



Comhairle Contae an Chláir
Clare County Council

ENNIS SOUTH FLOOD RELIEF SCHEME

APPLICATION FOR APPROVAL IN ACCORDANCE WITH SECTION
177AE OF PLANNING AND DEVELOPMENT ACT 2000 - 2010

August 2012

Clare County Council
Áras Contae an Chláir
New Road
Ennis
CO. CLARE

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Client	Clare County Council
Project No.	2188
Project Title	Ennis South Flood Relief Scheme
Report Title	Application for Approval in accordance with Section 177AE of the Planning and Development Act 2000 - 2010

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
0	Issue to Client	R. Kiely	C. Lyons	M Joyce	16 Aug 2012
1	Minor Changes	R. Kiely	C. Lyons	M Joyce	22 Aug 2012



Comhairle Contae an Chláir Clare County Council

1.0 Introduction

2.0 Planning and Development Requirements

3.0 Nature and Extent of Proposed Scheme

4.0 Description of Potential Ecological and Archaeological Impacts

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1.0 INTRODUCTION

The objective of the Ennis South Flood Relief Scheme is to alleviate flooding in two catchments located in South Ennis, namely, the Ballybeg Lough sub-catchment and the Flannan's Stream sub-catchment. It is proposed to construct flood overflow culverts from each of these sub-catchments to the River Fergus in order to formalise the existing situation that occurs during flood events, whereby floodwaters flow overland (generally by road) through the southern suburbs of Ennis town to the Clareabbey floodplain at Clareabbey, Ennis, Co. Clare. It is also proposed that the existing flood defence embankment along the River Fergus in the Clare Abbey Flood Plain will be upgraded to increase the height of defence and as a result widen and strengthen the embankment. Two existing sluices from the floodplain to the river will be replaced and an additional sluice is proposed to provide for increased efficiency in draining floodwater from the floodplain to the River. It is proposed to construct an emergency flood pumping station in the floodplain that would come into operation in the event of a major flood event that threatens existing infrastructure.

This application for approval is being made in accordance with Section 177AE(3) of the Planning and Development Act 2000 – 2010 which states;

'Where a Natura impact statement has been prepared pursuant to subsection (1), the local authority shall apply to the Board for approval and the provisions of Part XAB shall apply to the carrying out of the appropriate assessment'

This application is being made in accordance with the procedure outlined in Article 249 of the Planning and Development Regulations 2000 (as amended) and Sections 177AE(4)(a) and 177AE(4)(b) of the Planning and Development Act 2000 – 2010.

2.0 NATURE AND EXTENTS OF PROPOSED SCHEME

The main objective of the Ennis South Flood Relief Scheme (referred to hereafter as the Project) is the provision of flood overflow culverts between Ballybeg and St. Flannan's College in the southern suburbs of Ennis town to the Clareabbey floodplain in order to formalise the existing situation that occurs during flood events, whereby floodwaters flow overland (generally by road) through the southern suburbs of Ennis town to the Clareabbey floodplain at Clareabbey, Ennis, Co. Clare. It is also necessary to rehabilitate and raise the existing embankment to reduce the risk of the Lower Fergus River from entering the flood plain while increasing the capacity of the system to drain flood waters.

The proposed works comprise of the following:

- Provision of 2 No. 1,200mm internal diameter concrete flood overflow culverts, 1,135m and 310m in length, respectively, mainly in road and road verge. 210m of open drain will also be constructed to convey the flood waters from the overflow culvert at Ballybeg.
- Raising and widening (required to facilitate the increase in height) of the existing flood defence earthen embankment over a length of 2.7km on the landward side of the existing embankment.
- Re-aligning where required, of the existing associated flood defence embankment backdrain (man-made) located on the landward side of the existing embankment.
- Replacement of 2 No. existing malfunctioning sluices and the construction of 1 No. additional sluice from the backdrain to the River Fergus on the riverside of the existing embankment at 3 No. discrete locations on the riverbank.
- Construction of an emergency pumping platform to facilitate the pumping of flood water from the Clare Abbey flood plain to the River Fergus, if required in an emergency situation.

2.1 St. Flannan's Flood Overflow Culvert

The Flannans Stream, which has a catchment of less than 5km², upstream of the college, drains to a sink or swallow-hole located at the edge of the college sports field. The swallow hole has been proven (by KT Cullen as part of the Ennis Main Drainage Report) to be connected to springs located 880m east at Toberteascain via an underground karst conduit system. When the capacity of this underground system is exceeded the Flannans Stream backs up and begins to flood the lands in the vicinity of the swallow-hole. Flooding around the swallow hole at Saint Flannans is reported to be a regular event, occurring following prolonged wet spells and generally in winter when groundwater levels are high.

It was subsequently recommended in the "Flood Alleviation Feasibility Report St. Flannan's (Edenvale) Stream, Ennis, Co. Clare." (Hydro-Environmental,2010) that a flood overflow culvert be constructed from the swallow hole at St. Flannan's College to the Clareabbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the suburbs of Ennis town to the floodplain at Clareabbey, through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters over an overflow weir to a dedicated overflow culvert which will cross St. Flannans grounds and follow St Flannans Drive, across the Limerick Road and down Toberteascain road to the Clare Abbey Flood Plain area where it will

discharge to the existing back-drain channels. Works required include the construction of a concrete overflow weir structure adjacent to the swallow-hole, laying 1,135m of 1200mm diameter culvert, and the construction of associated manholes and chambers. A number of these manholes will be watertight as the proposed culvert will be pressurised during design flood conditions. A crossing under the Ennis Railway line will also be required. Drawing 101/BP shows the route of the proposed flood overflow culvert. A headwall is required at the outfall of the culvert to the drain in the floodplain. This headwall will reduce the risk of erosion of the ground at this outfall.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 8.0mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment.

It is noted that this culvert is solely for the purpose of conveying floodwater from the area around the swallow hole and will not come into operation until the groundwater capacity has been exceeded to such a level that it threatens to flood property and road infrastructure.

Due to the design flood level and topography of the proposed route, this culvert will operate as a pressurised system under design conditions. Therefore, it will not be possible to connect any surface water drainage systems to this proposed culvert as doing so could result in flood waters backing up through the surface water drainage system into properties.

Details of the works proposed as part of the St. Flannans flood overflow culvert are shown on Drawings 101/BP to 104/BP in Appendix A.

2.2 Ballybeg Flood Overflow Culvert

The Ballybeg Stream is a small stream which outfalls from Ballybeg Lough and disappears underground via a swallow hole in the rear garden of a private dwelling, 100m south of the Limerick Road between Ennis town and Clarecastle town. The stream re-emerges on the far side of the N85 road some 380m away. The swallow-hole has limited capacity which may have deteriorated in recent years, resulting in flood levels surcharging upstream of it and inundating surrounding properties and roads. Extreme flooding has occurred in this area in 1995, 1999 and in November 2009. The nature of the system is such that flooding can prevail for many weeks with roads and house entrances cut off. The November 2009 event saw the most dramatic flooding of recent history with the Ballybeg stream backing up and inundating large areas of agricultural land and private properties. Two properties were flooded and a further 12 dwellings saw flood waters reaching the driveway and footpath surrounding their houses. A peak flood level of 4.3mO.D. at the swallow-hole rising to 4.45m O.D. immediately upstream of the Ballybeg Road culvert was observed.

It was recommended in the report "Ballybeg Stream Limerick Road, Ennis - Proposed Flood Relief Scheme" (Hydro-Environmental, 2010) that a flood overflow culvert be constructed from the swallow hole in Ballybeg to the Clareabbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters over an overflow weir to a

dedicated flood overflow culvert which will convey the floodwaters from the Ballybeg Stream to the culvert under the N85 which drains to the Clare Abbey floodplain. This proposed overflow structure is located in the townland of Ballybeg, adjacent to the Ballybeg Stream and just downstream of the bridge on the R475 road. Its function is to divert flow from the Ballybeg Stream to a proposed 1200mm overflow culvert once the water level in the stream reaches a height of 3.20mOD. The total length of the proposed flood overflow culvert is 310m, with an additional 210m of proposed open drain. This open drain is proposed due to the flat nature of the proposed culvert route. Details of the proposed flood overflow culvert and open drain, associated overflow weir and headwall are described in Drawing No. 105/BP and 108/BP in Appendix A.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 3.2mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment.

2.3 Upgrading of the Existing Flood Defence Embankment

The existing flood defence earthen embankment was constructed in the 1950's and runs from the Quin Road to the tidal barrage at Clarecastle. It is 2.7km in length and has an existing crest level ranging from 2.23mOD to 4.23mOD. The width of the existing embankment ranges from 1.5m to 2.5m, with a backdrain running parallel to the embankment on the landward side which facilitates drainage from the Clareabbey floodplain to the river through the existing sluices. Over the years, the existing flood defence earthen embankment has reduced in height due to settlement. Some of the existing sluices are not providing the non-return function for which they were designed, which is allowing water from the River Fergus to pass under the existing embankment into the flood plain at high tide.

The main aim of the proposed embankment rehabilitation works is to raise the crest level of the existing embankment where it has settled and to replace the existing malfunctioning sluices with new sluices fitted with non-return valves.

It is proposed to increase the crest level of this embankment to 4.0mOD which includes an allowance for potential future embankment settlement. Because the existing level of the embankment is being raised, the width of the embankment will also have to increase to provide stability. All of this increase in the width of the embankment footprint will take place to the landward side of the existing embankment. The side slopes of the embankment will be constructed at a slope of 1:2.5 which will result in the embankment footprint increasing on the landward side throughout the 2.74km length. The finished footprint of the proposed embankment will be 4.1hA, representing a 1.9hA increase on the existing footprint of 2.2hA.

As the embankment footprint will increase, the existing manmade backdrain on the landward side of the existing embankment will have to be realigned to accommodate the increase in the embankment footprint, which will encroach on the footprint of the existing backdrain. The proposed backdrain works are described in Section 3.4 below.

The proposed embankment profile will be formed by placing imported cohesive material on the crest and the landward side of the existing embankment to form a consistent cross-section along the length of the embankment. Typical cross-sections, shown on Drawings 113/BP to 115/BP (see Appendix A),

show how the existing embankment will be integrated into the proposed embankment. In order to reduce seepage through the proposed embankment, cohesive material will be used to form the proposed embankment cross-section. A sustainability assessment has been carried out to determine whether material excavated for the backdrain (discussed below) would be suitable for re-use in the proposed embankment. It has been determined, however, that the existing material on site is unsuitable for this purpose and therefore, the cohesive material required will have to be sourced elsewhere. It will be the responsibility of the Contractor appointed to construct the scheme to source this material, subject to the appropriate permissions and permits being in place. The volume of cohesive material that will need to be imported is 65,000m³.

In order to minimise the risk of erosion from water and wind action, a geo-grid will be placed over the entire embankment profile and the embankment will be planted with suitable vegetation.

Due to space constraints at the riverbank under the N85 road bridge, it will not be possible to upgrade the existing embankment at this location. Along this section, a flood wall will need to be constructed on the landward side of the existing embankment. Due to the ground conditions in this area, it is likely that the wall will need to be sheet-piled. The flood wall is required over a length of 80m and will have a crest height of 3.7mOD, the same crest level as the proposed embankment.

No embankment works are proposed on the river channel itself. The closest point of the existing flood defence earthen embankment to the river channel is 3.0-4.0m and on average 10m and all embankment improvement works will be carried out from the landward side of the existing embankment.

See Drawings 111/BP and 115/BP of the planning drawings in Appendix A for details of the proposed embankment upgrade.

2.4 Proposed Backdrain Works

A manmade backdrain is located on the landward side of the existing embankment along the majority of the length of the existing embankment. The purpose of the backdrain is to collect water from the floodplain and direct it to the sluice locations to discharge to the River Fergus when the water levels allow. It also collects runoff from the landward slope of the embankment itself.

The proposed increase to the footprint of the embankment is such that the toe of the proposed embankment will encroach on the footprint of the existing embankment along all but approximately 1km of the length of the embankment. For this reason, the existing backdrain will need to be infilled over approximately 1.75km of its length. The total area of the existing manmade backdrain affected is 0.53hA.

A new backdrain will be excavated on the landward side of the proposed embankment to facilitate the discharge of floodwaters to the river via the sluices as is currently the case (described in Section 3.5 below). The new backdrain will have a similar capacity to the existing backdrain. The volume of material to be excavated to form the new backdrains will be approximately 11,000m³. This excavated material will be re-used where suitable in the formation of a berm on the landward side of the new embankment along certain sections of the proposed embankment as shown on the cross-

sections.

For geotechnical reasons, it will not be possible to construct a new backdrain along a 350m length of embankment located between Section 21 and 29 (see Drawing No.111/BP) as it could lead to destabilisation of the proposed embankment. An infiltration trench constructed using granular material and porous pipe will be constructed on the landward side of this section of embankment in lieu of the existing backdrain. The volume of imported granular material required will be approximately 11,000m³.

Details of the proposed backdrain works are shown on the proposed embankment cross-sections on Drawing Nos. 113/BP, 114/BP and 115/BP in Appendix A.

2.5 Proposed Sluice Works

There are 5 no. existing sluices located along the existing embankment between the Quin Road and the tidal barrage at Clarecastle. The existing sluices are generally 600mm diameter pipes fitted with a flap gate on the outlet at the riverbank. These existing sluices do not function properly as the capacity of the pipe through the embankment is too small to allow the backdrain to discharge to the river efficiently and the flap gates are malfunctioning allowing the River Fergus to flow into the floodplain during high water levels in the river.

Existing Sluice Gate No. 1, located in the vicinity of the Quin Road Business Park at the northern end of the embankment, has been installed in recent years and appears to be functioning adequately. No works are proposed at this location.

Existing Sluice No.2 is located between Sluice No.1 and the N85 road. This sluice does not have sufficient discharge capacity, is leaking and has caused the adjacent bank to erode. It is therefore proposed to replace Sluice No. 2 with a new sluice at the same location. The existing pipework and flap gate will be removed and a 2 No. new 900mm diameter pipes will be constructed through the proposed embankment at the same location. A headwall will be constructed on both the landward and the riverside of the embankment to reduce the risk of erosion in the vicinity of the pipeline. The outlet ends of the new pipelines will be fitted with non-return valves. These non-return valves will be of the duckbill valve type, an example of which would be the proprietary "tideflex" valve. This type of valve is much less prone to malfunction than the existing flap gates which allow the river to enter the floodplain via the sluices.

Similar to Sluice No. 2, existing Sluice No.3 needs to be replaced with 2 No. new 900mm diameter pipes fitted with non-return duckbill valves at the same location as the existing sluice. Headwalls will also be required as per proposed Sluice No.2.

The existing Sluice No.4 was installed recently and appears to be functioning adequately. It is not proposed to carry out any sluice works at this location.

There is currently no sluice provided to the section of floodplain between the N85 bridge and the railway line that traverses the floodplain and it is therefore proposed to construct a new sluice just upstream of the railway line. This new sluice, Sluice No.5, will consist of a 900mm diameter pipe which will be constructed through the embankment, and will terminate in a non-return duckbill type valve. A

headwall will be required on either side of the embankment.

Existing Sluice No.6 is located at the downstream end of the existing embankment. This sluice appears to be functioning adequately and it is not proposed to carry out any works to the sluice at this location.

In summary, works are required at the location of the existing Sluice No.2 and Sluice No.3 and at the location of the proposed Sluice No.5. The works proposed at these three discrete locations are the only works pertaining to the project that are required on the riverside of the existing embankment. The works at these three locations will be minor in nature and all concrete components ie. pipes and headwalls will be pre-cast. The non-return valves will be fitted inside of the downstream end of the pipes. An access chamber will be provided on the landward side of the embankment at each sluice where works are required, to facilitate future valve maintenance, without needing to access the riverbank. The locations of the proposed sluice works and a typical detail of the sluice is provided in Drawing No. 116/BP of Appendix A.

2.6 Emergency Pumping Station

It was recommended in the report entitled “Clare Abbey Flood Plain River Embankments Upgrade Works Feasibility Study” (Hydro Environmental Ltd, 2010c) that infrastructure be put in place to facilitate the installation of emergency over-pumping from the back drains / flood plain during extreme flood events when free discharge through the sluice gates from the Clare-Abbey flood plain is prevented. It is therefore proposed to construct an emergency pumping station in the vicinity of the proposed embankment upgrade.

The emergency pumping station will consist of a reinforced concrete overflow sump and provision for the installation of axial flow pumps at times of exceptional flood. The overflow will divert flood water from the backdrain to the pumping station once the level reaches 2.2mOD. The existing ground level in the Clareabbey floodplain typically varies from approximately 1m OD to 1.5m OD.

The water level at which the pumps would come into operation is set so that pumping can be initiated only at the level at which the flood waters threaten to inundate infrastructure and property. The pumping station will not be brought into operation during normal winter flooding. It is intended that the pumping station would only be brought into operation in a flood event of similar or larger magnitude to the event of November 2009. During the normal course of events, the pumps will not be installed in the pumping station; rather pumps will only be installed at times of potential flood risk. It is noted that during previous flood events, including November 2009, temporary pumps had to be brought into operation to reduce the risk to property and infrastructure. This situation is not sustainable, due to the health and safety risk to personnel installing and operating temporary pumps during high water levels and the difficulty with sourcing pumps due to demand during such events.

In the event that the flood level in the floodplain starts to exceed 2.2mOD, 2 No. axial flow pumps, with a combined capacity of 3m³/sec, will pump the water from the pump sump into the River Fergus, making it possible to begin draining the flood plain before the river recedes to such a level to allow the sluice drains to become operational.

The construction of this pumping station will not result in any in-stream works, with the aforementioned pumps discharging onto a proposed rock armour apron to be constructed on the flood defence embankment.

3.0 DESCRIPTION OF POTENTIAL ECOLOGICAL & ARCHAEOLOGICAL IMPACTS

3.1 Potential Ecological Impacts

The upgrading of the existing flood defence embankment involves construction work within and adjacent to the Lower River Shannon Special Area of Conservation (Site Code 002165) and 250m upstream of the River Fergus Estuaries Special Protection Area (Site Code 004077). A Natura Impact Statement has been prepared in relation to the proposed development and is included in Appendix C.

Overall, it is not predicted that the favourable conservation status of the Qualifying Interests of the SAC and the Special Conservation Interests of the SPA or the *integrity* of the Lower River Shannon cSAC or the River Shannon and River Fergus SPA would be significantly effected by the proposed Ennis South Flood Relief Scheme taking cognisance of the avoidance and standard mitigation measures proposed

3.2 Potential Archaeological Impacts

There are a total of ten previously recorded sites/monuments of archaeological interest identified with the general area of the overall proposed scheme. An Archaeological Impact Assessment has been carried out and is included in Appendix D.

The Archaeological Impact Assessment concludes that proposed works are not being carried out in the immediate environs of Clare Abbey, or other monuments and as such, no adverse impacts are predicted. A mitigation strategy has been proposed which includes for supervision of the works by a licensed archaeologist.

