal x 2_Fealge) found that it was expected to achieve good status (See Figure 8-2 – WFD Risk Status of waterbodies).

There is no water or biological data available for the Cappeen Stream or the Garage Stream.

8.3.2 Chemical Water Analysis

Water samples were taken from the River Fealge upstream of the proposal sluice and downstream of the tidal defence walls. The samples were sent to the analytical laboratory under chain of custody. The results of the analysis are shown in Table 8-4 below. The results are compared with the salmonid water quality requirements.

Table 8-4 : -Chemical Results for water samples taken for the River Fealge

Parameter	Location No. 1	Location No. 2	Quality Levels for Salmonid Waters
Dissolved Oxygen (%)	60	65	50
pH	7.31	7.47	≥6 ≤9
Suspended Solids (mg/l)	45	125	≤25
Biochemical Oxygen Demand (mg/l)	<1	<1	<5
Ortho Phosphate as PO ₄ (mg/l)	0.37	0.37	-
Total Ammonium (mg/l)	0.34	0.39	<1.0
Total Zinc (mg/l)	0.022	0.052	≤0.5
Dissolved Copper (mg/l)	<0.007	<0.007	≤0.112
Total Hardness Dissolved (as CaCO ₃) (mg/l)	278	90	-
Conductivity (uS/cm)	2041	280	-
Nitrite as NO ₂ (mg/l)	<0.02	<0.02	≤ 0.05
Nitrate as NO ₃ (mg/l)	10.1	11.9	-

The full laboratory report is given in Appendix 6 and the sampling locations are shown in Figure 8-3.

The results indicate that, with the exception of nitrate levels, the water quality in the river is good. Previous analysis of the river water conducted by Cork County Council as part of a discharge licence application to the Environmental Protection Agency found elevated levels of nitrate in the river water (a mean of 6.3 mg/l). The levels recorded during this sampling event were higher (11.9 mg/l upstream and 10.1 mg/l downstream). Diffuse sources such as agricultural runoff are the most likely source of this.

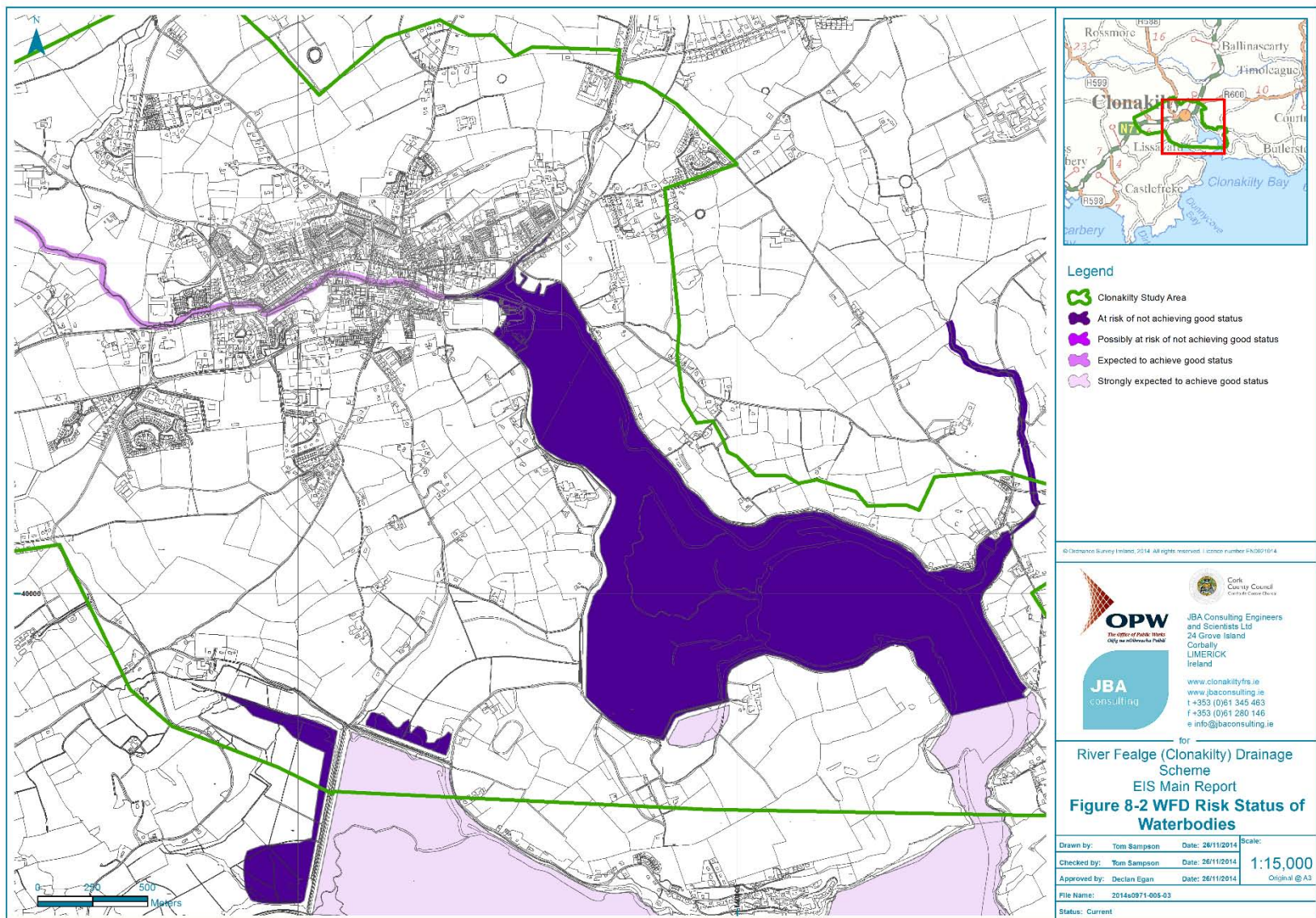
8.4 Transitional Waters within the Study Area

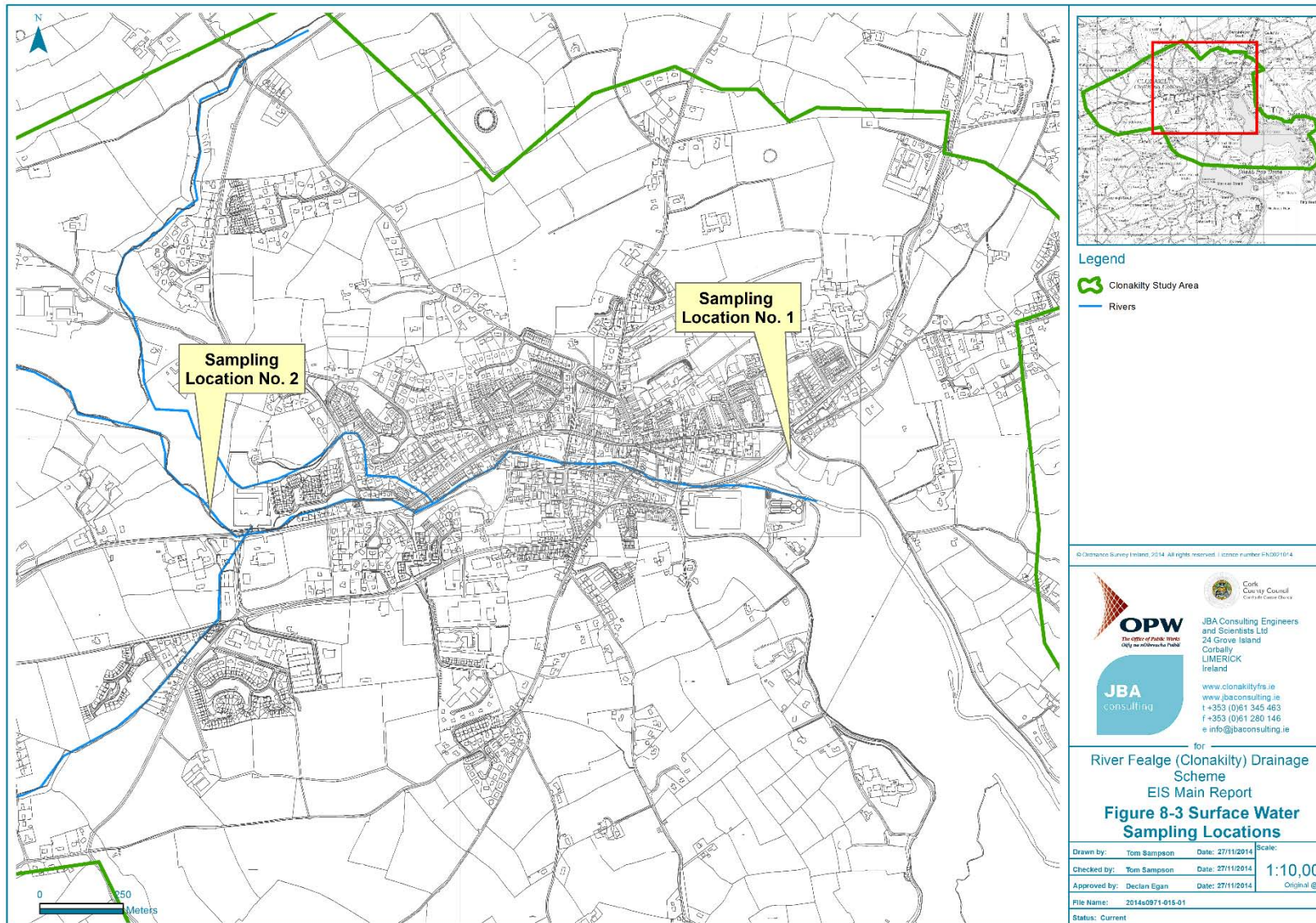
8.4.1 Desktop assessment for Transitional Wasters

Clonakilty Harbour comprises transitional water within the Study Area. It is a Special Area of Conservation under the Habitats Regulations and a Special Protection Area under the Birds Directive. This is discussed in more detail in Section 8 Ecology & Fisheries, of this report. A review of the South Western River Basin District found that Clonakilty Harbour is a Nutrient Sensitive Water designation within the Urban Waste Water Treatment (Amendment) Regulations 2010 (S.I. No.48 of 2010). Clonakilty Waste Water Treatment Plant (WWTP) provides secondary treatment and has a design capacity of 15,000 P.E. It operates under EPA Reg. No. D0051-01. The influent to the WWTP comprises foul and surface water from either gravity feed or pumped systems. The foul sewerage consists of both domestic and industrial effluent. The treatment plant has failed on the quality of the treated effluent - the most recent non-compliance is for the levels of suspended solids in the treated effluent. A major upgrade of the treatment plant has been approved and is expected to be completed by May 2016. This will increase the capacity of the plant to 20,500 P.E. The treatment plant will be designed to allow

retrofitting of disinfection equipment so that coliform levels in the treated effluent can be reduced.