Appendix A
Planning Drawings
(Bound Separately)



CLARE COUNTY COUNCIL

ENNIS SOUTH FLOOD RELIEF SCHEME

PLANNING APPLICATION

PLANNING DRAWINGS

AUGUST 2012

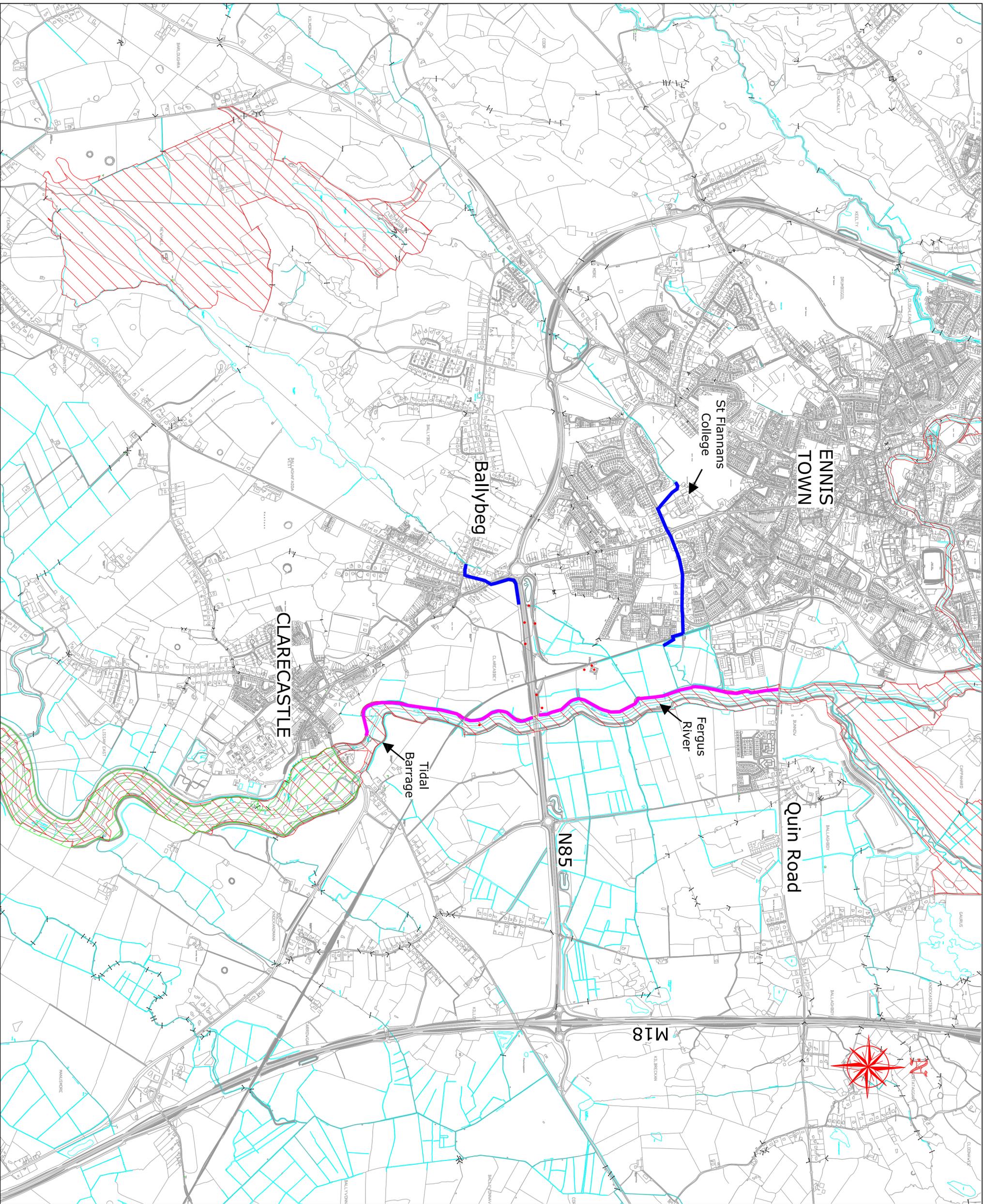
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Ennis,
CO CLARE.

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Taylor's Hill,
GALWAY.

DRAWING INDEX

<u>Dwg. No.</u>	<u>Drawing Title</u>
100/BP	Overall Scheme Location Plan
101/BP	Proposed Overflow Culvert from St. Flannans
102/BP	Plan and Longsec of Proposed St. Flannans Culvert
103/BP	Proposed Overflow Structure at Swallowhole
104/BP	Proposed Outfall Structure on St. Flannans Culvert
105/BP	Proposed Overflow Culvert from Ballybeg
106/BP	Plan and Longsection of Proposed Ballybeg Culvert
107/BP	Proposed Overflow Structure on Ballybeg Stream
108/BP	Proposed Outfall Structure on Ballybeg Culvert
109/BP	Location Plan and Site Plan of Proposed Emergency Pumping Station
110/BP	Plan and Sections of Proposed Emergency Pumping Station
111/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 1 of 2)
112/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 2 of 2)
113/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 1 of 3)
114/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 2 of 3)
115/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 3 of 3)
116/BP	Indicative Sluice Design
117/BP	Site Compound, Access Routes and Extent of Works Area



LEGEND

- Proposed Culvert Route 
- Proposed Embankment Improvement Works 
- Special Area of Conservation 
- Special Protection Area 
- Recorded Monument 

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REV DATE DRN DESCRIPTION CHK APP

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DRAWING STATUS

PRELIMINARY CONTRACT TENDER

FOR YOUR INFORMATION CONSTRUCTION FOR APPROVAL

AS CONSTRUCTED DRAFT

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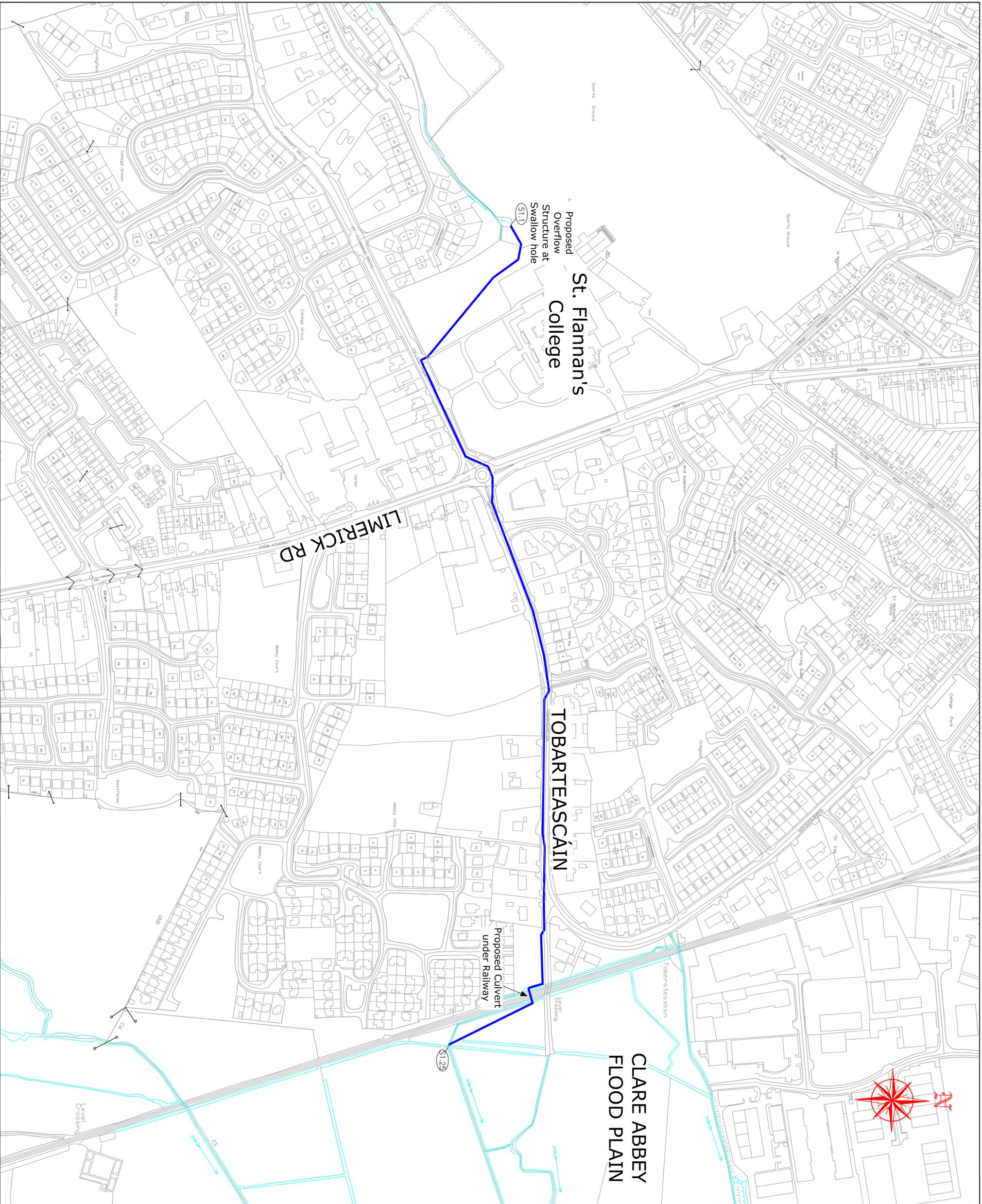
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CLIENT
 CLARE COUNTY COUNCIL

PROJECT
 ENNIS SOUTH FLOOD RELIEF SCHEME -
 PLANNING DRAWINGS

TITLE
 OVERALL SCHEME LOCATION PLAN

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:10,000	AUG 2012	RK	CL	MJ
JOB No.	DRAWING No.			REV.
2188	100/BP			



LEGEND
Proposed Culvert Route

REV	DATE	DRN	DESCRIPTION	CHK	APP
REVISIONS					

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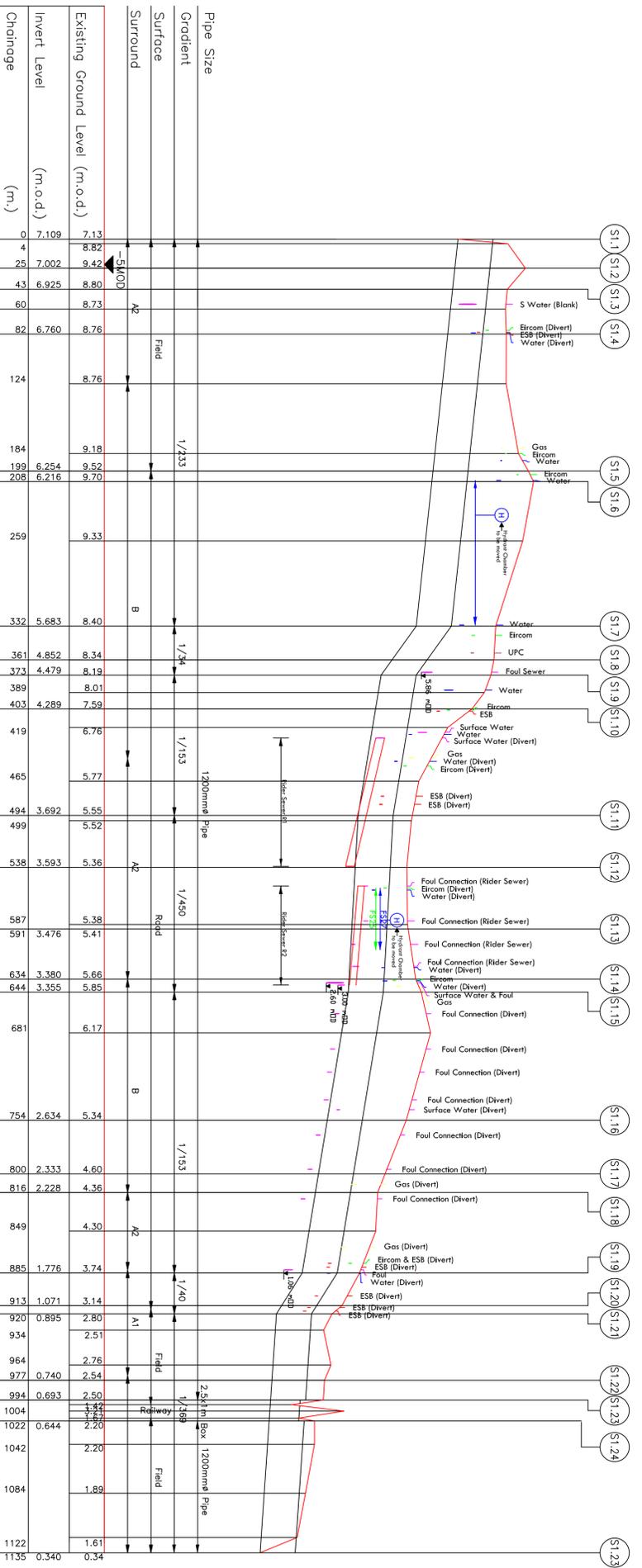
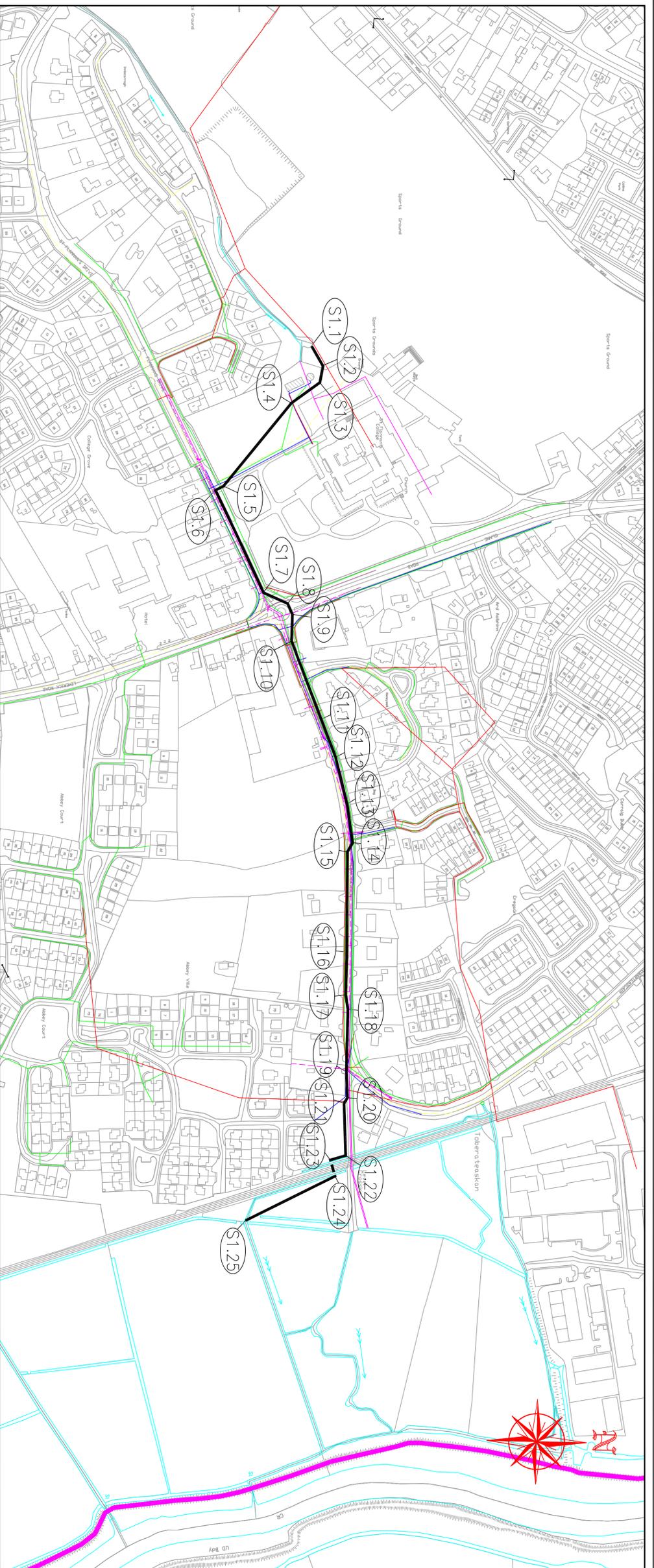
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CLIENT
CLARE COUNTY COUNCIL

PROJECT
**ENNIS SOUTH FLOOD RELIEF SCHEME -
PLANNING DRAWINGS**

TITLE
**PROPOSED OVERFLOW CULVERT FROM
ST. FLANNANS**

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
2:000	AUG 2012	RK	CL	MI
JOB No.	DRAWING No.	REV.		
2188	101/BP			



LEGEND

- Proposed Culvert Route
- Proposed Embankment Improvement Works
- Eircom
- Eircom (FibreOptic)
- Esb
- Gas
- Water
- Surface Water
- Foul
- UPC

THIS CULVERT IS A PRESSURISED SYSTEM UNDER DESIGN CONDITIONS. TO AVOID FLOODING OF PROPERTIES ALONG THE ROUTE, NO SURFACE WATER CONNECTIONS ARE TO BE MADE TO THIS CULVERT.