A review of the South Western River Basin District: Transitional & Coastal Waters Action Programme (www.wfdireland.docx) found that Clonakilty Harbour is at risk from land based point source pressures and identifies the overflows from the WWTP as a point source potentially putting the Harbour at risk. The 2005 assessment found that the waste water treatment plant overflows, and the combined sewer overflows were placing the harbour at risk of not achieving good water quality status. (See Figure 8-2 – WFD Risk Status of water bodies).





The Office of Environmental Assessment (OEA) conducted ambient water quality monitoring in Clonakilty Harbour to determine its trophic status between 2010 and 2012. Elevated dissolved inorganic nitrogen (DIN), opportunistic algae and 95th percentile dissolved oxygen levels demonstrated that the Harbour is eutrophic. The quality of the water in the Harbour is described as moderate.

8.5 Coastal Waters within the Study Area

8.5.1 Desktop Assessment

Clonakilty Bay forms the only coastal waters within the study area. A review of the EPA's 2012 report on The Quality of Bathing Water in Ireland found that Inchydoney is designated bathing water (Bathing Water ID IESWBWC100_0000_0100). The beach forms part of the Clonakilty Bay SAC (Site Code 00091). It is also a Blue Flag beach.

Since 2011 interim transitional measures have been in place whereby bathing water quality is reviewed against the microbial standards in the existing 1976 Directive (Bathing Water Directive 76/160/EC). Microbial compliance is assessed annually based on the percentage (number) of samples meeting the relevant microbiological standard and using a three tier classification of 'Good', 'Sufficient' or 'Poor' status. Under this classification system, 'Good' water quality represents compliance with both EU guide and mandatory values. Table 8-5 below illustrates the microbial monitoring results for Inchydoney beach.

Table 8-5 : Microbial Monitoring for Inchydoney Beach

Date	E.Coli	Intestinal Enterococci	Status
29.07.2013	52	8	Good
06.08.2013	20	3	Good
19.08.2013	41	3	Good
26.08.2013	110	12	Sufficient
02.09.2013	109	16	Sufficient

The annual classification for the beach has been good for 2010, 2011 and 2012. No data was available for 2013.

The WFD Risk score for Clonakilty Bay is that it is strongly expected to achieve good status.

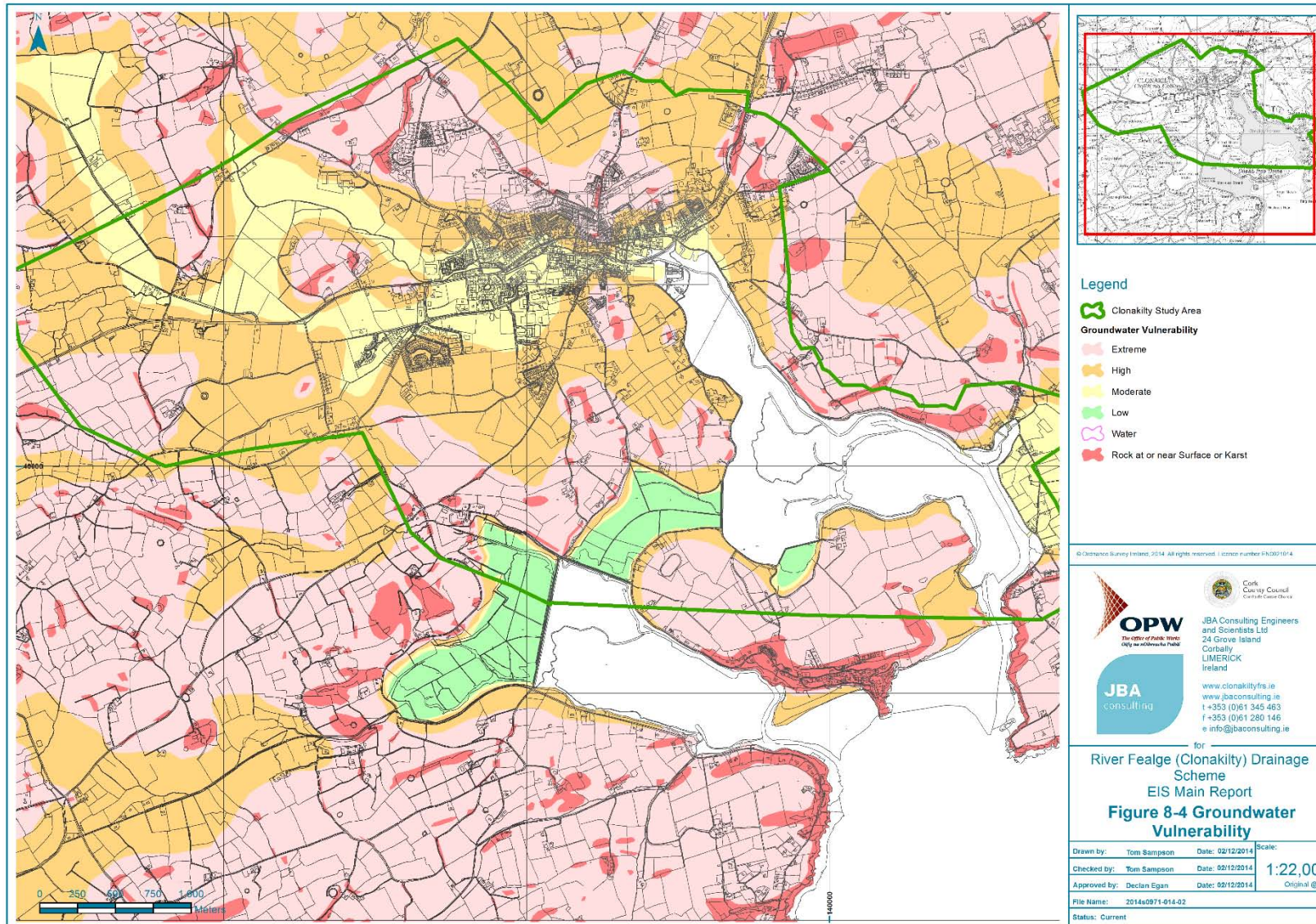
However, the accumulation of sea lettuce on the beach has been a serious problem in the past. In 2009 some 10,000 tonnes was accumulated on Inchydoney, Harbour View, Coolmaine and Courtmacsherry. A study undertaken on the causes of the problem identified excessive inputs of nutrients to the receiving waters as a likely source of the problem. As a result specific actions have been identified to reduce nutrient input such as improved waste water treatment capacity with nutrient removal at the waste water treatment plant in Clonakilty.

8.6 Groundwater within the Study Area

A review of the Geological Survey of Ireland's data base (www.spatial.dcenr.gov.ie/) identified a number of boreholes within the study area. These wells are not a potable water supply as the study area has poorly productive bedrock except for local zones. A review of the information on three wells within the study area located in the townlands of Clonakilty town, Miles and Tawines Lower show that groundwater vulnerability in the area ranges from moderate to high. The recharge coefficients vary between 20 and 85% and the maximum recharge capacities for the wells are 200 mm/yr.

The WFD Risk Score for the groundwater in the area states that it is at risk of not achieving good status.

A review of the GSI's groundwater vulnerability map (Figure 8-4) shows that groundwater in the area of the embankments and the sluice is moderate/high. Groundwater vulnerability at the eastern end of the town around Croppy Road and Deasy's Quay is moderate.



8.7 Impacts of the Proposed Scheme in the Absence of Mitigation Measures on Water during Construction

The impacts of the proposed scheme in the absence of mitigation measures on water within the Study Area are described in the following sections.

8.7.1 Site Preparation works for the Contractors Compound

Site preparation works for the contractor's compound will include the stripping of topsoil and the placement of mobile offices and toilets. The location of the compound will be agreed with the contractor and Cork County Council prior to the commencement of construction. The stripping of the topsoil has the potential for silt laden runoff to enter the river during heavy rainfall events. Any silt laden runoff discharges to the river will have a **moderate short-term negative impact** on both water quality and the species (eg. macroinvertebrates and fish) that inhabit the river. The spillage of diesel, hydraulic oil or lubricants from the contractor's compound to the water course will have a **significant medium-term negative impact** on the river and may result on the loss of some of the inhabitants in the river.

Similarly the stripping of the topsoil will increase the vulnerability of the groundwater in the area. Currently groundwater vulnerability in this area is moderate to high. The vulnerability will rise to extreme when the topsoil is removed. Any spillage of diesel/hydraulic oil will have a **significant medium-term impact** on groundwater in the area.

8.7.2 Site Preparation works for the Fluvial Embankments and Sluice

This construction of the fluvial embankments will involve the removal of the top soil and excavating to subsoil over the footprint of the embankment on both sides of the river. The excavated material will be held on-site for possible re-use in the construction of the embankments. Soil will be imported to the site and depending on its permeability may need to be screened on site prior to use in the construction of the embankments. The excavation of the soil and the removal of the subsoil will increase the vulnerability of groundwater to pollutants. In the event of any spillages of diesel or rupturing of the hydraulic pipes on the excavators this would cause a **significant medium-term negative impact** on groundwater because of the immiscible nature of the material.

Silt laden runoff from the stockpiles will have the potential to discharge to the river and this will have a **moderate negative short-term impact** on water quality. The presence of suspended soils in the runoff has depending on their size and the velocity of flood in the river, the potential to settle out in the river bed. If the solids settle out in potential salmon spawning grounds (redds) downstream of the embankment then this will be a **significant medium-term negative impact** on salmonids. Salmonids are particularly vulnerable to suspended solids runoff and the ova and the early juvenile stages are most sensitive. These stages are present during the mid-winter and early summer period.

The land for the proposed site of the embankments has been used in the past for arable farming and growing crops. Fertiliser, pesticide and herbicide applications would have been applied to these crops in the past. Depending on the level and frequency of applications the soil may contain some residual fertilisers or organic chemical (pesticides and herbicides). The typical fertiliser would be nitrogen, phosphorus, and potassium based fertiliser with trace amounts of other nutrients and heavy metals. The silt laden runoff to the river from the excavated areas would also contain these chemicals. The surface water sampling carried out on the River Fealge showed elevated levels of nitrogenous based chemicals particularly nitrate. The work under taken by Cork County Council on the causes of the excessive sea lettuce growth in Clonakilty Bay found that nutrients, particularly nitrogen were a causative factor. Additional nutrient loading into the river and ultimately into the estuary would have a **moderate short-term negative impact** on water quality in the estuary and bay. Clonakilty Bay is eutrophic and additional nutrients would make it more eutrophic. The pH of the water is neutral (around 7) and consequently the mobility of any heavy metals present in the runoff would not be very mobile.

The presence of pesticides and herbicides in the soil would have a **significant moderate-term negative impact** on water quality in the river and estuary. Groundwater will also be impacted by these anthropogenic pollutants. A number of commercially available pesticides and herbicides are persistent in the environment and the breakdown of some of these complex organic chemicals can take years.

The construction of the wing walls and the sluice gate will involve a number of steps namely:

- The excavation of a portion of the river bank to accommodate the wing walls
- Diversion of the river around the works
- Foundations may either be excavated or piled
- The placement of reinforced steel bars
- The placement of form work around the steel framework
- Pouring and vibrating of concrete/grout
- Allowing the concrete to go off
- Removing the formwork
- Making good the faces of the walls.

The diversion of the river around the site of the wing walls will have a **moderate short-term negative impact** on water quality in the river. The release of the river basin sediments into the water column will have a significant negative impact on the water quality. The re-suspension of nutrients, trace heavy metals will cause an additional impact. In addition the diversion of the river will have a significant negative impact on fish that live in the river but if correctly designed should not affect the movement of the fish. The reduction in the overburden over the bedrock will place increasing vulnerabilities on the groundwater and leave it more susceptible to pollutants.

The excavation of the foundations for the wing walls is another potential source of pollutants to the water and groundwater in the area. Diesel/hydraulic oil from the bucket of the excavator are significant sources of pollutants to the river and groundwater. Any spillage of diesel or hydraulic oil to the river will cause a **significant medium-term negative impact** on water quality with the possibility of fish kills particularly during the summer months when river levels are low. Any spillage of diesel or hydraulic oil to the river will cause a **significant medium-term negative impact** on groundwater quality.

The permanent loss of aquatic habitat and riparian habitat at the site of the proposed wing walls and sluice will impact on fish and mammals that use the banks of the River Fealge as a foraging corridor. The evidence of Otter was noted a distance upstream from the site of the sluice. No evidence of otter usage was however recorded at this site. The removal of a trees/hedgerow on the southern river bank will cause a **moderate short-term negative impact** to bats that use the area for foraging. This is discussed at length in Section 9 - Flora and Fauna.

The pumping of concrete into the formwork is a potential pollutant. The spillage of uncured concrete into a water body will cause a rise in the pH of the water (an increase in hydroxyl ions). This will cause a moderate **short-term negative impact** on water quality. This portion of the work will be carried out in the summer season when generally water levels are low. The impact of a spillage of concrete into the river when flows are low would be even more significant and could result in fish kills. A concrete spill would also increase the suspended solids levels in the river which would have a significant negative impact on fish and macroinvertebrates.

The replacement of the 2Nr. existing channels under the road at the Garage Stream between The Pines and the Cloheen Cottages will result in the suspension of silts and suspended solids into the Garage Stream. This will have a **short-term moderate negative impact** on the water quality and the inhabitants of the Garage Stream.

8.7.3 The Construction of Tidal Defence Walls and Embankments along the Banks of the River Fealge

The reader is referred to Section 6 (Description of the Project) for the location and the description of the work to be undertaken on the existing flood defence walls in Clonakilty. The construction of the tidal defence embankment along the Old Timoleague Road (E10 on Figure 6-1) will require the importation of approximately 300 tonnes of impermeable soil. The site of this embankment is removed from any major water courses so it is anticipated that the construction of the embankment will have a **slight negative impact** on water quality. The reduction in the overburden over the bedrock will place increasing vulnerabilities on the groundwater and leave it more susceptible to pollutants.

Similarly the 1.3 m high flood walls behind the properties on Convent Road (L38-L42 in Figure 6-1:) will have a **slight negative impact** on water quality in the area.

The construction of the tidal flood defence wall along Croppy Road on the North Bank of the estuary (L36 on Figure 6-1:) has the potential to cause significant impacts on water quality in the estuary. The spillage of diesel, hydraulic fluid or concrete into the estuary will have a **significant short-term negative impact** on the water quality in the estuary.

The construction of the tidal defence wall along the South Bank of the estuary (L35 on Figure 6-1:) has the potential to impact on the Clonakilty Bay Special Protection Area (SPA). This wall will replace the existing tidal defence wall from Clarke's Street Bridge to tie in with the proposed embankment along the western boundary of the waste water treatment plant. The removal of the existing wall, excavation for foundations, placing of formwork, and pumping concrete to form the wall all have the potential to cause **moderate short-term negative impacts** on the water quality in the estuary. The ebbing and flowing of a number of tidal cycles will however naturally disperse these pollutants.

All of the works for the strengthening of the parapets on Clarke's Street Bridge (B7 on Figure 6-1:) will be carried out at ground level. There is a potential for concrete to fall into the river during the construction of the parapets. This will have a **moderate short-term negative impact** on the water quality in the River Fealge. Similar impacts may arise during the replacement of the parapets on the Credit Union Pedestrian Bridge (B2,B3 on Figure 6-2) and Rossa Street Bridge (B5 on Figure 6-2) and the remaining pedestrian bridges between Rossa Street Bridge and Michael Collins Bridge.

The section of river between Clarke's Street Bridge and Rossa Street Bridge (L25 - L34 on Figure 6-1) will require the excavation for foundations and the construction of reinforced walls to a height between 1.1m and 1.3m. The construction will involve placing a cofferdam around the area for excavation, removing the material to the required depth, formwork and pumping of concrete/grouting into the footings. The formwork will be put in place, reinforced steel and concrete/grouting pumped into the formwork. The construction of these walls has the potential to have a **moderate short-term negative impact** on water quality in the River Fealge. Any contaminants in the water will be flushed out to the estuary on an outgoing tide. This will have a **moderate short-term negative impact** on the estuary.

The existing defence walls between the Credit Union and Michael Collins Bridge are in general in fair to good condition. However, these walls will be removed (L16-L24 on Figure 6-2) and replaced with 1.1m high reinforced concrete walls. A cofferdam will be placed around the existing wall, the wall will be dismantled and a mini excavator will be used to dig foundations for the wall. A cement/grouting mix will be pumped into the footings. Formwork will be placed around the footings, reinforced steel placed and concrete pumped into the formwork. The formwork will be removed and any blemishes made good. A number of operations in this process have the potential to pollute the surrounding water. The pollutants range from oil on the excavator, to diesel and lubricants on the formwork. These pollutants would have a **significant short-term negative impact** on the water quality in the river. The release of suspended solids and silt into the river would have a **moderate short-term negative impact** on the fish in the river. This impact would be exasperated in summer when river flows are expected to be lower.

Other sections of the walls along this stretch of the river (L8-L15 on Figure 6-2) are in fair condition and will require some work. The level of work that will be required is not known at this stage, but as a minimum some sections of the walls will need re-pointing or re-grouting. This will involve constructing a cofferdam and re-pointing from the river bed level. This operation has the potential to cause a **moderate negative short-term impact** on water quality in the river.

There are a number of sections of the defence walls situated between Michael Collins Bridge and Tobin's Bridge that will require replacement. The construction methodology for these walls will be the same as described in the preceding paragraph. The impacts of the construction activities will be **moderate short term negative impacts**. The defence walls in front of the Malt House and Old Brewery are in poor condition and will require replacement.

8.7.4 The construction of the storm water pipeline and pumping stations

7 Nr. Storm water drainage pipelines will be installed as part of this scheme. The excavation of the ground to the required level to lay the pipes will reduce the depth of overburden and consequently increase the vulnerability of the groundwater to pollutants. Pollutants such as

diesel and hydraulic oil are potential pollutants to groundwater and surface water and would cause a **significant negative short-term impact** on groundwater and surface water quality.

8.8 The Impacts of the Proposed Scheme on Water during Operation

8.8.1 Impacts of the Operation of the Embankments and Sluice on Water Quality

The short term storage of the flood water in the reservoir will cause it to accumulate nutrients (nitrogen and phosphorus) from the soil and any other herbicides that may have been used on the crops. The flood water will also accumulate suspended solids and silt from the land. This will have the effect of increasing the loading of these chemicals and pollutants to the river. After a flood event the river water will be naturally turbid and will contain suspended solids and silt from the surrounding land in the catchment. However, the discharge from the storage reservoir will extend that loading and will add additional suspended solids and silts to the river. This will have a **moderate short-term negative impact** on the water quality in the river.