REV	DATE	DRN	DESCRIPTION	CHK	APP
REVISIONS					

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DRAWING STATUS

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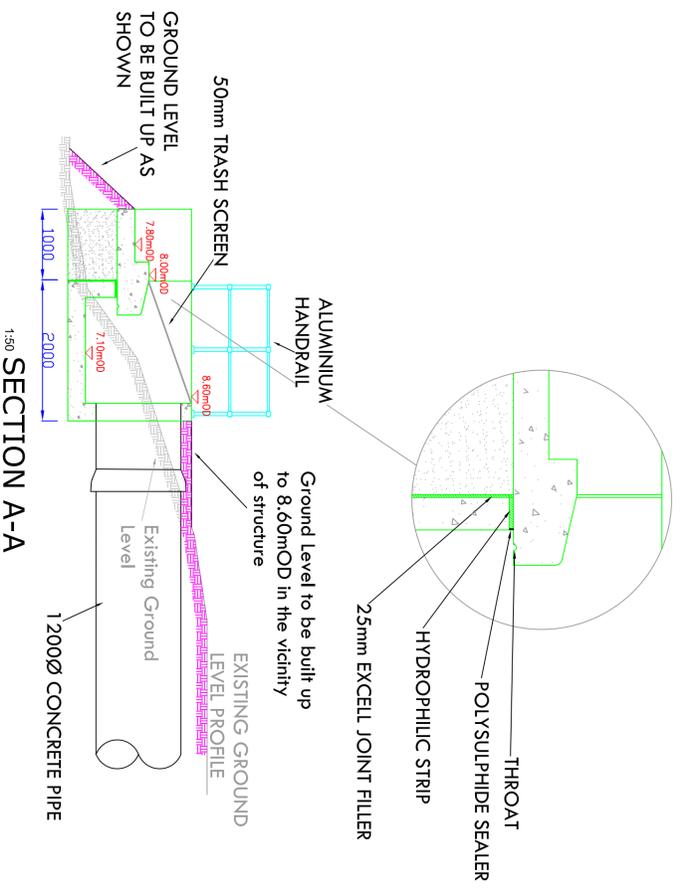
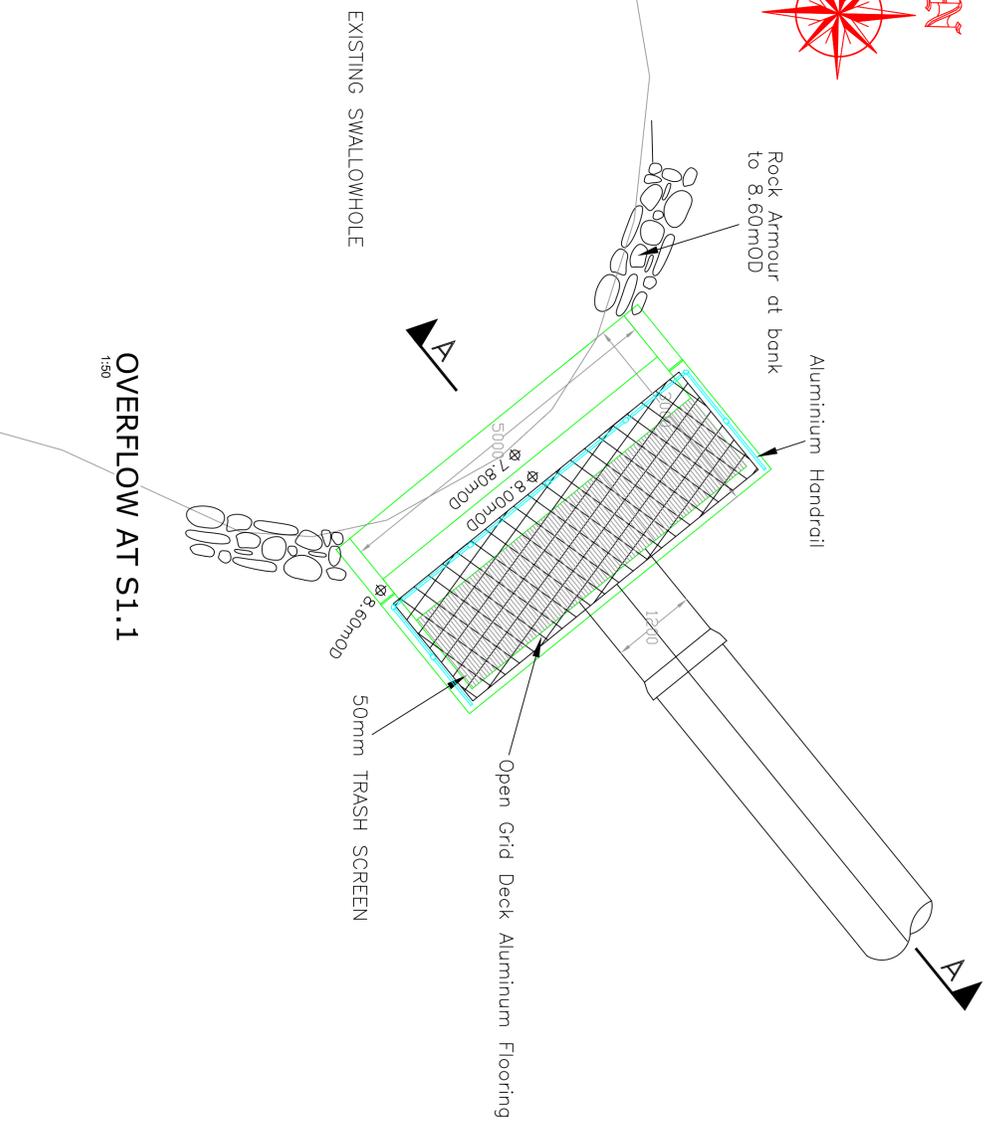
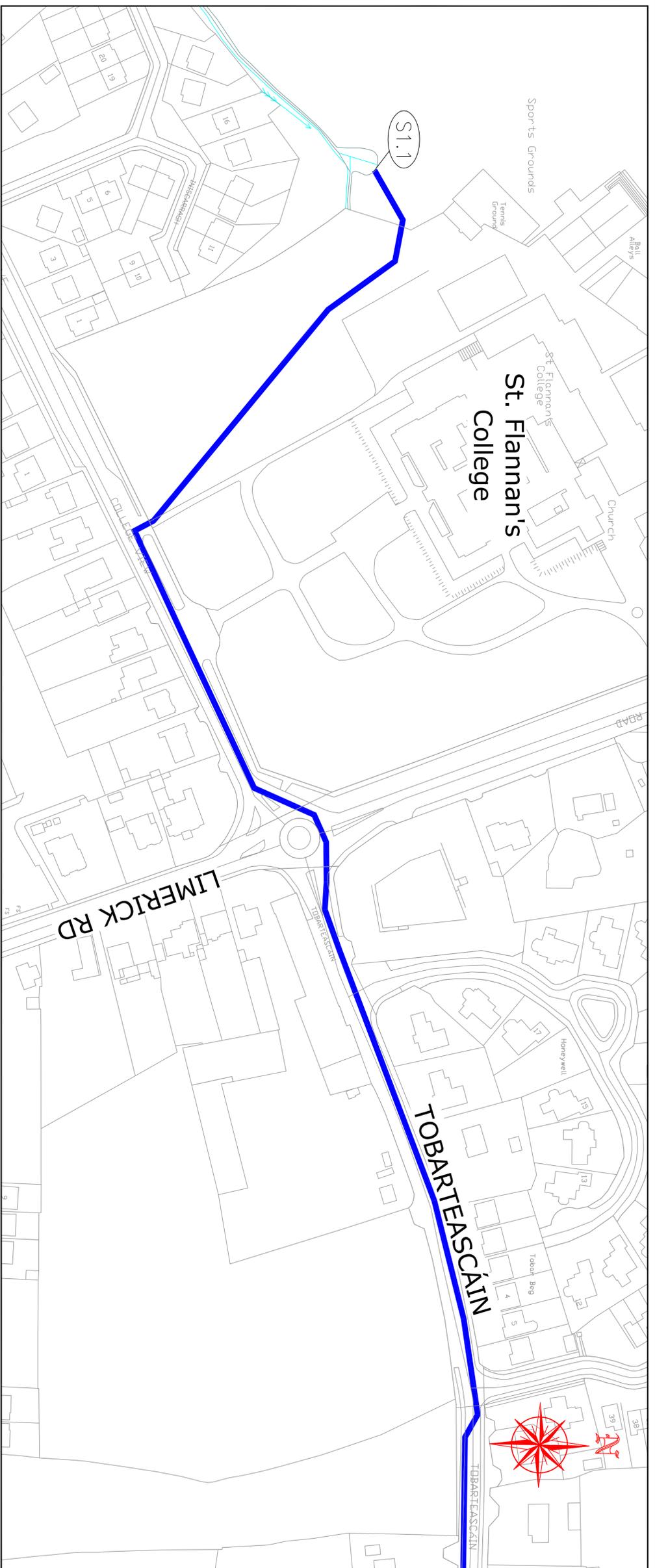
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PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME
PLANNING DRAWINGS

TITLE
PLAN AND LONGSECTION OF
PROPOSED ST. FLANNANS
CULVERT

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:2,500	AUG 2012	RK	CL	MJ
JOB No.	DRAWING No.	REV		
2188	102/BP			



OVERFLOW AT S1.1
1:50

SECTION A-A
1:50

LEGEND
Proposed Culvert Route

REV	DATE	D/N	DESCRIPTION	CHK	APP

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DRAWING STATUS

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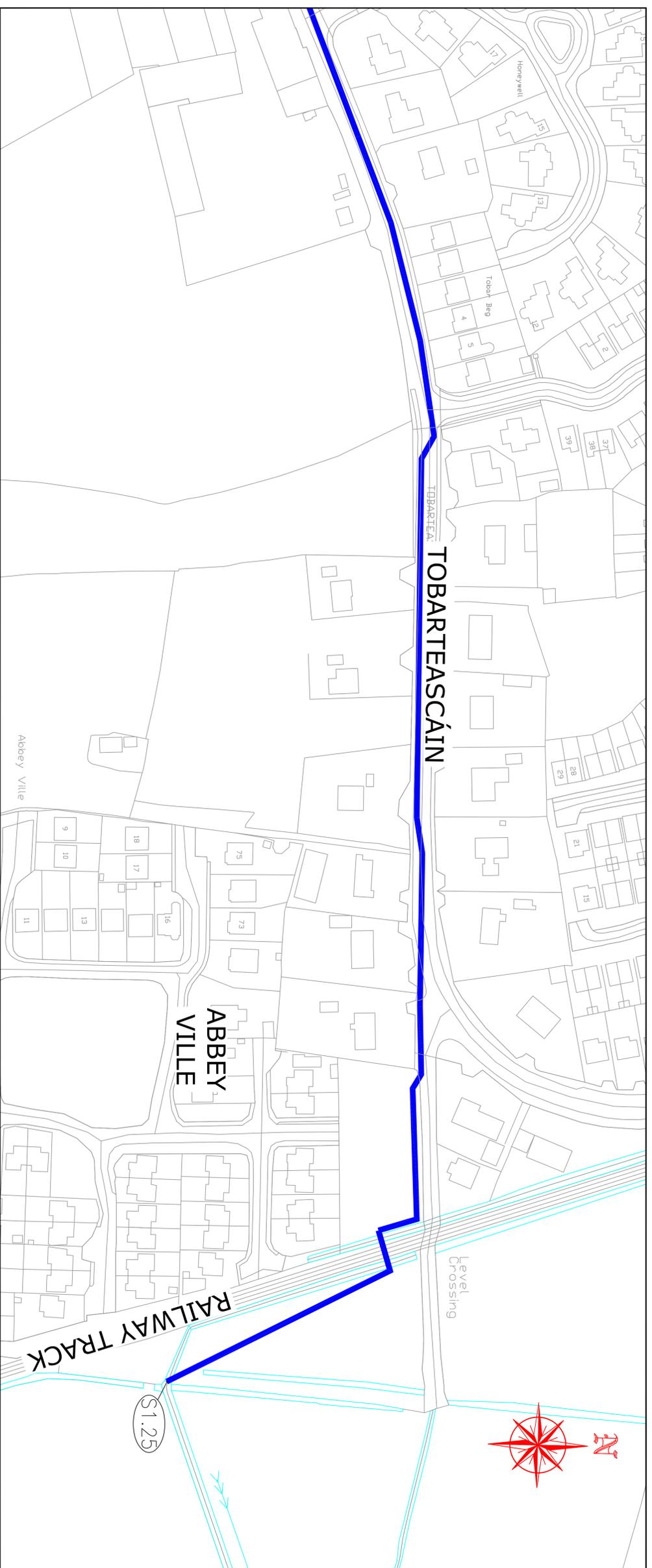
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PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME -
PLANNING DRAWINGS

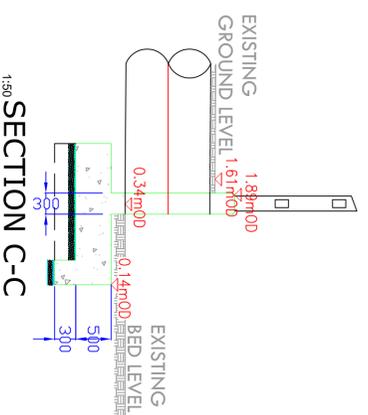
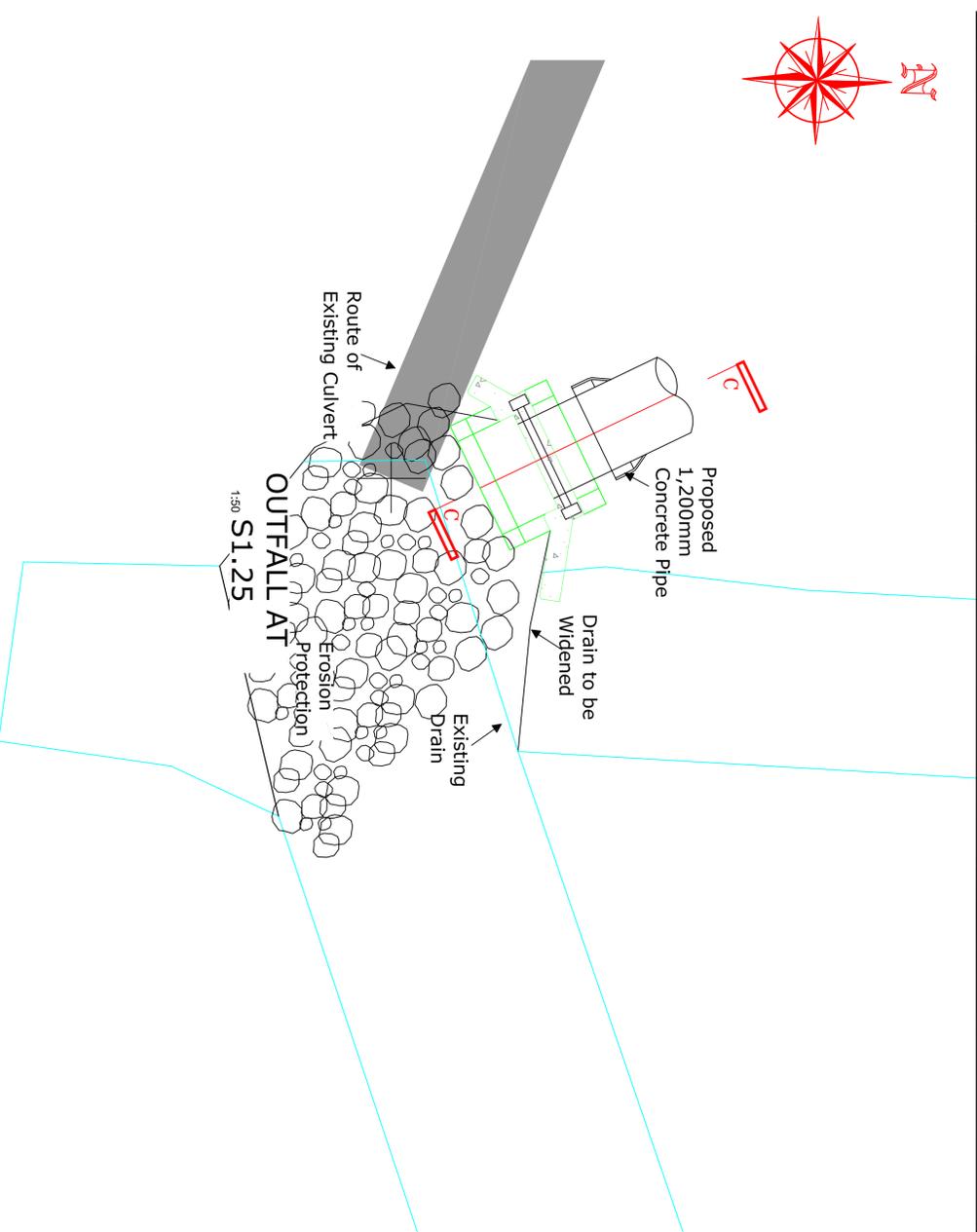
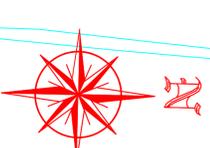
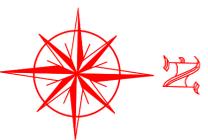
TITLE
PROPOSED OVERFLOW STRUCTURE
AT SWALLOW HOLE

SCALE @/A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	ML

JOB No. **2188** DRAWING No. **103/BP**



LEGEND
Proposed Culvert Route



REV	DATE	DRN	DESCRIPTION	CHK	APP
REVISIONS					

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- PRELIMINARY
 - CONTRACT
 - TENDER
 - PLANNING
 - CONSTRUCTION
 - FOR APPROVAL
 - FOR INFORMATION
 - AS CONSTRUCTED
 - BRIFT

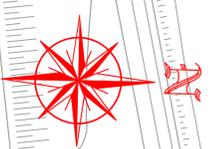
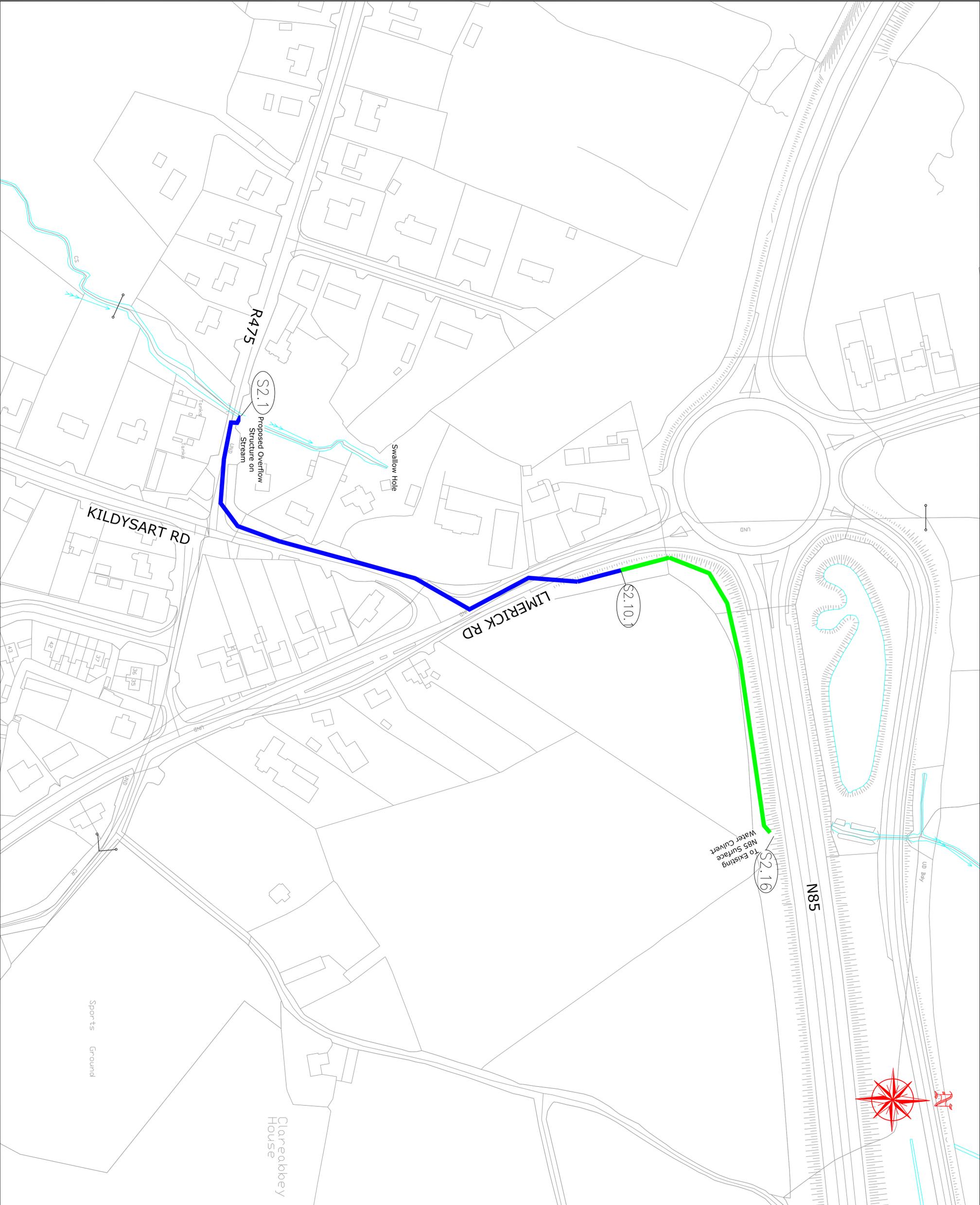
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PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME -
PLANNING DRAWINGS

TITLE
PROPOSED OUTFALL STRUCTURE
ON ST. FLANNANS CULVERT

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	ML
JOB No.	DRAWING No.	REV.		
2188	104/BP			



- LEGEND**
- Proposed Culvert Route —
 - Proposed Open Drain —

REV	DATE	DRN	DESCRIPTION	CHK	APP
REVISIONS					

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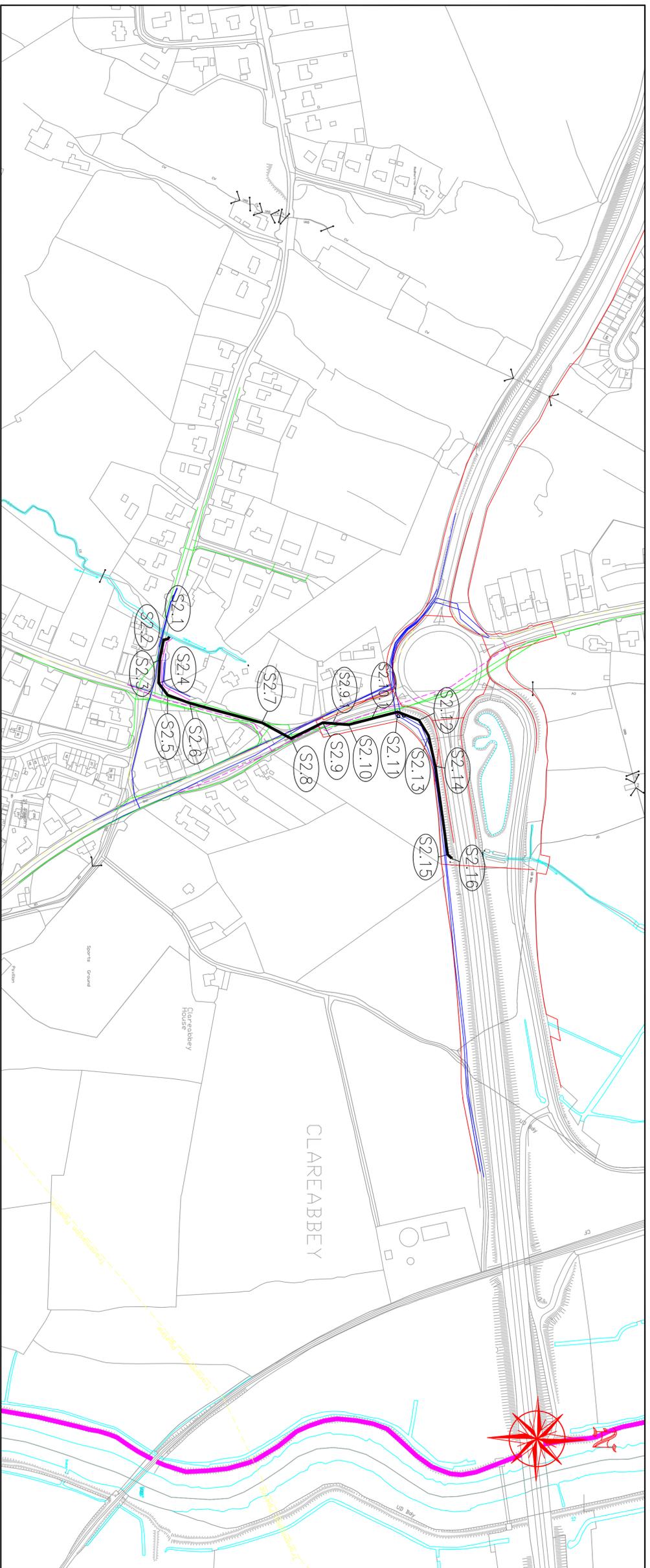
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PROJECT
 ENNIS SOUTH FLOOD RELIEF SCHEME -
 PLANNING DRAWINGS

TITLE
 PROPOSED OVERFLOW
 CULVERT FROM BALLYBEG

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:1,000	AUG 2012	RK	CL	ML
JOB No.	DRAWING No.	REV.		
2188	105/BP			



LEGEND

- Proposed Culvert Route
- Proposed Embankment Improvement Works
- Eircom
- Eircom (Fibreoptic)
- Esb
- Gas
- Water
- Surface Water
- Foul

Station	Chaining (m)	Invert Level (m.o.d.)	Existing Ground Level (m.o.d.)	Notes
S2.1	0	2.600	2.92	
S2.2	28	2.594	4.39	
S2.3	29	2.580	4.97	
S2.4	53	2.563	4.65	
S2.5	72	2.552	4.59	
S2.6	99	2.533	4.38	
S2.7	108	2.479	4.23	
S2.8	126	2.455	4.22	
S2.9	143	2.428	4.24	
S2.10	180	2.409	4.39	
S2.11	216	2.373	3.75	
S2.12	255	2.353	3.40	
S2.13	284	2.341	3.20	
S2.14	310	2.318	3.25	
S2.15	338	2.252	3.49	
S2.16	346	2.250	3.74	

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PROJECT
 ENNIS SOUTH FLOOD RELIEF SCHEME
 PLANNING DRAWINGS

TITLE
 PLAN AND LONGSECTION OF
 PROPOSED BALLYBEG CULVERT

SCALE @ A1: 1:2,500
 DATE: AUG 2012
 DRAWN: RK
 CHECKED: CL
 APPROVED: MJ

JOB No: 2188
 DRAWING No: 106/BP

REVISIONS

REV	DATE	DRN	DESCRIPTION	CHK	APP

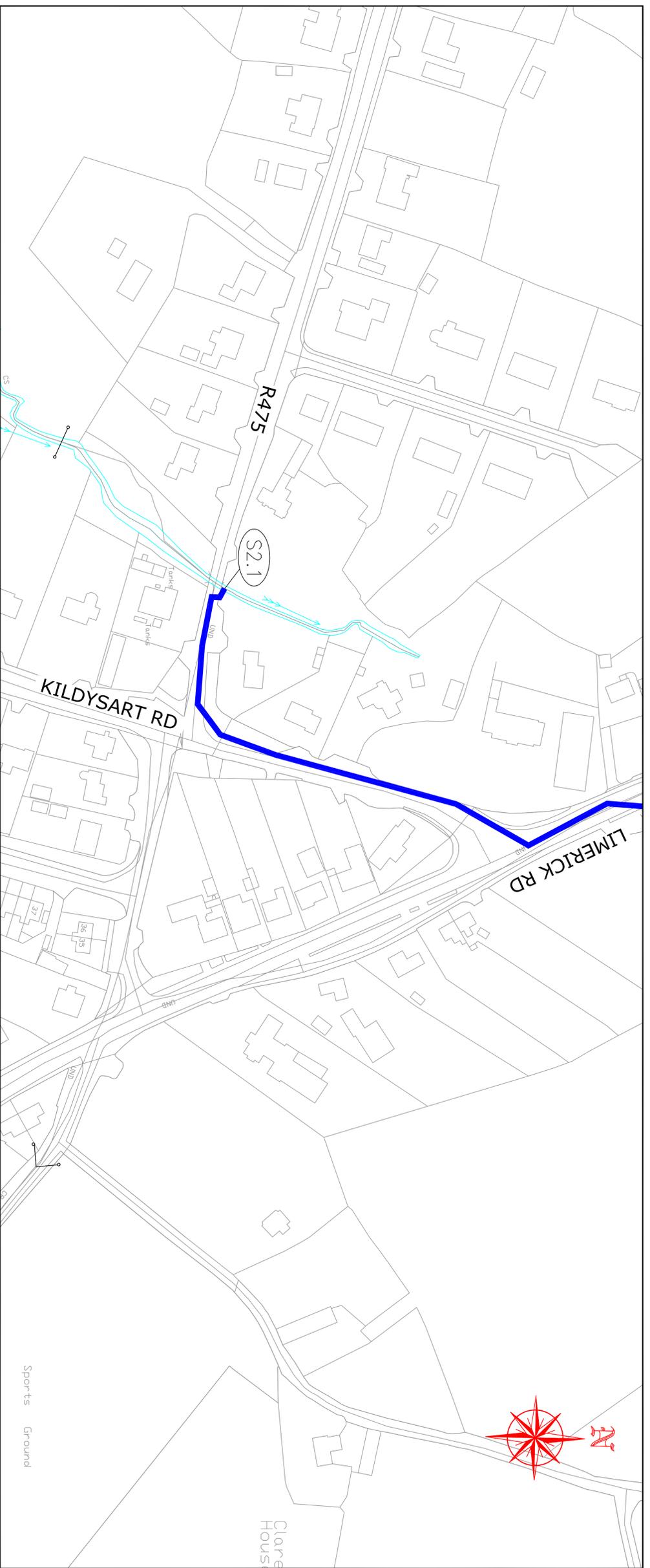
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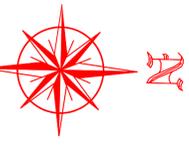
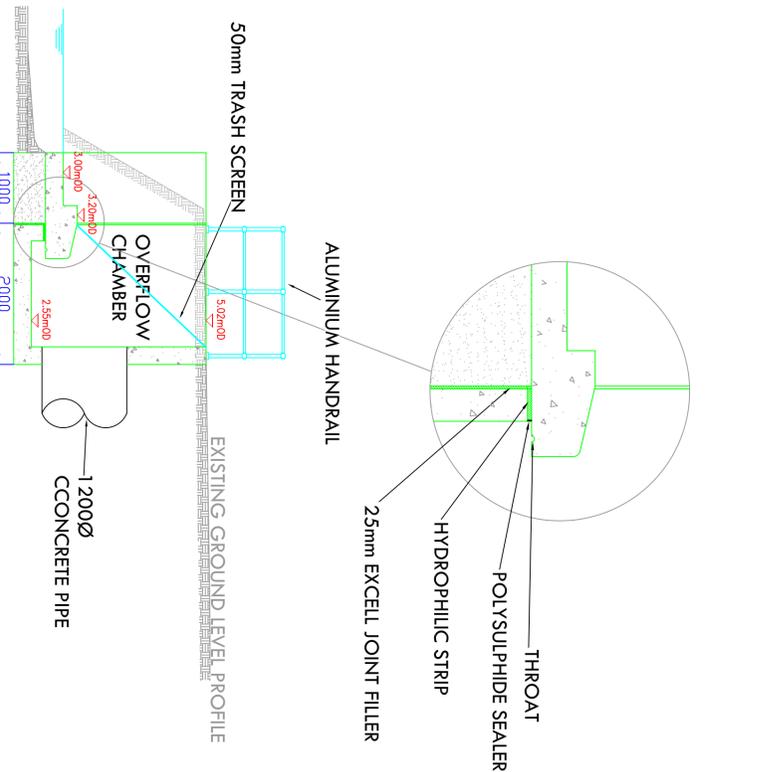
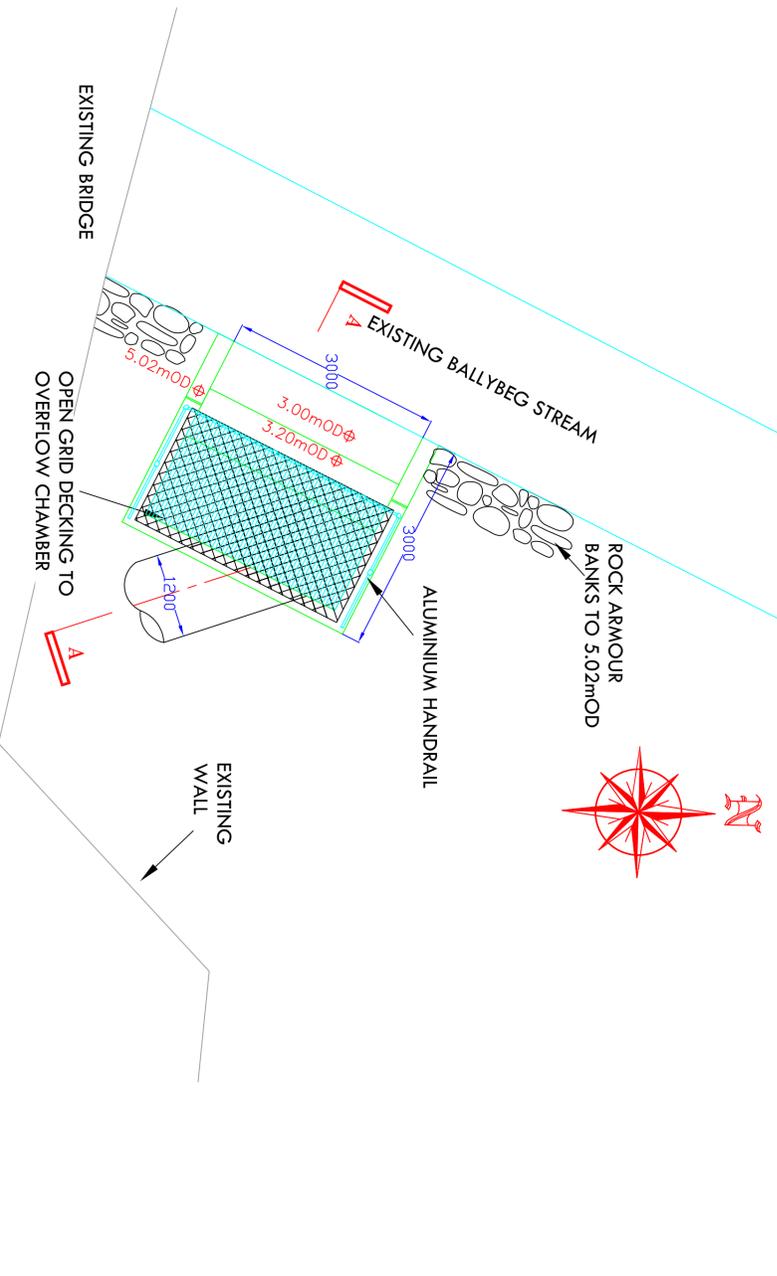
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FOR INFORMATION AS CONSTRUCTED AS BUILT

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LEGEND
Proposed Culvert Route



REV	DATE	DWN	DESCRIPTION	CHK	APP
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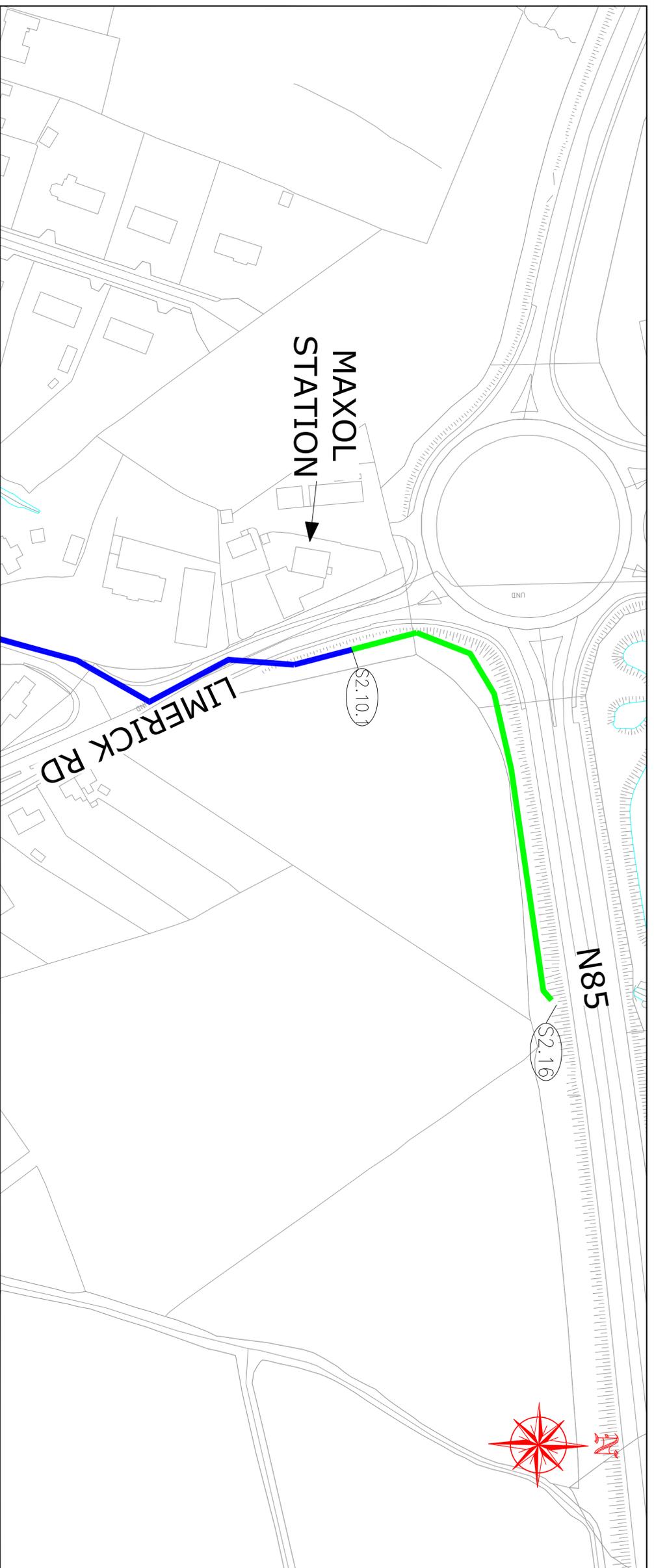
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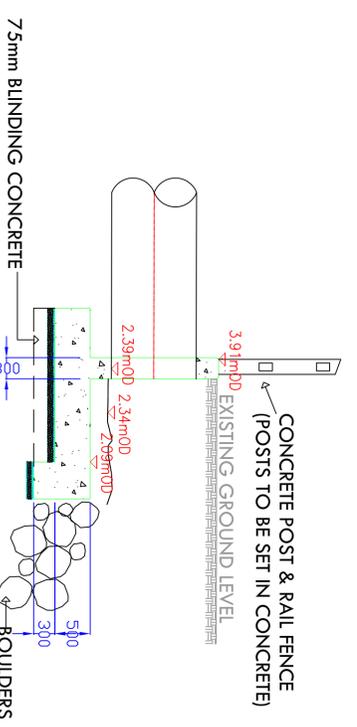
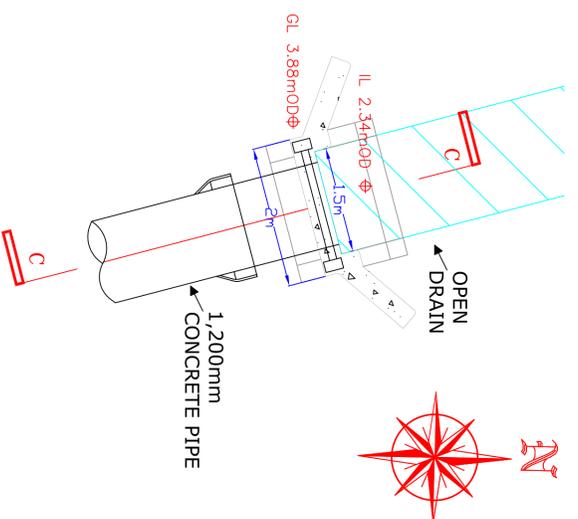
PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME -
PLANNING DRAWINGS

TITLE
PROPOSED OVERFLOW STRUCTURE
ON BALLYBEG STREAM

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	ML
JOB No.	DRAWING No.	REV.		
2188	107/BP			