Based on the design outlined in Section 6.2 of this chapter, a range of control heights for the sluice gate depending on the top of the water level and a maximum discharge rate of 6.2m³/s the peak velocity in the vicinity of the sluice gate could be in order of 9.4m/s. During lower order floods the velocity through the gate could be about 3m/s. These could have a significant impact locally on bed and bank erosion. The scouring will result in the re-suspension of sediments and silts into the water that will be carried downstream. The rate of deposition of this material will be dependent upon its size and the velocity in the river, but it is expected that the majority of the material will settle out within the riverine system. It will have a localised **moderate negative impact** on the water quality in the river.

The impacts of the operation of the sluice on species inhabiting the river are discussed in Section 9 of the EIS.

The maintenance of the sluice as part of the OPW's maintenance programme will involve oiling and greasing the manual control mechanism for the sluice. This material will be petroleum based and unless used in accordance with a Standard Operating Procedure there is the potential for some of this material to enter the river. This would result in a **moderate negative impact** on the water quality.

Structures such as the culverts on the Garage Stream may cause a minimal change to river flow patterns in the area of the culvert. This may increase sedimentation around this area but it is anticipated that this will be a **minimal negative impact** on water quality.

8.8.2 Impacts of the operation of the tidal defence walls on water quality

When construction is completed it is anticipated that the impact of the tidal defence walls on water quality will be minimum. There may be some localised changes in the flow patterns around or close by to them but it is anticipated that this will be a localised **minimal significant negative impact**.

8.8.3 Impacts of the Operation of the Pumping stations on water quality

The outfalls from the pumping stations on Kent Street, Kent Street car park and Rossa Street will discharge to the river Fealge. The storm water will contain contaminated suspended solids. The storm water may also contain hydrocarbons particularly from the Kent Street car park. These discharges will have a **moderate localised negative impact** at the outfall locations.

Similarly storm water discharges to the bay from the Croppy Road outfall and the Waterfront outfall will contain suspended solids and possibly hydrocarbons. The impact of these discharges on the bay will be a **minimal negative impact** on a localised area around the discharge pipes.

8.9 Mitigation Measures

8.9.1 Mitigation Measures during Construction - an overview

Mitigation measures relate to the protection of the aquatic environment from significant impacts that have been identified during the construction works. In addition to mitigating the significant impacts for water quality these mitigation measures will also protect the aquatic species and

fisheries in the rivers and streams. It was considered that the guidance given in the following documents would identify robust and workable mitigation measures for this scheme. The mitigation measures are based on the NRA's 'Guidelines for the Crossing of Watercourses during Construction of National Road Schemes (NRA, 2005); the Eastern Regional Fisheries Board guidance document 'Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites' (Murphy, 2004); and the Southern Regional Fisheries Board guidance document 'Maintenance and protection of the inland fisheries resource during road construction and improvement works' (Kilfeather, 2007).

At the start of the project it is recommended that the main contractor holds a series of tool box talks with the sub-contractors and supervisors to make them aware of the various environmental commitments made in relation to the scheme. It is recommended that responsible personnel and communication lines are agreed in advance of the work starting. These named responsible people should be documented in an Environmental Operating Plan for the scheme.

All Method Statements for in-river works and estuarine work must be agreed with the Inland Fisheries Ireland (IFI) and the National Park and Wildlife Services (NPWS) in advance of any of the works taking place.

It is recommended that an Environmental Management Plan (EMP) is installed prior to the work commencing. The plan can follow the guidelines and headings of the ISO 14001:2006 Environmental Management Systems Standard. The plan should also incorporate waste management, separation, disposal and documentation for wastes generated on-site, and in the contractor's compound. All contractors working on site should be made aware of the EMP, its requirements and reporting procedures. A nominated person should be tasked with maintaining the EMP, ensuring that training is given to all workers and that all records regarding waste handling and disposal, environmental incidents and emergencies procedures are kept in the main site office. It is recommended that an independent audit of the EMP is carried out before the work commences. Similarly a review of the EMP should be carried out during the construction programme.

For in-river works the following mitigation measures are recommended:

- Measures to minimise the suspension and mobilisation of sediment downstream of the working area should consider silt barriers and cofferdamming to create dry working areas
- Works should allow the river to recover for at least 14 hours on a daily basis meaning that the period of in river work should be about 10 hours maximum.
- A dry working area should be created for pouring of concrete
- In areas of the river where there are alien species, all plant and machinery should be thoroughly washed before moving to another section of the river
- All vehicles should be regularly checked for oil leaks, and ruptured hose pipes

8.9.2 Control of suspended solids

The potential for the release of suspended solids to the river/estuary during the construction of the storage embankments will be significantly increased during wet weather. It is recommended that temporary fencing is erected within 50 m of the river to prevent earth-moving equipment from encroaching too close to the watercourses when constructing the outer edges of the fluvial embankments.

The risk of erosion will be minimised where possible by planning the construction and construction routes. It is recommended that the topsoil under the footprint of the embankment is removed on a phased basis to help reduce the likelihood of soil erosion at the site. Where the topsoil is stripped and the subsoil removed; a drainage system should be installed to collect water from the excavated/denuded areas. The water should drain to a settlement pond. The overflows for the settlement ponds should be to land rather than the river. The design of the pond should be agreed with the IFI. Sandbags should be used in denuded areas to attenuate runoff and reduce soil erosion. Stockpiles of soil should be situated a distance away for the edge of the river. Sandbags should be placed around the stockpiles to prevent sediment laden runoff to the river.

Only certified soil should be used for the construction of the embankments.

Truck/excavator or other site equipment wash down areas should be located away from the riparian zone. This wash water should be directed to the settlement pond.

The pouring of the concrete for the wing walls of the sluice should be undertaken in dry weather and the concrete should be allowed to cure for 48 hours minimum. Wash water from the concrete pumps or surplus concrete left in the truck must not be discharged to the river.

8.9.3 Control of other pollutants

Best practice methods should be employed at all stages during the construction. It is recommended that the contractors compound is situated as far as is practicable from the river/estuary.

Fuel, lubricants, hydraulic oil, repair equipment used on the construction site should be carefully handled to avoid spillage. All tanks, barrels or containers containing hazardous materials (oils, lubricants, sealants etc.) must be stored in a sufficiently sized bunded area. In the event that a spillage does occur, adsorbent material should be placed on the material to adsorb it. The contaminated adsorbent should be correctly disposed of as a hazardous waste, and brought to a licenced waste handling site by a licenced waste contractor. The site manager must retain a copy of any waste transport and disposal documentation. In the event of a larger spillage of oil/hydraulic oil then Cork County Council Environment Section should be contacted immediately. The Emergency Procedures for the site should have a procedure for dealing with large spillages.

All empty diesel/oil/hydraulic oil containers should be drained to a single labelled container. The empty oil containers should be stored in a dedicated labelled totally sealed skip. Waste skips should be collected by a licenced waste carrier and brought to a licenced facility for disposal. All disposal records must be retained at the site offices.

The waste from the chemical toilets should be collected by a licenced waste carrier and brought to a licenced treatment facility.

A supply of oil booms and soak pads must be maintained within the contractor's area.

8.9.4 Timing of in-river works

The River Fealge and its tributaries contain salmonids and eels. Measures must be taken by the contractor to avoid impacts to the watercourses during the most sensitive period of the lifecycles of these species. For salmonids, the ova and early juvenile stages are most sensitive. Spawning takes place in the winter time fry do not emerge until mid-late May, therefore no in river work should take place during the period October to May. All in-river construction work must not prevent fish passage up the river. No in-river obstructions should be placed in the rivers or streams that would affect fish movements. No watercourse should be fully dried out unless approval is sought and approved by the IFI.

It is recommended that any diversions of the river during construction should follow the NRA's 'Guidelines for the Crossing of Watercourses during Construction of National Road Schemes' (NRA, 2005). It is recommended that the diversion of water should only occur during the period May to September. The compensation channel will need to be designed in consultation with the IFI. When the compensation channel is complete to the satisfaction of the IFI, reconnection to the river can happen. The salvage of the fish from the section of the river to be temporarily abandoned should be carried out by an ecologist approved by the IFI. Consultation with NPWS will be required because the species of fish that are found in the River Fealge are protected. Any sediment removed from the abandoned section of river must be stockpiled and reused to reinstate the river bed before reconnection of the sections of river.

No in river work should take place without prior consultation with the IFI and NPWS. Method Statements for all in river works must be approved by the statutory bodies.

8.10 Cumulative Impacts

The in-river works will generate increased levels of silt and suspended solids in the water. The dilution effects of the tide will help to minimise this impact on water quality. It will also reduce the impact on species living in the river and estuary. However cumulative impacts may arise particularly during the summer when river levels are low. The spillage of diesel into the river would on these occasions result in a cumulative impact on say migrating fish, particularly

salmon. It is recommended that the Standard Operating Procedures for the construction of the scheme considers these possibilities.

8.11 Residual Impacts

The construction of the scheme will require in river works along the length of the River Fealge and the estuary. There is a potential for increased silt and suspended solids in both the river and estuary during the construction work. But with strict adherence to the Standard Operating Procedures for working in the river and the estuary these impacts should be minimised. Overall the scheme will result in the loss of a small amount of habitat in the rivers and the streams, but in general the habitat will remain largely unchanged. In summary the impacts of the construction and operation of the scheme will be localised and short term.

9 Flora and Fauna

9.1 Introduction

This chapter relates to the potential ecological impacts of the proposed River Fealge (Clonakilty) Drainage Scheme, considering designated sites, habitats, flora and protected/notable species. The aim of this chapter is to identify the key ecological receptors within the study area, determine their ecological value, assess the potential impacts of the scheme upon them and propose mitigation to offset any identified impacts.