- LEGEND**
- Proposed Culvert Route
 - Proposed Open Drain



**HEADWALL FOR BALLYBEG
CULVERT AT S2.10.1**

SECTION C-C

REV	DATE	DRN	DESCRIPTION	CHK	APP
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PRELIMINARY CONTRACT TENDER
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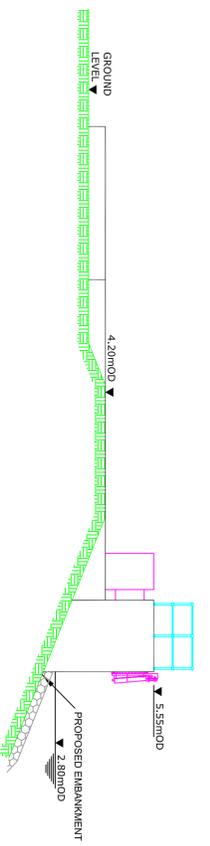
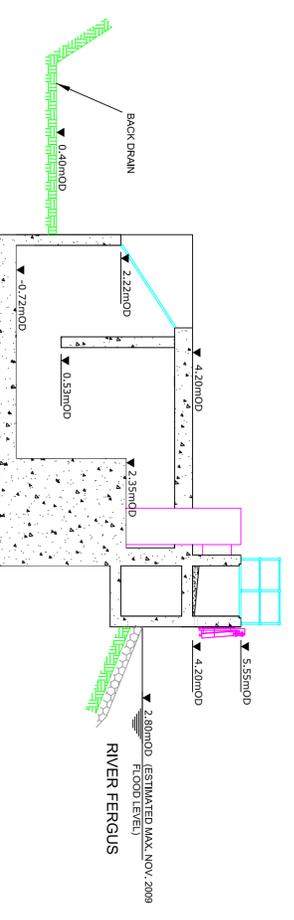
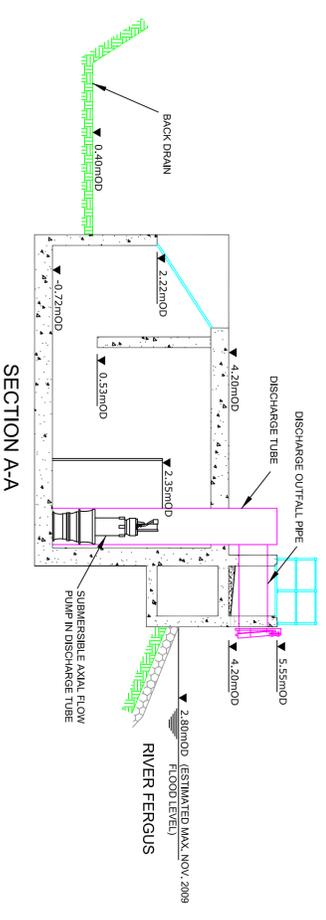
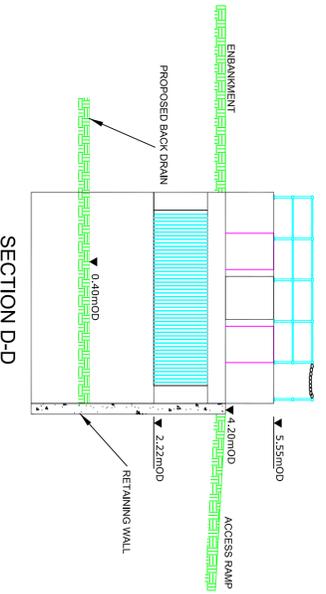
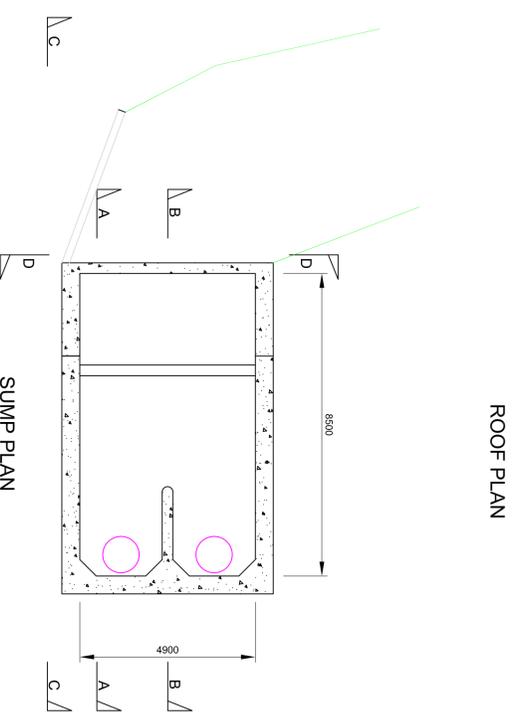
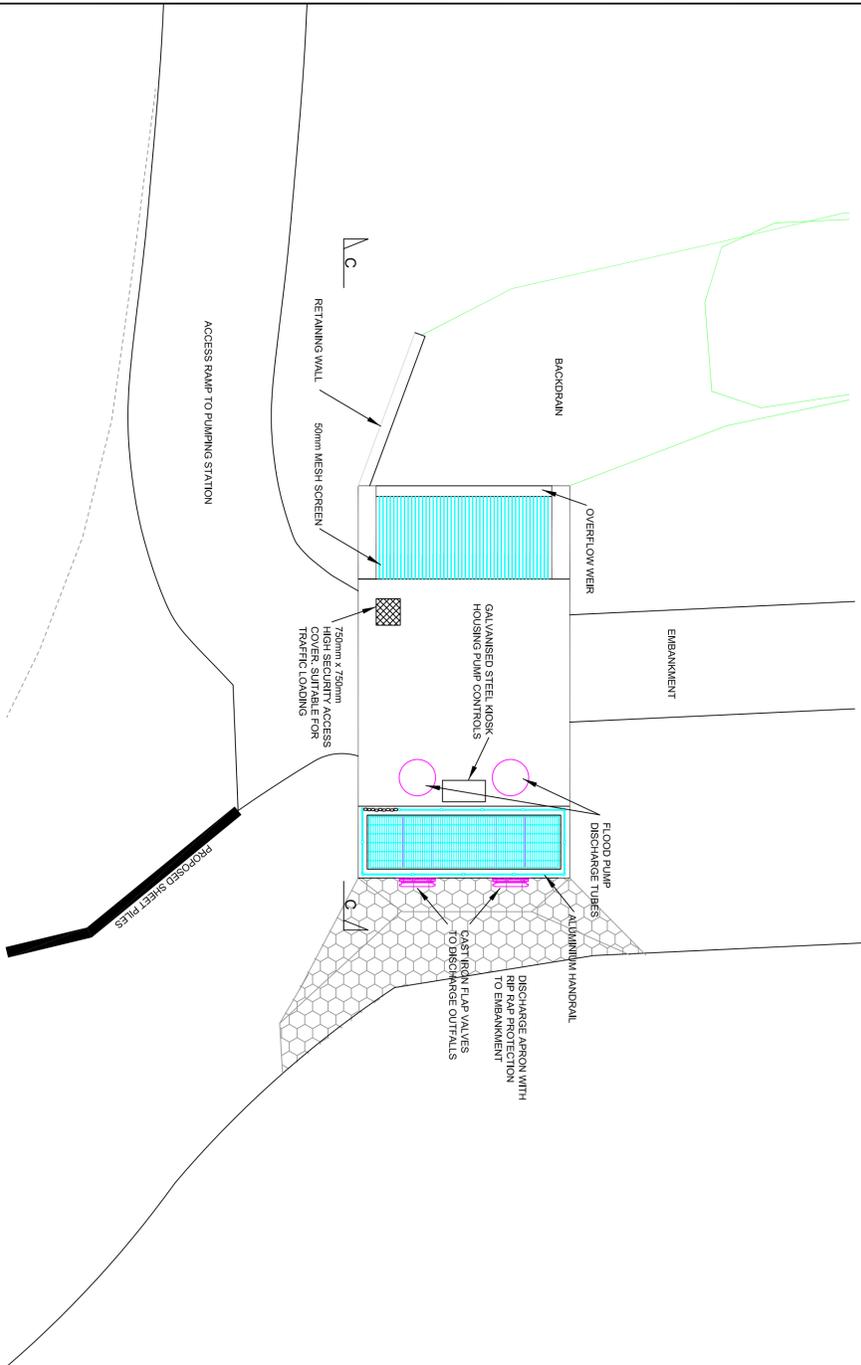
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PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME -
PLANNING DRAWINGS

TITLE
PROPOSED OUTFALL STRUCTURE ON BALLYBEG CULVERT

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	ML

JOB No.	DRAWING No.	REV.
2188	108/BP	



REV	DATE	DN	DESCRIPTION	CHK	APPD
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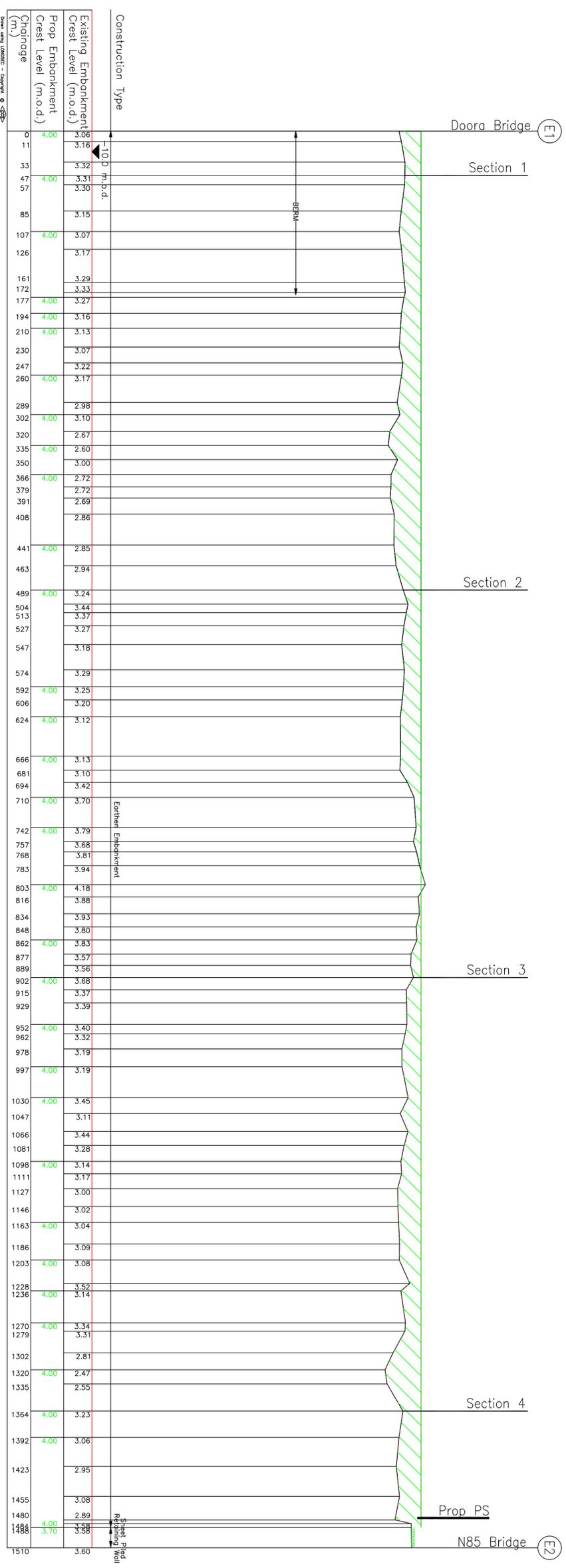
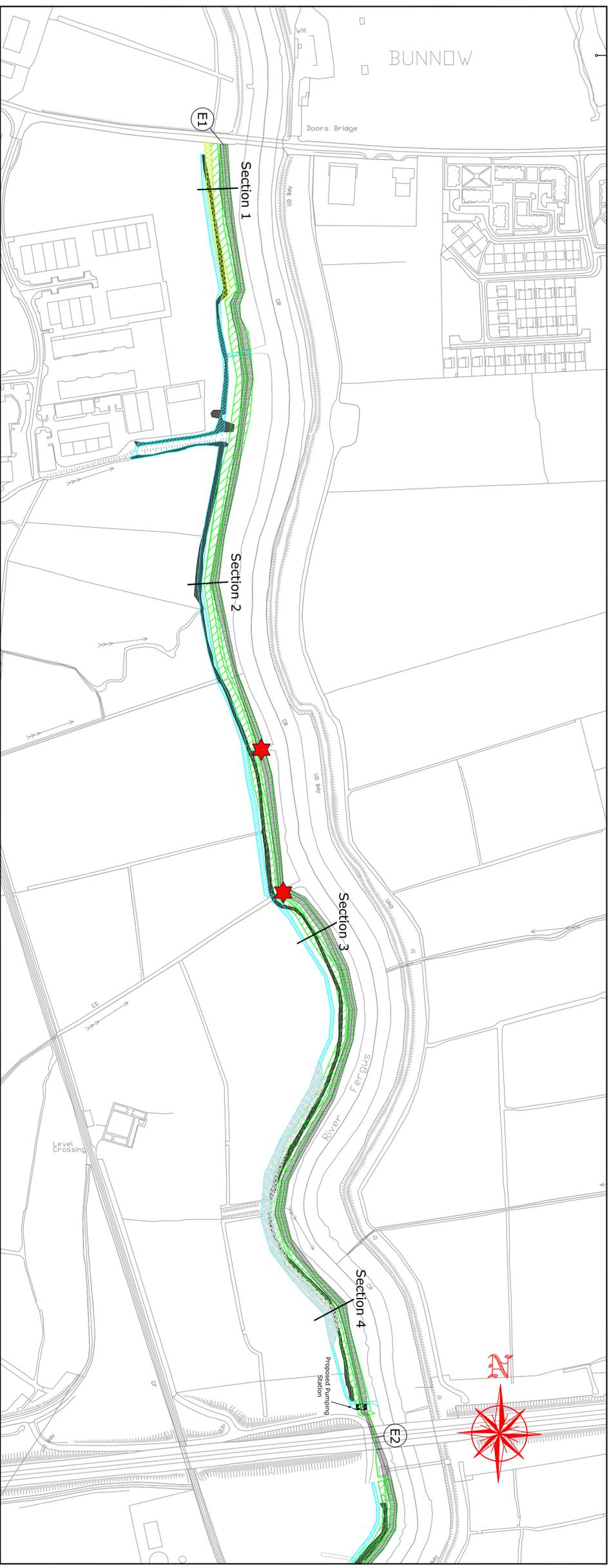
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CLARE COUNTY COUNCIL

PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME - PLANNING DRAWINGS

TITLE
PLANS AND SECTIONS OF PROPOSED EMERGENCY PUMPING STATION

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:100	AUG 2012	SL	CL	MJ
JOB NO.	DRAWING NO.	REV.		
2188	110/BP			



Change (m)	Prop Embankment Crest Level (m.o.d.)	Existing Embankment Crest Level (m.o.d.)	Construction Type
0	4.00	3.06	TOP Proposed
11	4.00	3.16	
33	4.00	3.32	
47	4.00	3.31	
57	4.00	3.30	
85	4.00	3.15	
107	4.00	3.07	
126	4.00	3.17	
161	4.00	3.29	
172	4.00	3.33	
177	4.00	3.27	BERM
194	4.00	3.16	
210	4.00	3.13	
230	4.00	3.07	
247	4.00	3.22	
260	4.00	3.17	
289	4.00	2.98	
302	4.00	3.10	
320	4.00	2.67	
335	4.00	2.60	
350	4.00	3.00	
366	4.00	2.72	
379	4.00	2.72	
391	4.00	2.69	
408	4.00	2.86	
441	4.00	2.85	Earthen Embankment
463	4.00	2.94	
489	4.00	3.24	
504	4.00	3.44	
513	4.00	3.37	
527	4.00	3.27	
547	4.00	3.18	
574	4.00	3.29	
592	4.00	3.25	
606	4.00	3.20	
624	4.00	3.12	
666	4.00	3.13	
681	4.00	3.10	
694	4.00	3.42	
710	4.00	3.70	
742	4.00	3.79	
757	4.00	3.68	
768	4.00	3.81	
783	4.00	3.94	
803	4.00	4.18	
816	4.00	3.88	
834	4.00	3.93	
848	4.00	3.80	
862	4.00	3.83	
877	4.00	3.57	
889	4.00	3.56	
902	4.00	3.68	
915	4.00	3.37	
929	4.00	3.39	
952	4.00	3.40	
962	4.00	3.32	
978	4.00	3.19	
997	4.00	3.19	
1030	4.00	3.45	
1047	4.00	3.11	
1066	4.00	3.44	
1081	4.00	3.28	
1098	4.00	3.14	
1111	4.00	3.17	
1127	4.00	3.00	
1146	4.00	3.02	
1163	4.00	3.04	
1186	4.00	3.09	
1203	4.00	3.08	
1228	4.00	3.52	
1236	4.00	3.14	
1270	4.00	3.34	
1279	4.00	3.31	
1302	4.00	2.81	
1320	4.00	2.47	
1335	4.00	2.55	
1364	4.00	3.23	
1392	4.00	3.06	
1423	4.00	2.95	
1455	4.00	3.08	
1480	4.00	2.89	
1488	4.00	2.91	
1494	4.00	3.70	
1510	4.00	3.90	

Scale: 1:1000
 Date: 12/2012
 Job No: 2188
 Drawing No: 111/BP

LEGEND

- Existing Embankment
- Existing Backdrain
- Proposed Embankment
- Proposed Berm
- Proposed Backdrain
- Proposed Granular Fill
- Proposed Sheet Piling
- Cross Section Location
- Sluice Works Location

REVISIONS

REV	DATE	DN	DESCRIPTION	CHK	APP

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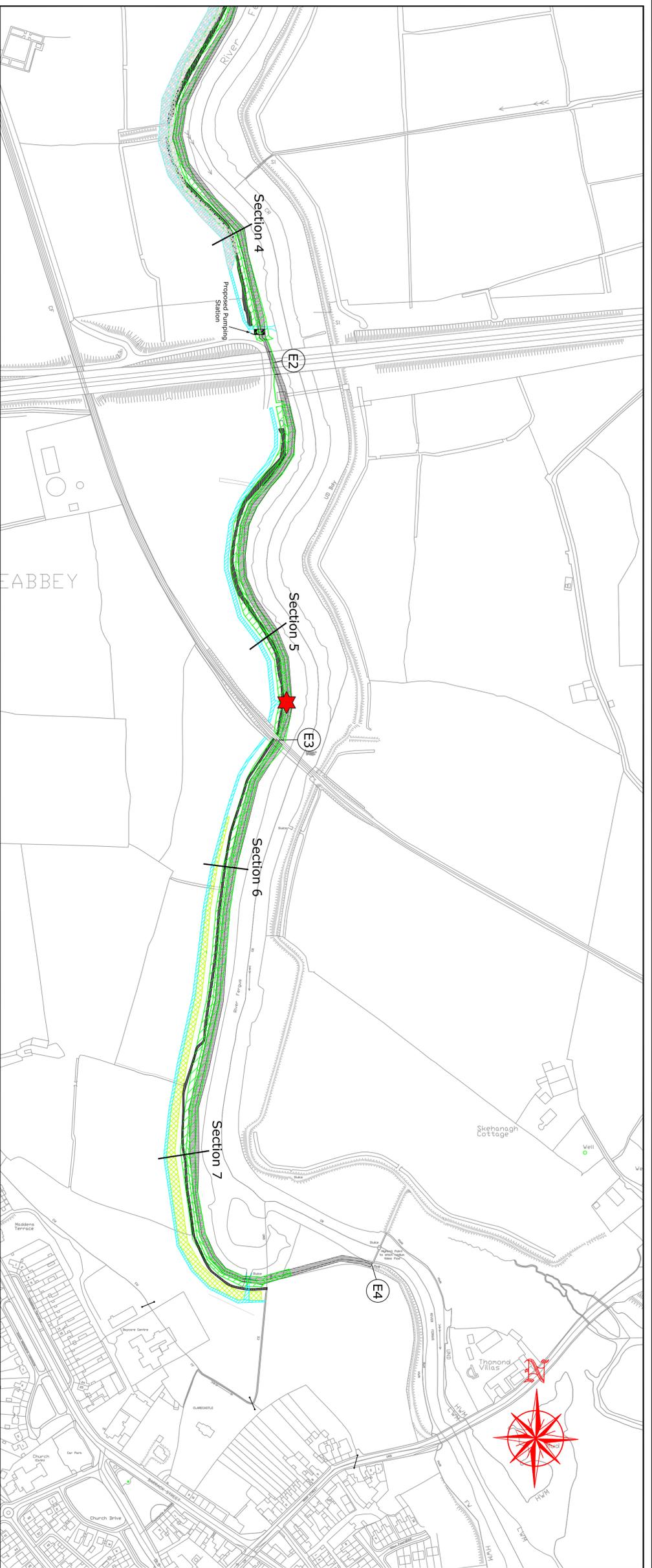
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PROJECT
 ENNIS SOUTH FLOOD RELIEF SCHEME
 PLANNING DRAWINGS

TITLE
 PLAN AND LONG SECTION OF
 PROPOSED EMBANKMENT UPGRADE
 (Sheet 1 of 2)

SCALE @ A1: 1:2,500
 DATE: AUG 2012
 JOB NO: 2188
 DRAWING NO: 111/BP

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:2,500	AUG 2012	RK	CL	MJ



- LEGEND**
- Existing Embankment
 - Existing Backdrain
 - Proposed Embankment
 - Proposed Berm
 - Proposed Backdrain
 - Proposed Granular Fill
 - Proposed Sheet Piling
 - Cross Section Location
 - Sluice Works Location

Chainage (m.)	Invert Level (m.o.d.)	Existing Embankment Crest Level(m.o.d.)	Construction Type
1510			Sheet Piled Retaining Wall -10.0 m.o.d.
1543	3.70	3.62	
1563	3.70	2.84	
1572	4.00	2.60	
1591		2.81	
1605		2.79	
1617	4.00	3.03	
1642		2.90	
1656	4.00	2.96	
1689	4.00	2.61	
1711		2.40	
1731		2.90	
1745	4.00	2.90	
1770		2.63	
1794		2.91	
1815		2.73	
1837	4.00	2.54	
1852		2.71	
1868		2.95	
1897		3.16	
1920		3.08	
1932	4.00	3.19	
1951		3.03	
1956		3.45	
1963	4.00	2.85	
1979		3.35	
1998	4.00	3.36	
2013		3.27	
2026		3.29	
2043		2.89	
2053	4.00	2.78	
2082		2.26	
2095		2.40	
2112	4.00	2.48	
2128		2.55	
2141		2.51	
2158	4.00	2.31	
2183		2.49	
2205	4.00	2.23	
2224		3.06	
2256		2.93	
2328		3.60	
2351		3.53	
2378	4.00	3.13	
2401		3.09	
2426	4.00	3.36	
2445		3.36	
2460		3.45	
2470	4.00	3.57	
2486		3.76	
2517	4.00	3.69	
2543		3.72	
2562		3.54	
2584	4.00	3.63	
2601		3.50	
2637	4.00		
2654		4.23	
2695		3.35	
2720		3.67	
2726		3.75	

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REV	DATE	DRN	DESCRIPTION	CHK	APP
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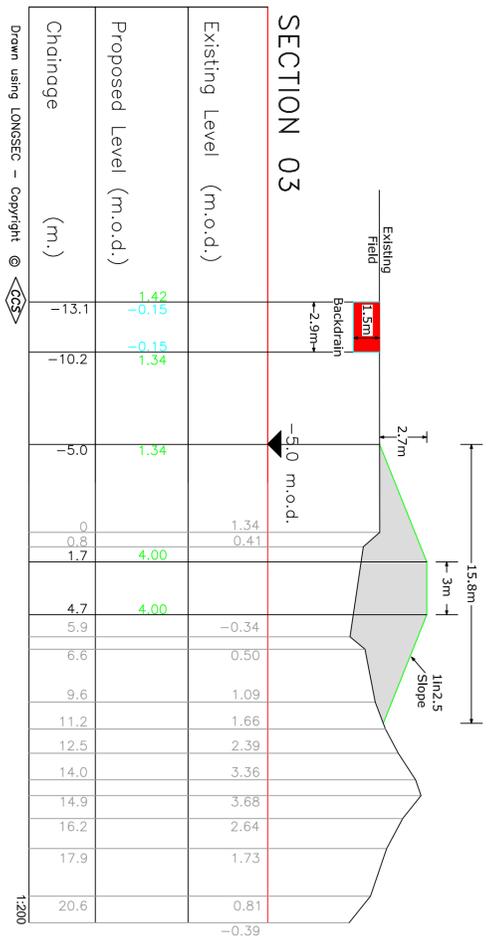
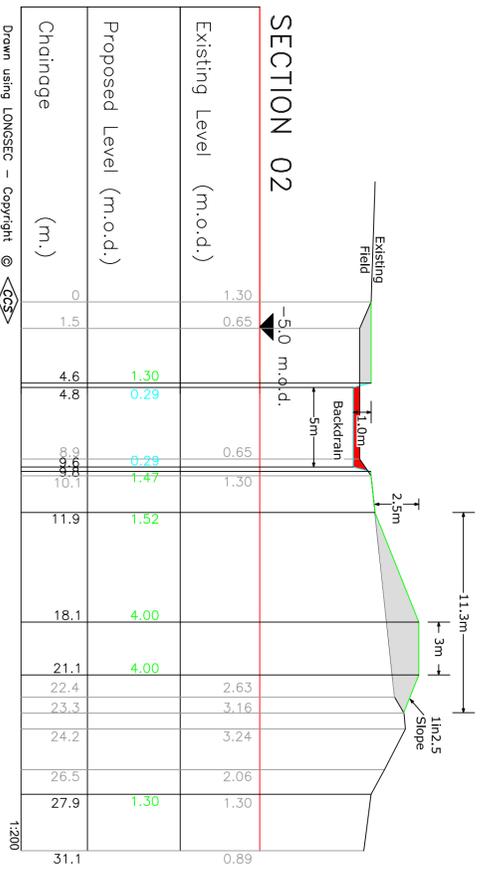
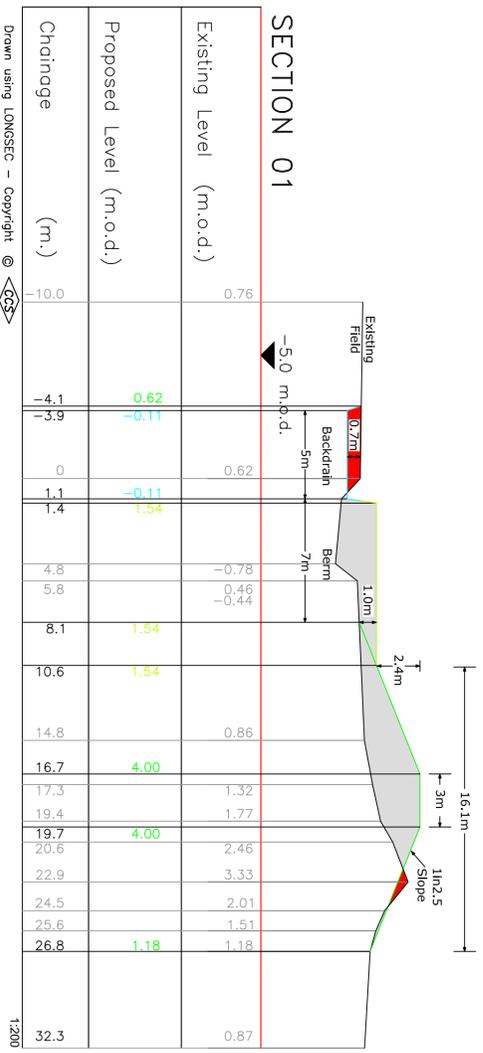
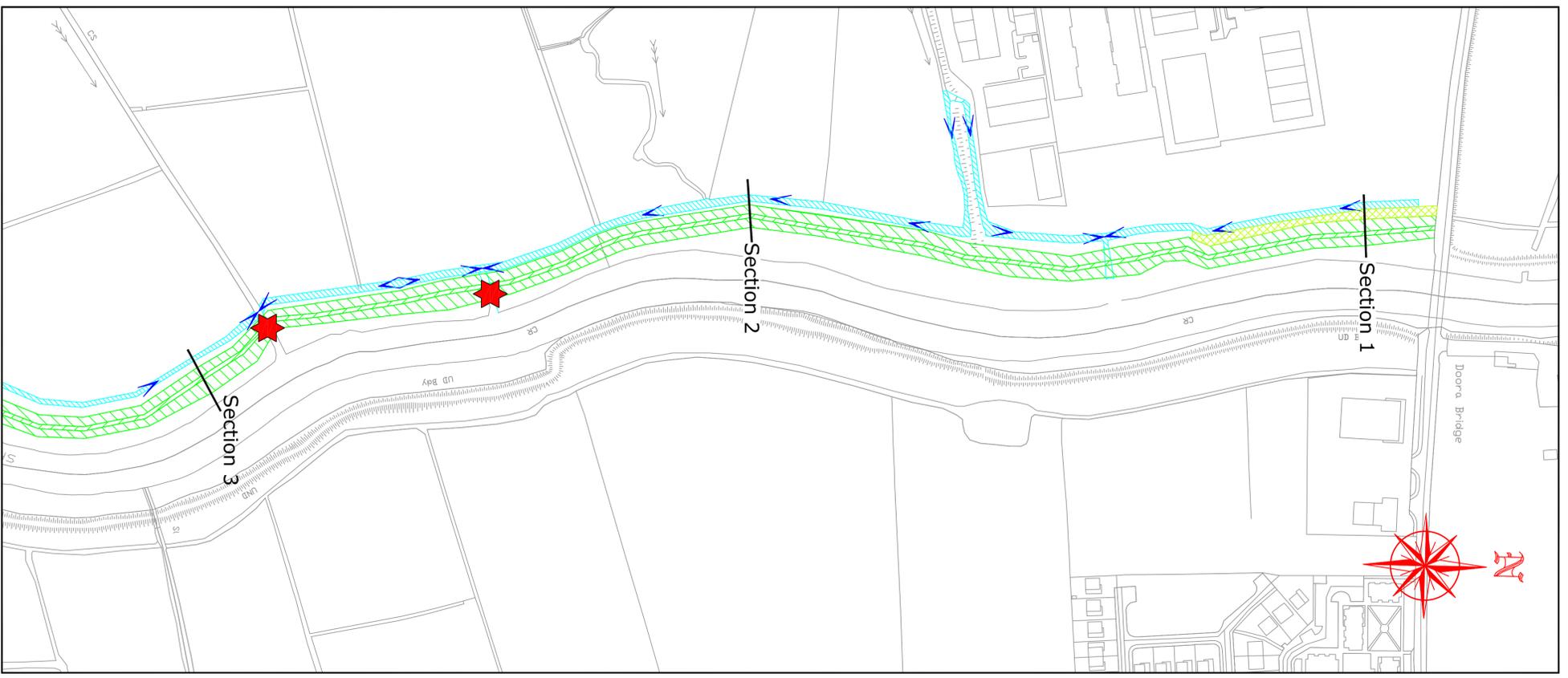
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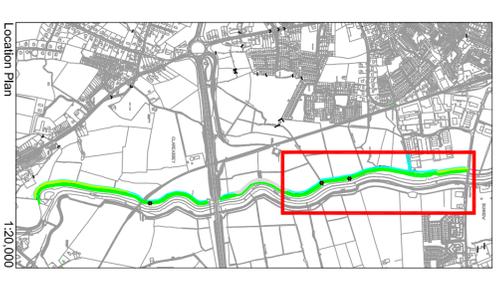
PROJECT: ENNIS SOUTH FLOOD RELIEF SCHEME
 PLANNING DRAWINGS

TITLE: PLAN AND LONG SECTION OF PROPOSED EMBANKMENT UPGRADE (Sheet 2 of 2)

SCALE: @A1 DATE: AUG 2012 DRAWN: RK CHECKED: CL APPROVED: MJ
 1:2,500
 JOB NO: 2188 DRAWING NO: 112/BP REV:



- LEGEND**
- Proposed Embankment
 - Proposed Berm
 - Proposed Backdrain
 - Proposed Granular Fill
 - Cross Section Location
 - Excavation Required
 - Fill Required
 - Flow Direction
 - Sluce Works Location



REV	DATE	DRN	DESCRIPTION	CHK	APP
REVISIONS					

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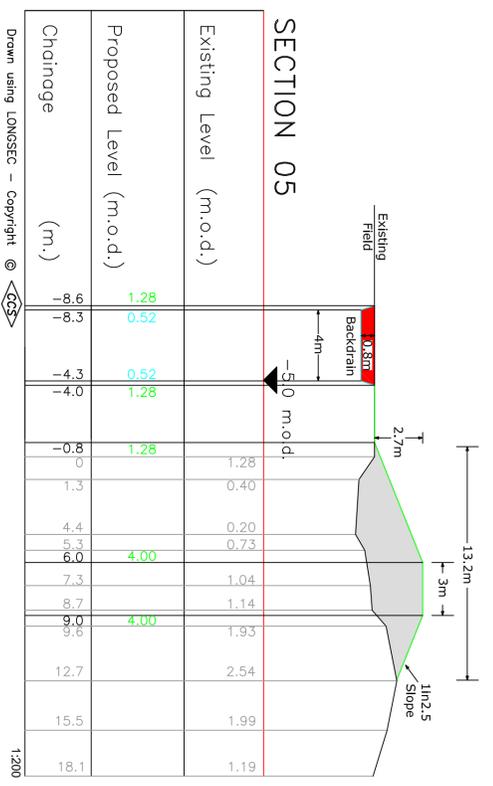
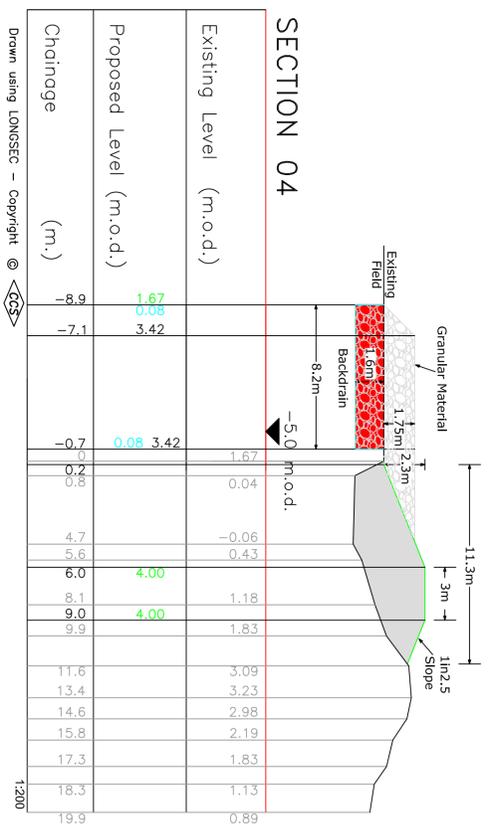
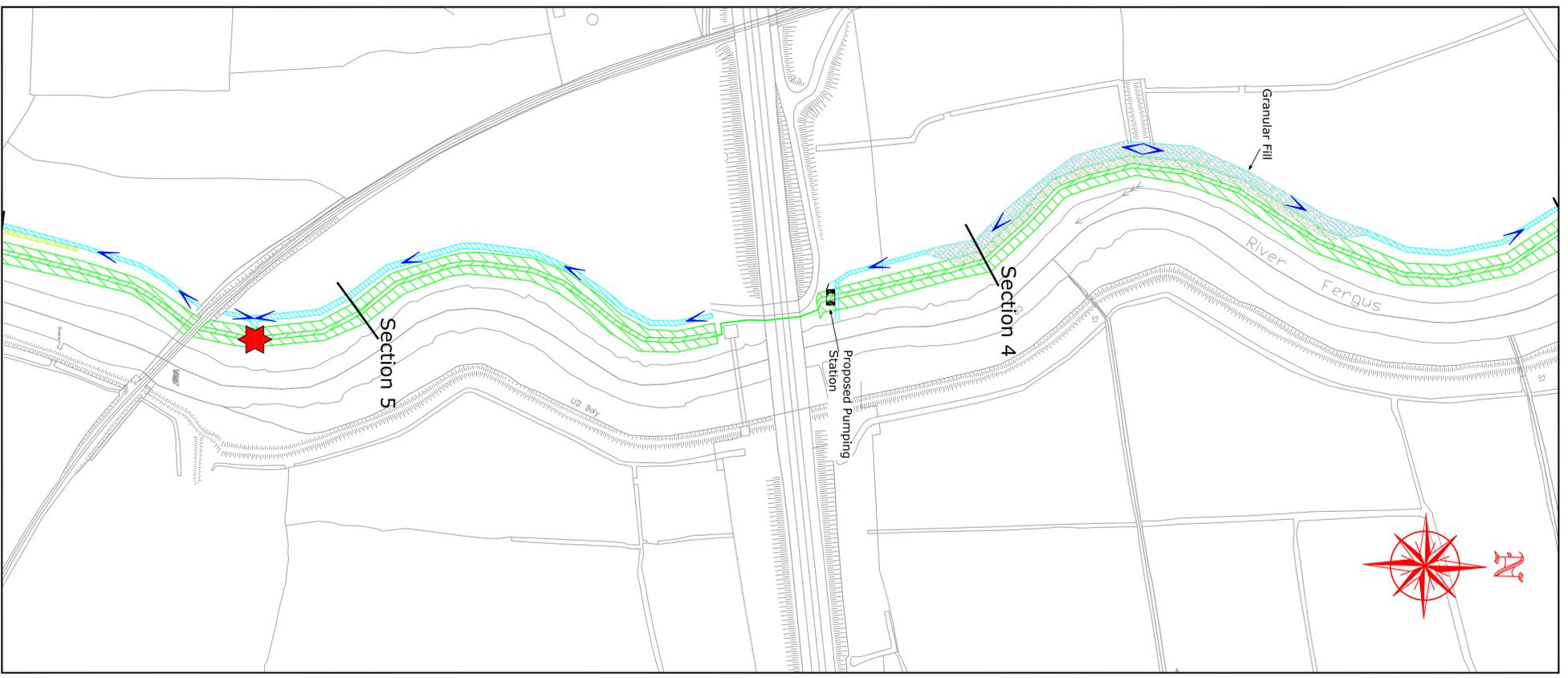
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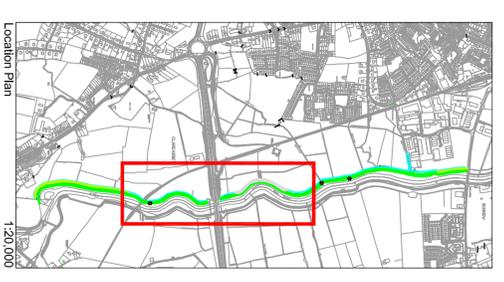
PROJECT
**ENNIS SOUTH FLOOD RELIEF SCHEME
PLANNING DRAWINGS**