Ecological receptors within the study area are strongly linked to the water environment and hydromorphological factors, and this chapter should give cognisance to the inter-relationships between these aspects, in particular.

9.2 Methodology

9.2.1 Guidance Used

This Ecological Impact Assessment has been produced in line with the following documents:

- Guidelines on the Information to be contained in Environmental Impact Statements (Environmental Protection Agency, 2002)
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (Environmental Protection Agency, 2003)
- Guidelines for Ecological Impact Assessment (Chartered Institute of Ecology and Environmental Management (CIEEM), 2008)
- Guidelines for Preliminary Ecological Appraisal (GPEA) (CIEEM, 2012)
- A Guide to Habitats in Ireland (Fossitt, 2000)
- Habitat Survey Guidelines: A Standard Methodology for Habitat Survey and Mapping in Ireland; (The Heritage Council, 201105)

Species-specific survey guidelines followed are detailed in section 1.2.3 below.

9.2.2 Desk-based Assessment

A desk-based assessment was carried out to collate information regarding protected/notable species and statutorily designated nature conservation sites in, or within close proximity to, the study area.

A data search for protected and notable species was conducted using the National Biodiversity Data Centre Mapping System (National Biodiversity Data Centre, 2014). A 4km grid square was used to encompass the study area and species records were extracted from the map at a 2km² resolution.

Information for statutory designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Ramsar Sites, Natural Heritage Areas (NHAs) and proposed NHAs (pNHA) was collected from the online resources provided by the National Parks and Wildlife Service (NPWS) (NPWS, 2014).

Other information on the local area was obtained, including:

- 2010/2011 Waterbird Survey Programme as undertaken by The National Parks & Wildlife Service (Cummins and Crowe, 2011)
- Irish Wetland Bird Survey (I-WeBS) data
- Clonakilty Town Development Plan 2009-2015
- Inland Fisheries Ireland

9.2.3 Field Surveys

Ecological Walkover Survey

An ecological walkover survey was conducted by an experienced ecologist on the 13th March 2014. The survey encompassed the areas likely to be impacted upon by implementation of possible flood alleviation options as detailed in the Clonakilty Public Consultation Day Report

(Mott McDonald, 2013) produced as part of the South Western Catchment-based Flood Risk Management (CFRAM) Study. This included a proposed flood storage area upstream of the town of Clonakilty, areas within the town itself, and intertidal areas where the River Fealge discharges into Clonakilty Bay. Development and buildings along the banks of the river limited access to some areas within the town.

As part of the ecological walkover survey, the following processes were conducted:

- Mapping of habitats present within and alongside the river in accordance with Fossitt's Guide to Habitats in Ireland (Fossitt, 2000) and Best Practice Guidance for Habitat Survey and Mapping (Smith et al, 2011). Within each general habitat type the dominant flora was recorded in order to determine general species composition and distribution. It should be noted for this survey that March is a sub-optimal period for conducting botanical surveys, with many species not yet evident or identification features not developed (e.g. flowering or fruiting parts). However, it is still possible to record the dominant component species present that typify the floristic composition of the habitat.
- Recording of any bird species noted during the habitat survey and the presence of any potential nesting habitat (i.e. Kingfisher burrows, cracks in brickwork, woodland and scrub areas).
- Recording of any evidence of Otter, based on the standard works of the RSPB (1994) and Chanin (2003). This involved surveying the accessible stretches of river, examining banks and prominent features for spraints (droppings) and footprints. A search was also made for possible holt and couch (resting) sites. Otters are extremely difficult to observe, and this method provides the most effective and efficient means of investigating presence or absence.
- Recording of any evidence of Badger. The accessible stretches of river, and surrounding areas, were searched for signs of the presence of Badgers. In addition to the presence of active setts, the following signs of activity were also searched for: latrines, footprints, evidence of feeding activity and well-worn paths through vegetation. Badgers will use a number of setts throughout their territory at different times of year; any large holes with the potential to be used by Badgers, but not showing obvious signs of recent activity, were therefore also recorded.
- Any features (e.g. bridges, culverts, mature trees) with suitability for roosting bats were also identified and mapped, as specified in the Bat Conservation Trust (BCT) Bat Surveys - Good Practice Guidelines (BCT, 2007). This includes looking for cracks, crevices, loose bark, holes and splits and for evidence indicating bat presence including dark stains running below holes or cracks, bat droppings, odours, or scratch marks.
- Recording and mapping of any non-native invasive species, such as Japanese Knotweed *Fallopia japonica*, Giant Hogweed *Heracleum mantegazzianum*, and Himalayan Balsam *Impatiens glandulifera*. However, it should be noted that March is a sub-optimal time for recording annual non-native invasive plant species, such as Himalayan Balsam, as growth may not be evident at this time of year.

Bat Survey

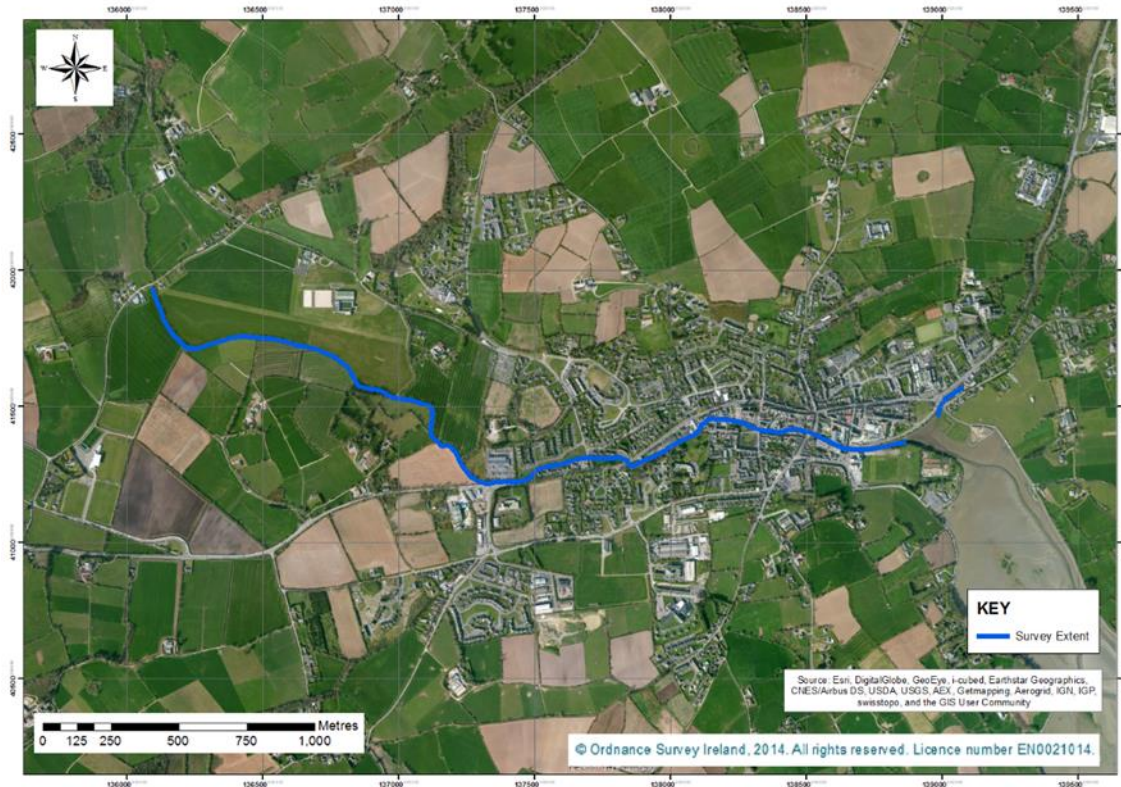
Due to the identification of features with the potential to support roosting bats, further bat surveys were conducted by and experienced bat ecologist (Kieran Sheehan - Natural England Bat Licence No CLS00195) on the 20th - 22nd August 2014. This involved walking the entire length of the River Fealge from the estuary in Clonakilty to the upstream limit of the proposed storage reservoir.

In advance of this a data request was made to the County Cork Bat Group although no response was received. In addition the National Biodiversity Data Centre website was accessed to ascertain details of bat populations in and around the town of Clonakilty. This revealed which species of bats have been recorded in the area in the past and also shows the habitat suitability, at a coarse scale, for each of these species in the study area.

The field survey was undertaken following the guidelines contained in Hundt (2012), in particular those relating to roost surveying and timed searches. All trees and structures between the tidal Fealge and the upstream extent of the proposed storage reservoir were assessed during daylight hours to determine their potential to hold bat roosts (Figure 9-1). Following this timed

searches were carried out in the same area to determine what species of bats were present within the study area, in what numbers and how they were using the landscape and its features.

Figure 9-1 : Surveyed section of the Fealge River and its tributaries



Crayfish and Fish Survey

As in-channel working is proposed as part of the River Fealge (Clonakilty) Drainage Scheme a crayfish and fish survey was commissioned. Salmonids, White-clawed Crayfish *Austropotamobius pallipes* and riparian/ riverine habitats were investigated using a combination of desktop reviews and on-site investigations.