TITLE
**CROSS SECTIONS OF PROPOSED
EMBANKMENT UPGRADE
(Sheet 1 of 3)**

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	MJ
JOB No.	DRAWING No.			REV.
2188	113/BP			



- LEGEND**
- Proposed Embankment
 - Proposed Berm
 - Proposed Backdrain
 - Proposed Granular Fill
 - Cross Section Location
 - Excavation Required
 - Fill Required
 - Flow Direction
 - Sluice Works Location



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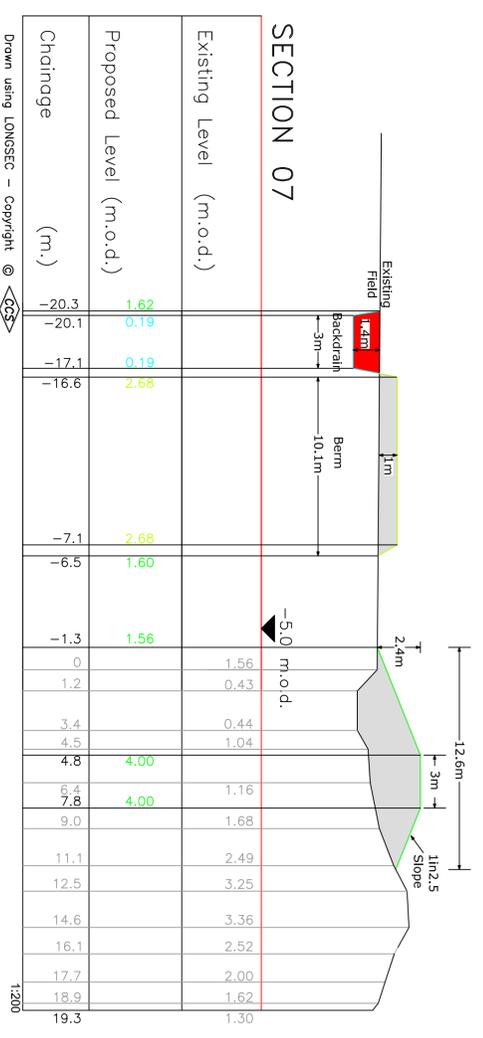
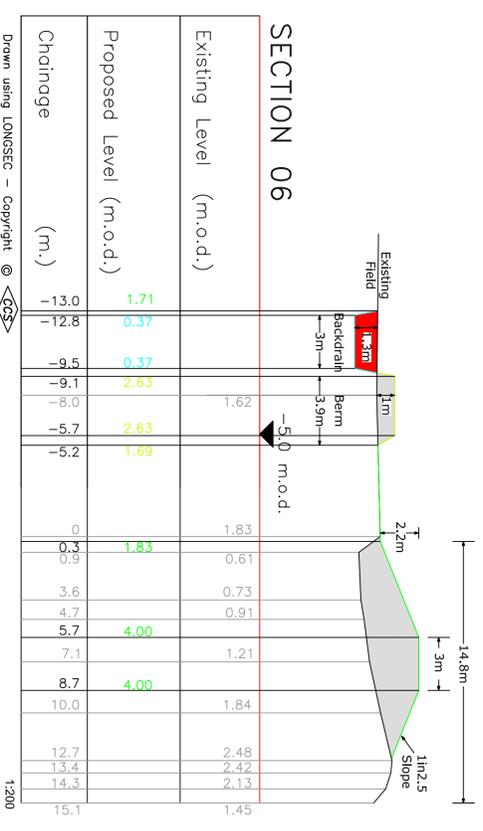
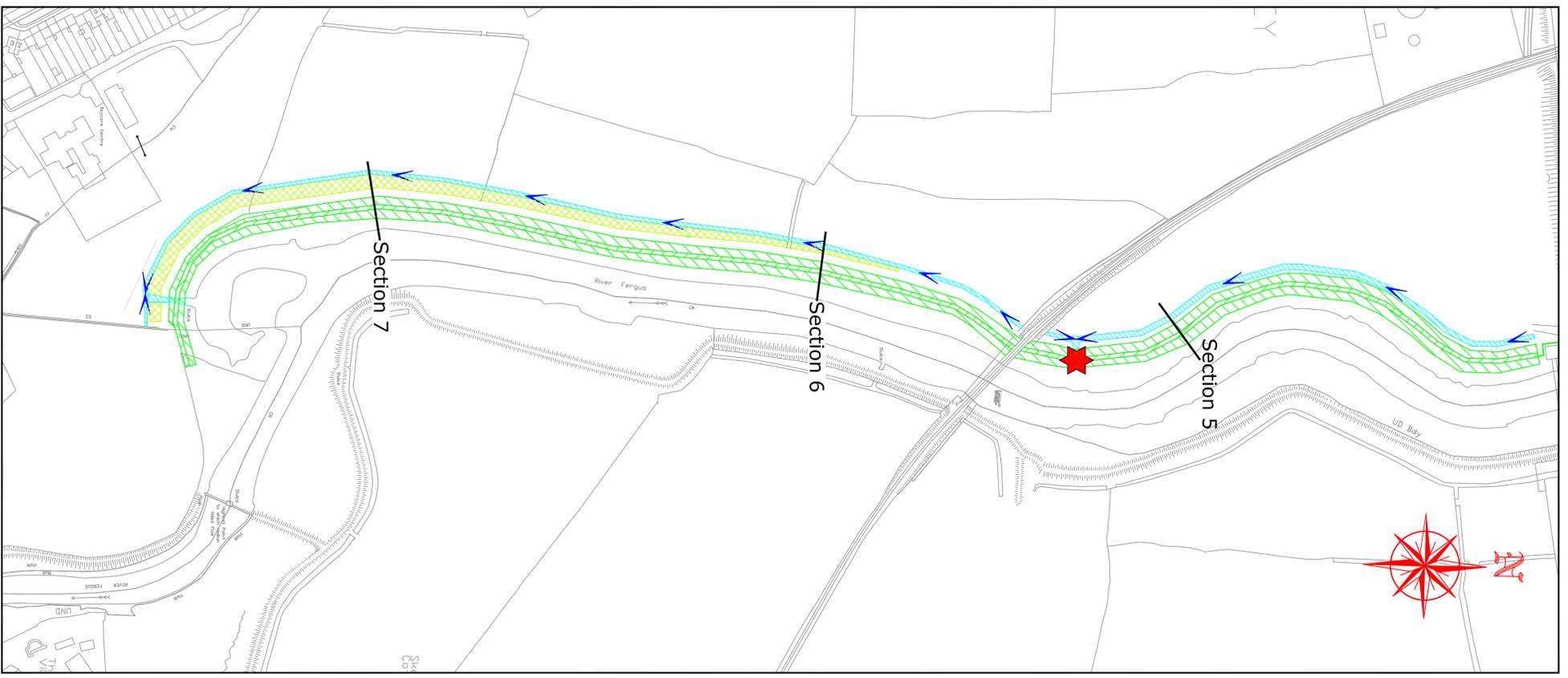
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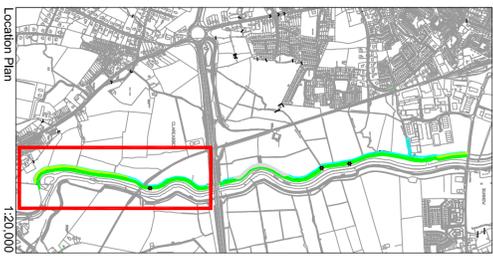
PROJECT
**ENNIS SOUTH FLOOD RELIEF SCHEME
PLANNING DRAWINGS**

TITLE
**CROSS SECTIONS OF PROPOSED
EMBANKMENT UPGRADE
(Sheet 2 of 3)**

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	MJ
JOB No.	DRAWING No.	REV.		
2188	114/BP			



- LEGEND**
- Proposed Embankment
 - Proposed Berm
 - Proposed Backdrain
 - Proposed Granular Fill
 - Cross Section Location
 - Excavation Required
 - Fill Required
 - Flow Direction
 - Sluice Works Location



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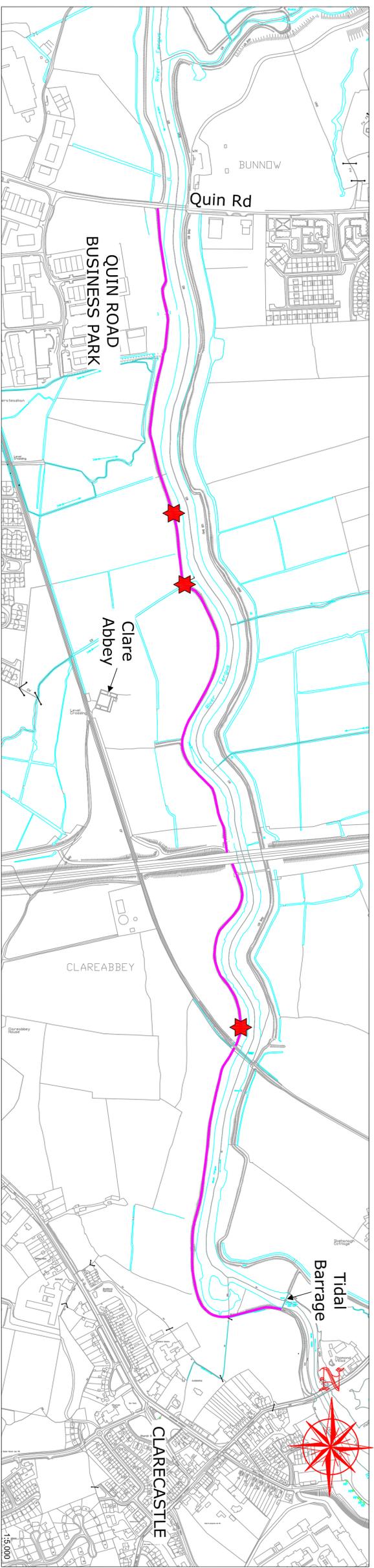
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PROJECT: ENNIS SOUTH FLOOD RELIEF SCHEME
 PLANNING DRAWINGS

TITLE: CROSS SECTIONS OF PROPOSED EMBANKMENT UPGRADE
 (Sheet 3 of 3)

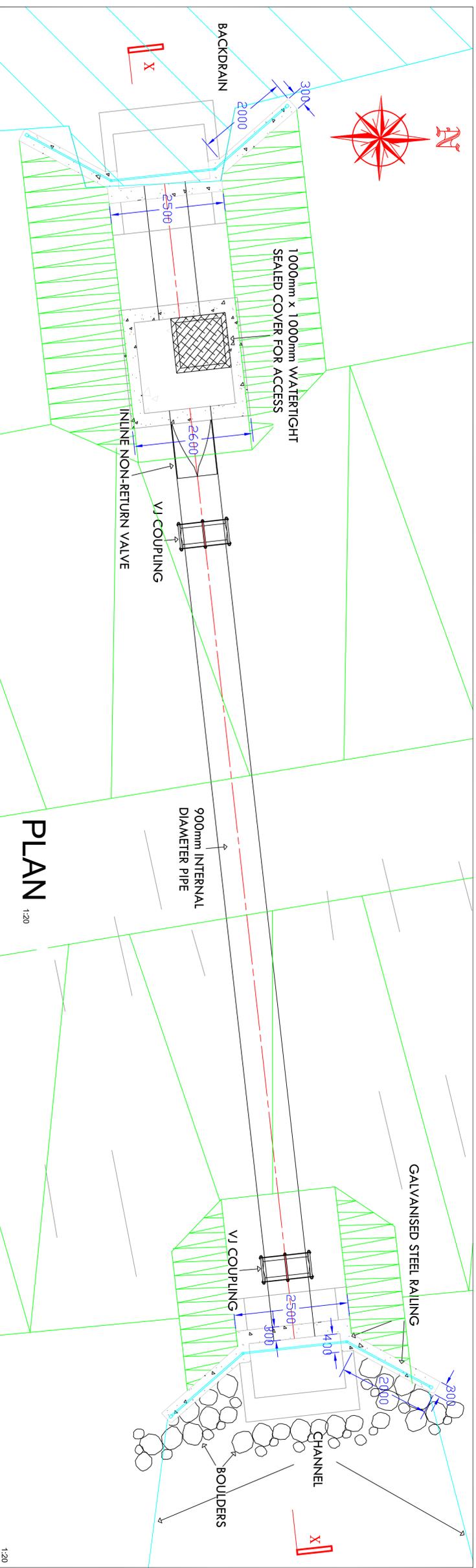
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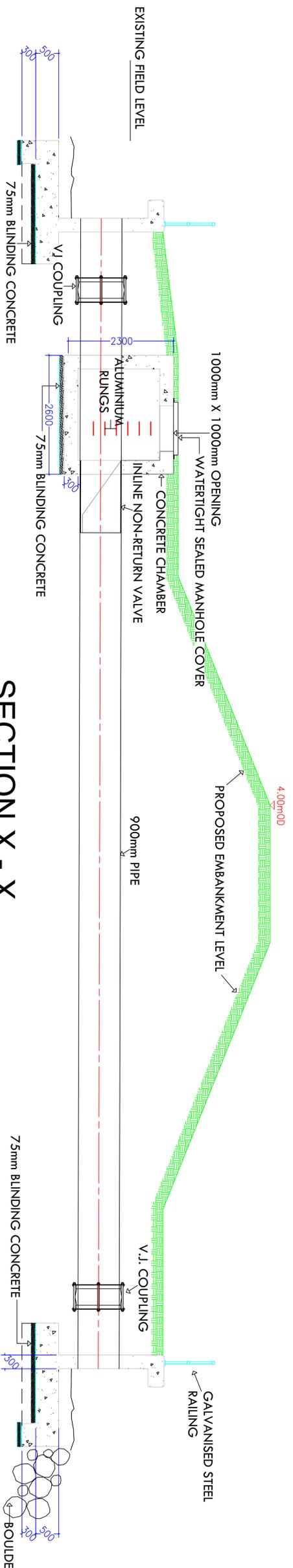
LEGEND

Location of Embankment Improvement Works

Location of Proposed Sluice Works



PLAN
1:20



SECTION X - X
1:20

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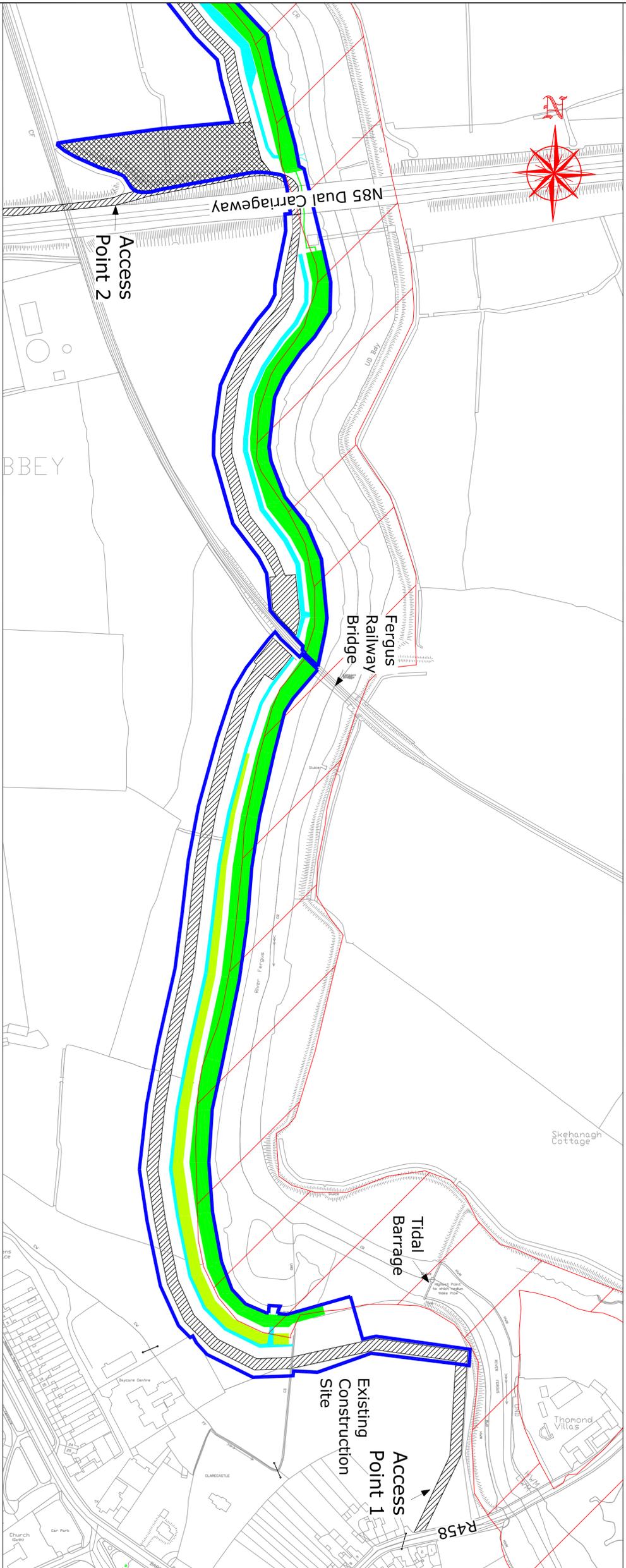
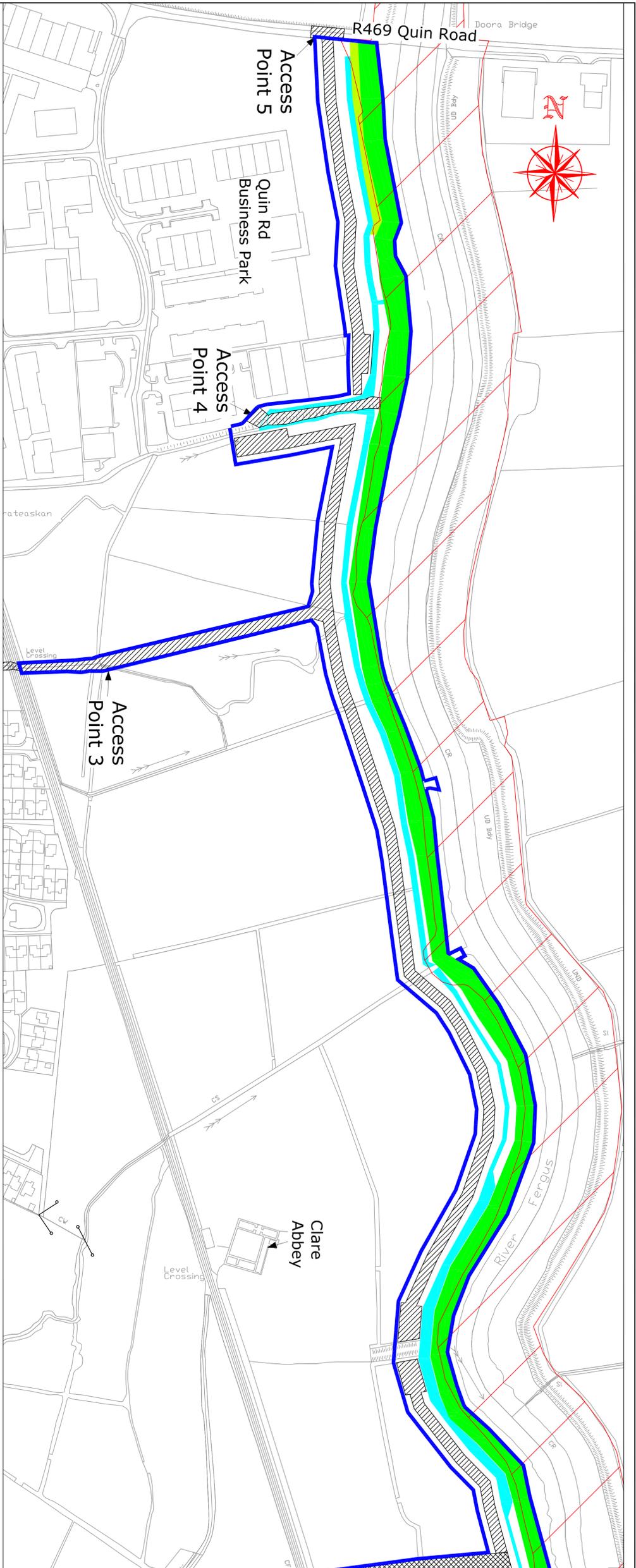
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PROJECT
ENNIS SOUTH FLOOD RELIEF SCHEME
PLANNING DRAWINGS