A desktop review was carried out to assess information from previous studies in the area, and to determine the most suitable methods for carrying out the field surveys. It also established the water quality of the river as close as possible to the Study Area. The desktop review included a full review of relevant literature (published reports, books, journals and peer reviewed papers) and websites for all pertinent information on aquatic areas of interest within the study area. Information sources included the websites of IFI, Environmental Protection Agency and O' Reilly's fly-fishers guide to the Rivers of Ireland (O' Reilly, 2004). Desktop reviews of relevant ecological/environmental assessments and survey guidance documents include:

- River Habitat Survey in Britain and Ireland Field Survey Guidance Manual, 2003 (Environment Agency, 2003)
- Methods for the Water Framework Directive: Electric fishing in wadable reaches. Central Fisheries Board (CFB), 2008)
- A Guide to Habitats in Ireland (Fossitt, 2000)
- A Desk Study to Determine a Methodology for the Monitoring of the Morphological Condition of Irish Rivers for the Water Framework Directive (Philip McGinnity, Paul Mills, William Roche & Mark Muller, 2006)
- Water Quality in Ireland 2006, Key Indicators of the Aquatic Environment (Environmental Protection Agency (EPA), 2006)
- Irish Wildlife Manuals, No 45. A technical manual for monitoring White-clawed crayfish *Austropotamobius pallipes* in Irish lakes (Reynolds et al., 2010)
- IFI Biosecurity Protocol for Field Survey Work (Inland Fisheries Ireland, 2010)

- Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish (King et al., 2011)
- EPA Web Browser Envision Portal Surface Water Quality (<http://gis.epa.ie/Envision>)
- Geological Survey Ireland Mapping Tools (www.gsi.ie)
- NPWS Web Browser Mapping Tool Environmental designations (www.npws.ie)
- National Biodiversity Data Centre Mapping Tool (www.nbdc.ie)

For the field survey, sampling points were chosen to allow information on the baseline presence (or absence) and abundance of White-clawed Crayfish and the various fish species within the area. This was not within the known distribution range of White-clawed Crayfish in Ireland (usually confined to the centre of the country). However, a specific request by the IFI was made to survey for crayfish, as they are believed to be under-recorded, and confirmation of presence/absence from the monitoring locations was required.

The site was surveyed during the weekend of the 25th - 27th July 2014. The location of the sites surveyed is presented in Table 9-1.

Table 9-1 : Location of the sampling sites

Sample Site No.	Grid Reference	Location
1	W 36037, 42265	Location upstream of the embankment
2	W 36484, 41753	Location upstream of the embankment
3	W 37360, 41214	Embankment upstream from Dunnes Stores
4	W 37885, 41293	Between Bridge street and Clarkes

The field survey included an assessment of the aquatic and riparian habitat, assessment of habitat suitability for macro-invertebrates, a snorkelling hand search for White-clawed Crayfish, sweep netting for White-clawed Crayfish and an electro-fishing survey. Full details of the methodologies followed are provided in the full aquatic ecology and fisheries assessment at Appendix 9.A.

A hydromorphological assessment was also conducted with the purpose of assessing salmonid spawning habitat within the River Fealge and other watercourses around Clonakilty (See Chapter 10 for further details). This survey included:

- A desk based assessment to collate information relating to the existing hydromorphological condition of the watercourses in Clonakilty, including the River Basin Management Plan.
- An initial field based hydromorphological audit and gravel condition survey to gain a further understanding of the current character and dynamics of the watercourse, along with the potential areas of gravel spawning habitats for salmonid fish species.
- A more detailed hydromorphic audit and gravel condition survey covering all of the watercourses in the study area. This included aerial photography analysis and field survey of all watercourses (where accessible) upstream of Clonakilty to determine sediment sources, potential spawning sites (redds) and hydrological issues. The estuary downstream of Clonakilty was also assessed to allow prediction of potential response to flood risk proposals. A gravel condition survey was conducted instead of a traditional redd survey due to the time of year; redd surveys are generally undertaken in mid-winter, when redds can be easily identified as oval depressions of clean gravel, sometimes in contrast to the surrounding gravel. However, due to project constraints, an understanding of the spawning habitat was required by autumn 2014. Therefore, a full redd survey could not be carried out, however, a gravel condition survey was undertaken to assess the suitability of gravels within the river channel for spawning. The survey focussed on the size and depth of the gravel, the location of the gravel in the context of river geomorphology, whether the gravel contained fine sediment, and the depth and velocity of the water over the gravel. A summer gravel habitat survey is further constrained by the presence of in-stream vegetation which obscures the substrate of the river from view and changes the flow patterns.

9.2.4 Consultation

During development of the River Fealge (Clonakilty) Drainage Scheme and production of this Environmental Impact Statement consultation meetings were held with NPWS and IFI; their recommendations have been incorporated into this assessment, in particular in relation to survey methodology.

9.2.5 Assessment Methodology

Ecological receptors include nature conservation sites, habitats, species assemblages/communities, populations or groups of species. The assessment of the significance of predicted impacts on ecological receptors is based on both the 'value' of a receptor, and the nature and magnitude of the impact that the project will have on it.

Valuation of Receptors

It is impractical for an assessment of the ecological impacts of a project to consider every species and habitat that may be affected; instead it should focus on valued ecological receptors. These are species and habitats that are valued in some way, and could be affected by the proposed project.

The value of designated sites, habitats and species populations is assessed with reference to:

- Their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations).
- Any social benefits that habitats and species deliver (e.g. relating to enjoyment of flora and fauna by the public).
- Any economic benefits that they provide.

The valuation of designated sites takes into account different levels of statutory and non-statutory protection. Assessment of habitat depends on a number of factors, including the size of the habitat, its conservation status and quality. The assessment also takes account of connected off-site habitat that may increase the value of the on-site habitat through association. Valuation of species depends on a number of factors including distribution, status, rarity, vulnerability, and the population size present.

Designated sites, habitats and species populations have been valued using the following scale, which is further detailed in Table 9-2.

- International
- National
- Regional/County
- Local
- Less than local

Table 9-2 : Examples of the Criteria used to define the Value of Ecological Receptors

Level of Value Examples of Criteria	Level of Value Examples of Criteria
International	An internationally important site e.g. Special Protection Area (SPA), Special Area of Conservation (SAC), Ramsar (or a site considered worthy of such designation). A regularly occurring substantial population of an internationally important species (listed on Annex IV of the Habitats Directive). Designated salmonid waters. Major salmon fisheries.
National	A nationally designated site e.g. Natural Heritage Area (NHA), a proposed Natural Heritage Area (pNHA), statutory Nature Reserve, or a site considered worthy of such designation. A viable area of a habitat type listed in Annex I of the Habitats Directive or of smaller areas of such habitat which are essential to maintain the viability of a larger whole. A regularly occurring substantial population of a nationally important species, e.g. listed on The Wildlife Act 1976 or The Wildlife (Amendment) Act 2000. A species included in the Irish Red Data Lists/Books.

Level of Value Examples of Criteria	Level of Value Examples of Criteria
	Significant populations of breeding salmonids. Major trout river fisheries and commercially important coarse fisheries.
Regional/County (County Cork)	Species and habitats of special conservation significance within County Cork, as identified in the County Cork Biodiversity Action Plan. An area subject to a project/initiative under the County Cork Biodiversity Action Plan. A regularly occurring substantial population of a nationally scarce species. Waters containing some resident salmonids or good stocks of coarse fish species.
Local (works site and its vicinity)	Areas of internationally or nationally important habitats which are degraded and have little or no potential for restoration. A good example of a common or widespread habitat in the local area. Species of national or local importance, but which are only present very infrequently or in very low numbers within site area. Small waterbodies with some coarse fisheries value or some potential salmonid habitat.
Less than local	Areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest. Common and widespread species. No significant population of any species of fish.

Magnitude of Impacts

Ecological impacts can be categorised and assessed in a number of ways. They can be considered to be:

- **Positive** - A change which improves the quality of the environment.
- **Neutral** - A change that does not affect the quality of the environment.
- **Negative** - A change which reduces the quality of the environment. A negative impact can be sufficiently minimised or eliminated by the adoption of appropriate mitigation measures.
- **Uncertain** - When the full consequences of a change in the environment cannot be described.

In addition, the nature of impact can also be described in a number of ways, including:

- **Direct/Indirect** - a direct impact could include the loss of a species or habitat, whereas an indirect impact could be as a result of noise, dust or disturbance.
- **Irreversible** - when the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost. Alternatively, impacts can be **temporary** in nature, with the baseline condition restored after a period of time; this could occur over the **short-term** (1-2 years), **medium-term** (2-10 years) or **long-term** (+10 years).
- **Cumulative** - the addition of many small impacts to create one larger, more significant impact.
- **Synergistic**: Where the resultant impact is of greater significance than the sum of its constituents.

These factors are assessed together to determine the magnitude of the impact on the status of a habitat or species population, and on the integrity of the site that supports them. Professional judgement is then used to assign the impacts on the receptors to one of four classes of magnitude, detailed in Table 9-3.

Table 9-3 : Definition of Magnitude

Magnitude	Definition
High	An irreversible or long-term impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status.
Medium	An irreversible or long-term impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group. If adverse, this is unlikely to threaten its sustainability; if beneficial; this is likely to be sustainable but is unlikely to enhance its conservation status.

Magnitude	Definition
Low	A short-term but temporary impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group that is within the range of variation normally experienced between years.
Negligible	A short-term but temporary impact on the integrity of a site or conservation status of a habitat, species assemblage/community, population or group that is within the normal range of annual variation.

9.2.6 Significance of Impacts

The significance of an impact is a product of the value of the ecological receptor and the magnitude of the impact on it, moderated by professional judgement. Table 9-4 shows a matrix which is used for guidance in the assessment of significance, with impacts being considered to be of major, moderate or minor significance, or negligible. Impacts can also either be assessed as positive or negative using the same matrix.

Table 9-4 : Significance of Impacts Matrix

Value of Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
International	Major	Major	Moderate	Neutral
National	Major	Moderate	Minor	Neutral
Regional/County	Moderate	Minor	Minor	Neutral
Local	Minor	Minor	Negligible	Neutral
Less than local	Negligible	Negligible	Negligible	Neutral

Residual Impacts

Where significant impacts are identified, mitigation measures will be proposed as part of the Ecological Impact Assessment process in order to avoid, reduce or minimise them. Each impact assessment section assigns a final significance level to the impact described, which takes into account the implementation of any stated mitigation measures; these are the **residual impacts**.

9.3 Existing Baseline

9.3.1 Designated Nature Conservation Sites

There are two, overlapping statutory designated sites within the study area: Clonakilty Bay SAC and SPA. These sites are located to the south-west of Clonakilty town, within the bay. Details of their designations and qualifying features are given in Table 9-5 below, with their location shown on Table 9-5.

Table 9-5 : Statutory Nature Conservation Sites. (Information from NPWS, 2014)

Site name	Description
Clonakilty Bay SPA	A wetland complex that stretches from the town of Clonakilty to the open sea. Several small rivers, including the River Fealge flow into the site. The site is valued for its ornithological importance, particularly for the internationally significant population of Black-tailed Godwit <i>Limosa limosa</i> that it supports in winter. Further to this, the SPA supports nationally important numbers of four other species, namely: Shelduck <i>Tadorna tadorna</i> , Dunlin <i>Calidris alpina</i> , Curlew <i>Numenius arquata</i> and Greenshank <i>Tringa nebularia</i> .

Site name	Description
Clonakilty Bay SAC	An inter-tidal expanse that stretches from Clonakilty to the open sea comprising two small estuaries separated by Inchydoney Island with adjacent sand dunes and inland marshes. This coastal complex has a good diversity of habitats including several habitats listed on Annex I of the EU Habitats Directive. The habitats show a succession from salt to freshwater influences including sandflats, mudflats, sand dunes, wetland, including saline lagoons, to brackish grasslands, open freshwater marsh and Alder <i>Alnus glutinosa</i> scrub. The value of the SAC is enhanced by the bird life that it supports.

There are no NHAs in, or within 2km of, the Study Area.

Figure 9-2 : Designated sites

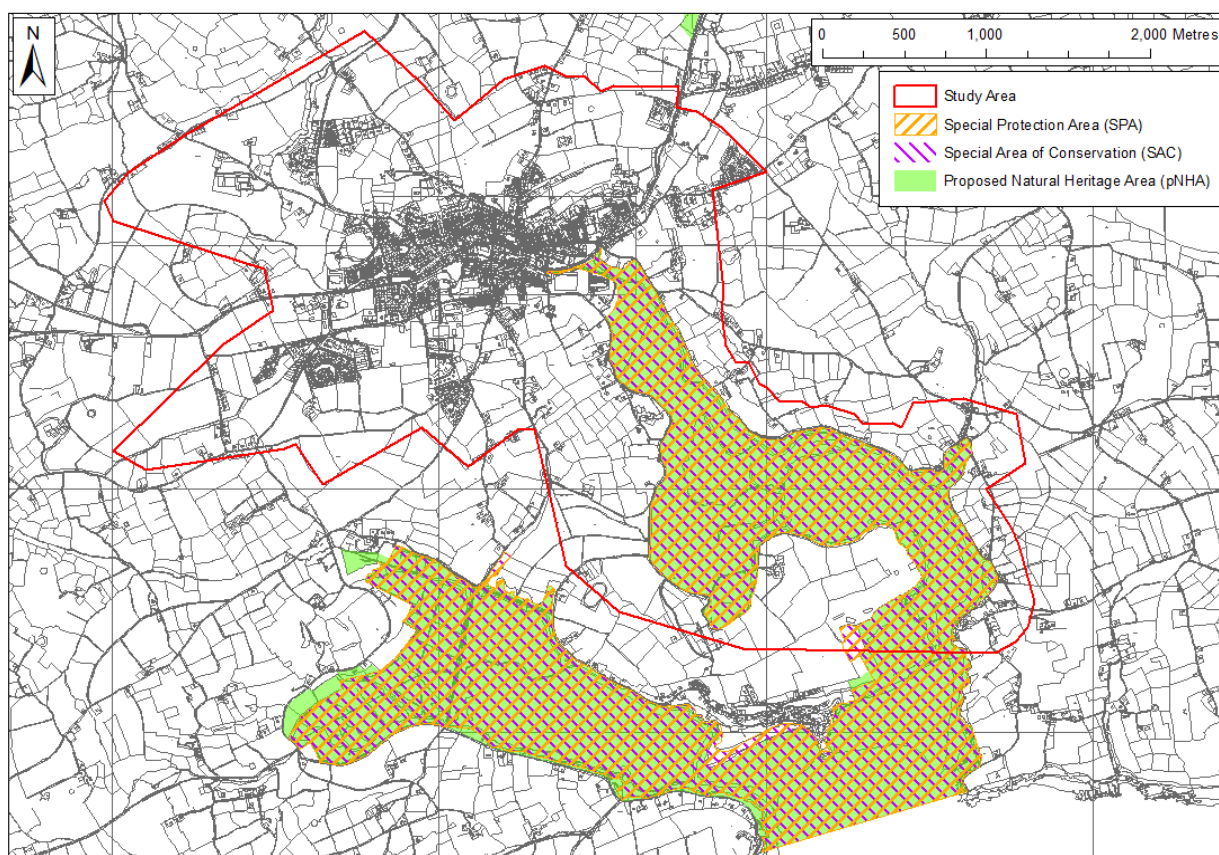
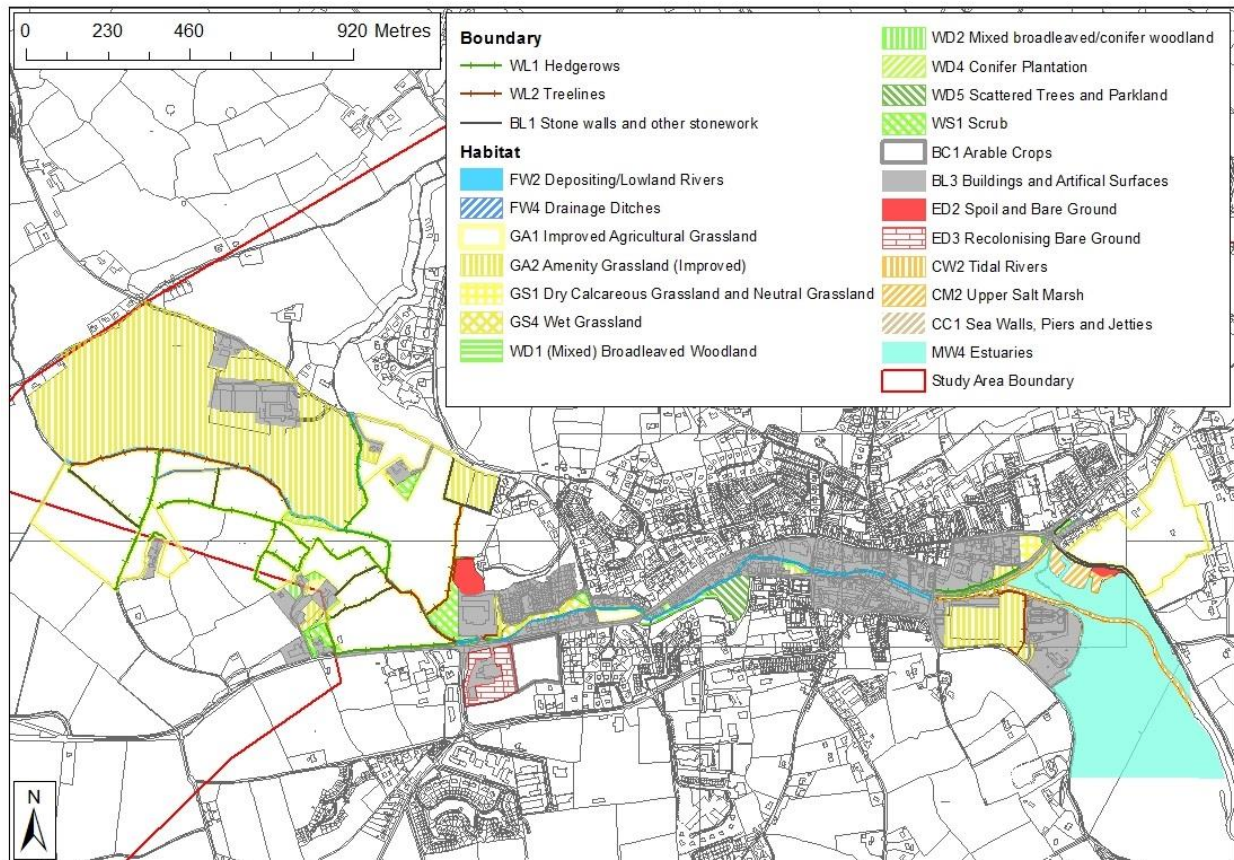


Figure 9-3 : Fossitt Habitat Classification



One proposed (non-statutory) Natural Heritage Area (pNHA) is located within the study area; Clonakilty Bay pNHA which is of significance for its wildlife and habitats and as such is also statutorily designated as described in the previous section. The non-designated pNHA overlaps directly with the statutorily designated sites (Clonakilty Bay SPA and SAC), although it extends slightly further inland in a few locations (outwith of the study area).

9.3.2 Habitats and Flora

The habitats recorded along the surveyed stretches of river are shown in Figure 9-3, followed by descriptions of the key habitat types found.

River Fealge

The River Fealge, in the upstream part of the study area, is a relatively narrow (approximately 3-4m in width), fast-flowing watercourse with a gravel/silt substrate. Upstream of the town of Clonakilty, the watercourse is tree-lined (WL2) on the right bank with Alder *Alnus glutinosa*, Ash *Fraxinus excelsior*, Sycamore *Acer pseudoplatanus* and Hawthorn *Crataegus monogyna* frequent, with a species-rich understorey consisting of Ivy *Hedera helix*, Common Valerian *Valeriana officinalis*, Lords-and-Ladies *Arum maculatum*, Cleavers *Galium aparine* and Honeysuckle *Lonicera periclymenum*. The left river bank upstream of the town is, in general, much more open with only occasional isolated shrubs or trees.

In-channel vegetation in the upstream reach consisted predominantly of Hemlock Water-dropwort *Oenanthe crocata* and River Water-crowfoot *Ranunculus fluitans*, with very occasional Water-starwort *Callitriche* sp. present in more slower flowing areas. The banksides were modified in some locations, with a stone toe reinforcement. Bankside flora on the more open left bank included abundant Soft Rush *Juncus effusus*, Lesser Celandine *Ranunculus ficaria*, Broad-leaved Dock *Rumex obtusifolius* and sedges *Carex* spp.

Figure 9-4 : The River Fealge in the upstream reaches of the study area



Riverine communities containing species such as those noted in the upstream reach (upstream of Dunnes Stores) can be considered to represent the notable habitat, listed on Annex I of the Habitats Directive, of = [3260]. Watercourses containing this habitat type are typically watercourses characterised by the abundance of water-crowfoots *Ranunculus* spp., subgenus *Batrachium* (i.e. *Ranunculus fluitans*, *R. pencillatus* ssp. *penicillatus*, *R. pencillatus* ssp. *pseudofluitans*, and *R. peltatus* and its hybrids), which form floating mats. However, there is no satisfactory definition of this habitat type and its sub-types and its distribution in Ireland. It can occur over a wide range of physical conditions from acid, nutrient-poor, flashy upland streams dominated by bryophytes to more nutrient-enriched, slow flowing streams dominated by water-crowfoot *Ranunculus* and water-starwort *Callitriche* species. The *Ranunculus* species can be associated with a wide assemblage of other aquatic plants, such as Water-cress *Rorippa nasturtium-aquaticum*, water-starworts *Callitriche* spp., water-parsnips *Sium latifolium* and *Berula erecta*, water-milfoils *Myriophyllum* spp. and Water Forget-me-not *Myosotis scorpioides*. In some rivers, the cover of these species may exceed that of *Ranunculus* species (NPWS, 2014a). Other associated species with this habitat type can include Horned Pondweed *Zannichellia palustris*, pondweed species *Potamogeton* spp. and the moss *Fontinalis antipyretica*. Opposite-leaved Pondweed *Groelandia densa* may also be present, with Flowering Rush *Butomus umbellatus* potentially present as part of the bank flora (OPW, 2007). Whilst the aquatic flora recorded in the upstream section of the River Fealge was of limited diversity, the presence of both River Water-crowfoot and Water-starwort species mean that it can be considered to represent this Annex I habitat type, although of relatively poor quality.

Through the town itself the river becomes wider, but constrained on both banks by walls and development (BL1, BL3). A number of bridges cross the river and some sections run through culverts beneath buildings. In-channel vegetation is very limited in these areas, although the walls alongside the river contain a number of species including Ivy, Polypody *Polypodium vulgare*, Broad-leaved Dock and a number of mosses and liverworts. This downstream reach of the river (downstream of Dunnes Stores) would not correspond to the Annex I habitat type of watercourses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation due to the lack of species aquatic flora.

Figure 9-5 : The River Fealge in the town of Clonakilty at the Casement Street Bridge (left) and the Seymour Street

footbridge (right)



Estuarine and intertidal habitats

The downstream reaches of the River Fealge are tidal (CW2). The Fealge discharges into the south-west of Clonakilty Bay alongside The Croppy Road, with a second smaller watercourse joining in the north-east at Facksbridge.

The Croppy Road is situated on an embankment at the head of the estuary and forms the initial defence to the town of Clonakilty. This embankment is also an amenity feature with small ornamental tree planting and park benches (BC4, WS3). The uppermost parts of this embankment are dominated by Perennial Rye-grass *Lolium perenne*, with common ruderal species including Ribwort Plantain *Plantago lanceolata*, Yarrow *Achillea millefolium*, Cock's-foot *Dactylis glomerata* and ornamental planting including daffodils. Moving down the slope of the embankment the influence of the tidal environment is more evident, with species including Alexanders *Smyrniolus olusatrum*, Sea Beet *Beta vulgaris* and Red Fescue *Festuca rubra* present. The species present on the lower embankment are more characteristic of upper salt marsh vegetation (CM2), but it is limited in extent and of poor quality due to the modified nature of the substrate and high levels of disturbance.

Figure 9-6 : Estuarine habitats adjacent to The Croppy Road with the change in embankment vegetation (left)



There are also areas of upper salt marsh/maritime grassland along the north-eastern boundary of the Clonakilty Bay, formed behind stone walls which have created tidal inlets.

At the time the survey was conducted the tide was high, but at low tide extensive areas of mudflat habitat would be exposed within the estuary (MW4, LS2, LS3).

Other Watercourses

A number of other watercourses join the River Fealge within the surveyed reach, including a number of drains (FW4) to the south of the river in the upstream section of the survey area. These agricultural drains are generally trapezoidal and 1-2m in width. The majority of these drains were relatively fast flowing with gravel substrates, but little in-channel vegetation. In addition, some short sections of drain were noted as relatively stagnant and eutrophic, with extensive algae cover.

Figure 9-7 : Drainage ditches in the area to the south of the river, the one of the right stagnant and eutrophic



Two main tributaries join the River Fealge within the surveyed reach. The first, the Capeen Stream, joins the Fealge on the left bank just downstream of the equestrian centre. The second, the Garage Stream, joins the main river from the right bank at the upstream end of the town. Both these watercourses are similar in character and species to the main River Fealge.

Grassland Habitats

Grassland was the dominant habitat in the upstream section of the study area. On the right bank of the river (to the south) improved agricultural grassland (GA1) is the dominant habitat, with Perennial Rye-grass, Creeping Buttercup *Ranunculus repens*, Creeping Bent *Agrostis stolonifera* abundant, with frequent Broad-leaved Dock. This area is cattle grazed and relatively species-poor.

Figure 9-8 : Grassland area on the right bank of the river (left) and overview of the upstream, grassland-dominated survey area (right)



On the left bank of the river (to the north) one large field dominates the upstream surveyed reach. The grassland here is also species-poor with Perennial Rye-grass again dominating. This field is associated with the equestrian centre and is reported anecdotally as being used as a runway for light aircraft in emergencies. It does not appear to be grazed or used for silage production, seemingly being regularly mown to retain a short sward, and therefore it has been classified as amenity grassland (improved) (GA2), rather than improved agricultural grassland, although not typical of this habitat type.

Figure 9-9 : Amenity grassland (improved) on the left bank of the river



Within the town itself a number of smaller grassland areas are present, predominantly of amenity type (GA2) and often with occasional ornamental tree and shrub planting (BC4, WS3).

Hedgerows and Field Boundaries

In the upstream reaches of the surveyed area, particularly to the south of the river, there are a number of field boundaries which are of notable interest for biodiversity. These boundaries consist of mature hedgerows with trees, often situated on a stone and/or earth embankment and appear to be of considerable age. Woody species composition is dominated by Hawthorn with some Alder and Bramble *Rubus fruticosus* agg, and there is a species-rich understorey with Wall Pennywort *Umbilicus rupestris*, Ivy, Bracken *Pteridium aquilinum*, Polypody, Bluebell *Hyacinthoides non-scripta* and Hogweed *Heracleum sphondylium*.

Figure 9-10 : Hedgerow and bank field boundaries



The hedgerows provide ample bird nesting habitat, particularly for passerine species, commuting corridors and cover for small mammals and amphibians. Rabbit *Oryctolagus cuniculus* activity was noted to be particularly extensive within some of the hedgerow embankments.

Many of the trees and treelines within the town fall within Tree and Hedgerow Protection areas as outlined within the Clonakilty Town Development Plan. Several of these are located adjacent to the river and estuary areas, and also along boundaries, such as that extending southwards from the cemetery adjacent to where a flood storage area embankment may be constructed.

Woodland/Scrub

Within the surveyed area there are few woodland areas, with tree cover generally present in treelines along the watercourses and field boundaries, or as mixed broadleaved woodland blocks (WD1) or mixed broadleaved/conifer woodlands (WD2) around buildings, in particular the Brookfield House complex.

One small plantation of conifer woodland (WD4) is also present on the right bank of the river, north of Brookfield House.

Figure 9-11 : Conifer plantation



Throughout the surveyed area there are also small areas of scrub habitat (WS1), around buildings and in small areas of previously developed land that are now being recolonized. The woody canopy cover in these areas varies considerably, as does species composition.

The Urban Environment

The town of Clonakilty dominates much of the downstream part of the surveyed area with developments and walls lining the River Fealge.

Flora

No species listed on the Flora (Protection) Order, 1999 were recorded during the site survey, and as stated above, March is a sub-optimal period for conducting botanical surveys. However, subsequent field surveys did not record any species listed on the Flora (Protection) Order, 1999 and the habitats recorded on site are generally of a modified and intensively managed nature, reducing the likelihood of notable plant species being present.

The desk-based assessment identified the presence of one plant species listed as endangered on the Flora (Protection) Order, 1999 within one of the 2km grid squares covering the study area (W34V); this is Pennyroyal *Mentha pulegium* (NBDC, 2014). This species tends to inhabit bare sandy ground by ponds and on commons (Rose, 2006), and also inundated grassland overlying silt and clay (Botanical Society of Britain and Ireland (BSBI) et al., 2014). Given the modified and relatively intensively managed habitats present within the works areas, they are considered to provide sub-optimal habitat for this plant species. Furthermore, O'Mahony (2001; 2006) report that the location of this species is in a tiny area of roadside amenity grassland bordering the western side of Clonakilty Harbour, near the Model Railway Village; this area is therefore outside the site of works and this species will not be impacted upon.

9.3.3 Birds

A considerable amount of data regarding bird populations within the study area was collected as part of the desk-based assessment, including from the NBDC and the NPWS Waterbird Survey Programme 2010/11 (Cummins and Crowe, 2011).

Table 9-6 provides details of those species within the study area, identified from the NBDC. This shows that the study area supports a number of notable species, in particular wetland birds in association with Clonakilty Bay.