TITLE
INDICATIVE SLUICE VALVE DESIGN

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
As Shown	AUG 2012	RK	CL	MJ

JOB No.	DRAWING No.	REV.
2188	116/BP	



- LEGEND**
- Permanent Works
 - Proposed Embankment
 - Proposed Berm
 - Proposed Backdrain
 - Temporary Works
 - Haul Road/Access Road
 - Site Compound
 - Works Area
 - SAC

- Access Point 1
Access from the R458, west of Clarecastle Village and through an existing abandoned construction site
- Access Point 2
Access via existing infrastructure used during the construction of the N85
- Access Point 3
Access from Tobartaescaín Road. Approximately 270m of temporary haul road required
- Access Point 4
Access from Quin Rd Business Park
- Access Point 5
Access from the Quin Rd (R469)

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CLARE COUNTY COUNCIL

PROJECT
**ENNIS SOUTH FLOOD RELIEF SCHEME
PLANNING DRAWINGS**

TITLE
**SITE COMPOUND, ACCESS ROUTES
AND EXTENT OF WORKS AREA**

SCALE @ A1	DATE	DRAWN	CHECKED	APPROVED
1:2,000	AUG 2012	RK	CL	MJ
JOB No.	DRAWING No.	REV.		
2188	117/BP			

Appendix B
Newspaper Advert

CLARE COUNTY COUNCIL/ENNIS TOWN COUNCIL

ENNIS SOUTH FLOOD RELIEF SCHEME

*Planning and Development Act 2000 - 2011
Planning and Development Regulations 2001-2012*

In accordance with Section 177AE of the Planning and Development Acts 2000-2011 and the Planning and Development Regulations 2001-2012 , notice is hereby given that Clare County Council and Ennis Town Council proposes to seek the approval of An Bord Pleanála to construct the following works located in the townlands of Clonroadmore, Ballybeg and Clareabbey;

- **Flood Overflow Culvert from St. Flannan's Stream to the Clare Abbey flood plain, with associated overflow structure and outfall structure;**
- **Flood Overflow Culvert from Ballybeg Stream to the Clare Abbey flood plain, with associated overflow structure, outfall structure and open drain;**
- **Upgrade of the existing flood defence embankment between the Quin Road and the Clarecastle tidal barrage, including rehabilitation and construction of sluices and modification of the existing backdrain.**

A Natura Impact Statement (NIS) has been prepared as part of the application for approval in respect of the proposed development.

Submissions and observations in respect of the proposed development relating to;

- the implications of the proposed development for proper planning and sustainable development in the area concerned,
- the likely effects on the environment of the proposed development, and
- the likely significant effects of the proposed development on a European site

may be made to An Bord Pleanála, 64 Marlborough Street, Dublin 1 and must be received **no later than 5.30 pm on 23rd October 2012**).

A copy of the NIS, and the documents, particulars plans, and other information relating to the application, may be inspected at the following locations:

- Clare County Council, Aras an Contae, New Road, Ennis between the hours of **9.00 am and 5 p.m on working days from 10th September 2012 to 23rd October 2012(inclusive of both dates)**
- Ennis Town Council, Waterpark House, Drumbiggle, Ennis, Co. Clare between the hours of **9.00 am and 4.00 p.m on working days from 10th September 2012 to 23rd October 2012(inclusive of both dates)**
- the offices of An Bord Pleanála, 64 Marlborough Street, Dublin 1 between the hours of **9.15 am and 5.30 p.m on working days from 10th September 2012 to 23rd October 2012(inclusive of both dates)**

The Natura Impact Statement (full text) may be purchased on payment of a fee of €25. Copies are also available on CD for purchase on payment of a fee €10.

Alternatively, these documents are available and can be downloaded from www.clarecoco.ie

In relation to the proposed development, An Bord Pleanála may:

- Approve the proposed development
- Approve the proposed development with modifications
- Refuse to approve the proposed development

A person may question the validity of a decision of the Bord by way of an application for judicial review, under Order 84 of the rules of the Superior Courts (S.I. No.15 of 1986) in accordance with section 50 of the Planning and Development Act 2000, as amended.

Further information in respect of the Judicial Review process can be found on www.citizensinformation.ie Contact Lo Call 1890777121 or + 353 21 4521600 for details of the locations and operating hours of your local Citizens Information Centre.

Appendix C
Natura Impact Statement



Comhairle Contae an Chláir
Clare County Council

ENNIS SOUTH FLOOD RELIEF SCHEME

NATURA IMPACT STATEMENT (NIS)

AUGUST 2012



CONSULTING ENGINEERS

Sherwood House, Sherwood Avenue, Taylor's Hill, Galway
Suite D4, The Cubes Offices, Beacon South Quarter, Sandyford Dublin 18

Client	Clare County Council
Project No.	2188
Project Title	Ennis South Flood Relief Scheme
Report Title	Natura Impact Statement

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
0	Draft	R Kiely	C Lyons	C Lyons	April 2012
1	Minor edits	C. Lyons	L. Dolan	C. Lyons	25 May 2012
2	Final	C.Lyons/L. Dolan	L. Dolan	C. Lyons	22 Aug 2012

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1. INTRODUCTION & BACKGROUND TO PROJECT

1.1 INTRODUCTION

Ryan Hanley was commissioned by Clare County Council to assess the potential for impacts to Natura 2000 sites in light of proposed Ennis South Flood Relief Scheme in accordance with Article 6.3 of the EU Habitats Directive (92/43/EEC).

The Stage 1 Appropriate Assessment Screening Report (Ryan Hanley, 2011; see Appendix A) for the Ennis South Flood Relief Scheme concluded that *“further ecological assessment is required to ascertain the presence and location of Annex II species before the proposed works are to be carried out. A suite of mitigation measures is to be prepared aimed at protecting the water quality, species and habitats found in/along the river. These mitigation measures are to be agreed with the NPWS prior to construction.”* On the basis of DoEHLG Guidance (2009 as amended in 2010) and the findings of the Stage 1 Appropriate Assessment Screening Report, the project must proceed to Stage 2: Appropriate Assessment: Natura Impact Statement (NIS).

This report constitutes a Natura Impact Statement (NIS) for the Ennis South Flood Relief Scheme in accordance with Article 6.3 of the EU Habitats Directive (92/43/EEC).

A River Habitat Corridor Survey and a targeted Molluscan Survey have also been carried out and form supporting documents for the NIS. These are included in Appendix B and C, respectively.

1.2 NEED FOR APPROPRIATE ASSESSMENT

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are sites that form part of a network, known as Natura 2000 sites, to be designated across Europe in order to protect biodiversity within the EU. SACs designated under the EU Habitats Directive (92/43/EEC) were transcribed into Irish law by the European Communities (Natural Habitats) Regulations, 2007 and the European Communities (Birds and Natural Habitats) Regulations, 2007 while SPAs are designated under the EU Birds Directive (79/409/EEC, as amended and codified in 2009/147/EC).

Article 6(3) of the EU Habitats Directive states that: *“Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site’s conservation objectives.”* Such an assessment is known as an Appropriate Assessment (AA). Further guidance on AA is provided by the European Commission (2000) and the Department of the Environment, Heritage and Local Government (DEHLG) (2009).

Following the DEHLG guidance (2009, as amended in 2010) where effects are evaluated as being significant, potentially significant or uncertain and/or the process becomes overly complicated under a Stage 1 Appropriate Assessment Screening Report one must proceed to Stage 2 Appropriate Assessment and prepare a Natura Impact Statement. This stage considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the *integrity* of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects.

Integrity is defined as: *‘the coherence of the site’s ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified’*. Therefore the integrity of a site is principally related to the structure and function of the site with regard to its Annex I habitats and Annex II species listed as the Qualifying Interests. The conservation status of these Qualifying Interests comprises the primary Conservation Objectives for all designated Natura 2000 sites.

1.3 OTHER DESIGNATED SITES

In accordance with the DoEHLG Circular L8/08 *“the screening methodology is designed to assist those planning and designing water services solutions when determining whether AA for Natura 2000/European sites or habitats & species listed in the annexes of the EU Birds and Habitats Directives is necessary or not. It should also be applied to NHAs”*.

In this regard, the Irish Wildlife (Amendment) Act 2000 provides for the designation and conservation of Natural Heritage Areas (NHAs). NHAs are sites that support features which are important at a national level.

In addition, there are 630 proposed NHAs (pNHAs), which were published on a non-statutory basis in 1995, but have not since been statutorily proposed or designated. Prior to statutory designation, pNHAs are subject to limited protection, in the form of:

- Agri-environmental farm planning schemes such as Rural Environment Protection Scheme (REPS 3 and 4) and Agri Environmental Options Scheme (AEOS) continue to support the objective of maintaining and enhancing the conservation status of pNHAs. The farm plans operate for a period of 5 years. REPS 4 plans will continue to operate until 2014.
- Forest Service requirement for NPWS approval before they will pay afforestation grants on pNHA lands
- Recognition of the ecological value of pNHAs by Planning and Licensing Authorities.
- Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally proposed for designation.

These sites may support Annex listed habitats or species which are protected under the EU Habitats Directive (92/43/EEC) or the EU Birds Directive (79/409/EEC, as amended and codified in 2009/147/EC).

Outside of these designated or proposed designated areas, habitats of high value local importance to national importance may also support Annex listed habitats or species. These habitats are also discussed in this Natura Impact Statement.

2. METHODS

The methodologies used to complete this NIS are based on best practice guidance, including the following: -

- European Commission (2000) Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC
- European Commission (2001) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC
- European Commission (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/49/EEC; clarification of the concepts of: Alternative solutions, Imperative reasons of overriding public interest, Compensatory Measures, Overall Coherence, Opinion of the Commission
- Department of the Environmental Heritage and Local Government (2009, as amended in 2010). Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities
- DoEHLG Circular L8/08
- Scott Wilson et al. (2006) Appropriate Assessment of Plans.

Please see Section 1.1 for details of additional guidance documents utilised in the preparation of this report.

This NIS is based on a combination of a desk study, a field walkover survey and a River Habitat Corridor Survey undertaken in November 2011 and August 2012 and a targeted Molluscan Survey undertaken in April 2012. Prior to the commencement of the initial field walkover survey, a desktop review of the relevant technical literature and databases was undertaken for the site in order to identify the presence of any rare or protected flora or fauna and designated conservation areas i.e. Natura 2000 sites [Special Area's of Conservation (SAC's), Special Protection Area's (SPA's)], Natural Heritage Area's (NHA's), proposed Natural Heritage Areas (pNHA's) or other non-designated sites of ecological/botanical interest e.g. supporting Annex I listed habitats, Annex II, Annex IV and Annex V listed species under the EU Habitats Directive and Annex I listed species under the EU Birds Directive within or in the vicinity of the site.

As part of the desk study, the locations and boundaries of all Natura 2000 sites within 1km, 3km, 5km and 15km of the proposed works pertaining to the Ennis South Flood Relief Scheme were identified and reviewed on the 20th of April 2012 using the National Parks and Wildlife Service (NPWS) online map viewer¹. Boundary shapefiles were also downloaded from this site. Where relevant, the NPWS Site Synopsis, Conservation Objectives and Natura 2000 Standard Data Form for any designated areas were also reviewed.

The Annex listed habitats and species described in the Conservation Objectives of the Natura 2000 sites as features of Qualifying Interest (for SAC's) or of Special Conservation Interest (for SPA's) formed the main focus of the assessment for likely significant effects.

The initial field walkover survey and River Habitat Corridor Survey were undertaken in November 2011 and August 2012 during which habitats and species on site were assessed and the suitability of the site to support plants, animals or habitats of note was also considered. Based on the findings of the River Habitat Corridor Survey a target molluscan survey was undertaken in April 2012.

Any watercourses close to the site were also examined during the River Habitat Corridor Survey with a view to determining potential ecological risks associated with the proposed development.

¹ www.npws.ie

The field surveys were undertaken in accordance with the '*Best Practice Guidelines for Habitat Mapping*' (The Heritage Council, 2010), the '*Guidelines for Baseline Ecological Assessment*' (IEA, 1995) and '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes*' (NRA, 2008), amongst other guideline documents (see Appendix B).

The habitats located were categorised as per Fossitt (2000) '*A Guide to Habitats in Ireland*' and where relevant they were also categorised according to EC (2007b) '*Interpretation Manual of European Union Habitats*' where they were found to correspond to Annex I habitats.

3 DESCRIPTION OF THE PROJECT

The main objective of the Ennis South Flood Relief Scheme (referred to herein as the Project) is the provision of flood overflow culverts between Ballybeg and St. Flannan's College in the southern suburbs of Ennis town to the Clare Abbey floodplain in order to formalise the existing situation that occurs during flood events, whereby floodwaters from St. Flannan's and Ballybeg Streams flow overland (generally by road) through the southern suburbs of Ennis town to the Clare Abbey floodplain at Clare Abbey, Ennis, Co. Clare. The Project also includes for the rehabilitation of an existing earthen flood defence embankment located between the River Fergus and the Clare Abbey floodplain.

The Clare Abbey flood plain is bounded by the Quin Road Industrial Estate and Quin Road to the north, the Ennis to Limerick Railway line to the west, the River Fergus flood embankments to the east and the high ground at Clare Abbey and the Ennis Western Relief road to the south.

St. Flannan's and Ballybeg Streams outfall to the backdrains in the Clare Abbey flood plain which in turn discharge to the River Fergus through existing sluices when water levels in the main channel allow. The storm sewers from the adjoining developed lands also discharge to the flood plain.

The water levels in the Lower River Fergus (between Tulla Road and Clarecastle) are controlled by a tidal barrage located at Clarecastle. During high tide in the Fergus Estuary, the barrage gates close thereby preventing high tide levels making their way upstream to Ennis while the River Fergus flows are stored between the flood embankments that line the lower River Fergus channel.

The River Fergus at Ennis floods as a result of persistent heavy rainfall associated with winter antecedent conditions (upstream karstic catchment requires groundwater storage to be saturated) and remains elevated for many days before any noticeable recession in flow magnitudes occurs. This, combined with tidal conditions in the Fergus Estuary at Clarecastle results in a build-up of water in the Lower River Fergus channel upstream of the tidal barrage with little difference between low water and high water conditions upstream of the Clarecastle Barrage.

The existing flood defence earthen embankment between the Clare Abbey floodplain and the River Fergus, constructed in the 1950's has reduced in height due to settlement over the years, while the existing sluice gates are malfunctioning, thereby allowing water from the River Fergus to pass under the existing embankment into the Clare Abbey flood plain at high tide. As a result of the settlement that has taken place, the flood defence embankment is being overtopped during a 1 in 100 year flood event or larger, allowing water from the River Fergus to enter the Clare Abbey floodplain. This happened most recently in during a flood event in November 2009. The November 2009 flood event and previous floods in December 1999, January 2005, and December 2006, resulted in extensive flooding of St. Flannan's College grounds, the Ballybeg Stream near the Limerick Road, Tobertaistean road, Abbeyville and the Clare Abbey floodplain.

Two reports were prepared as a result of the flood event in November 2009 i.e. "Ballybeg Stream Limerick Road, Ennis" (Hydro Environmental Ltd, 2010a) and the "Proposed Flood Relief Scheme and Flood Alleviation Feasibility Report St. Flannan's (Edenvale) Stream, Ennis, Co. Clare" (Hydro Environmental Ltd, 2010b) on behalf of Clare County Council to investigate potential solutions to the issue of flooding at St. Flannan's College and a number of private dwelling houses and local businesses.

These reports recommended measures to formalise the existing flooding scenario including the construction of underground culverts to convey the floodwaters to the floodplain at Clare Abbey by culvert rather than the existing dangerous scenario where they are conveyed overland through the suburbs of Ennis town.

A report entitled “Clare Abbey Flood Plain River Embankments Upgrade Works Feasibility Study” (Hydro Environmental Ltd, 2010c) was also prepared in June 2010 on behalf of Clare County Council which assessed the hydrological, hydraulic and physical condition of the existing flood defence earthen embankment and the Clare Abbey flood plain as a whole. This report concluded that the existing embankment originally constructed in the 1950’s had been overtopped by a flood event in November 2009 and that the existing sluice gates were malfunctioning and allowing water to flow from the River Fergus under the embankment and onto the Clare Abbey floodplain at high tide.

This report recommended measures to improve the flood defences, including raising the existing embankment, rationalising the backdrain, replacing the existing sluices and installing additional sluices and the construction of an emergency pumping station which is required to pump any floodwaters from the Clare Abbey floodplain to the River Fergus in the event that a spring tide in the River Fergus estuary coincides with an extreme flood event (i.e. 1 in 100 year flood event). The purpose of the works is not to enable drainage of the floodplain to facilitate development, rather it is to correct an existing deficient structure and take account of the potential impacts of future climate change.

The three proposed schemes were submitted by Clare County Council to the OPW Arterial Drainage Office for funding. The OPW has agreed to provide funding to bring these minor flood schemes through the planning process as a single integrated scheme referred to as the Ennis South Flood Relief Scheme. Delivery of all aspects of the Project, except for funding provision, is the responsibility of Clare County Council.

As part of a separate scheme, the OPW has proposed to upgrade the river embankments upstream of Doora Bridge at Clonroadmore and Cappahard and downstream of the tidal barrage at Clarecastle and Skehanagh under the River Fergus Lower (Ennis) Certified Drainage Scheme, located upstream of the Project, A number of flood relief works are proposed as part of this scheme (See Section 7.4).

3.1 SCOPE OF PROPOSED WORKS

The works proposed to achieve the objectives of the Project are;

- Provision of 2 No. 1,200mm internal diameter concrete flood overflow culverts, 1,135m and 522m in length, respectively, mainly in road and road verge.
- Raising and widening (required to facilitate the increase in height) of the existing flood defence earthen embankment over a length of 2.7km on the landward side of the existing embankment.
- Re-aligning where required, of the existing associated flood defence embankment backdrain (man-made) located on the landward side of the existing embankment.
- Replacement of 2 No. existing malfunctioning sluices and the construction of 1 No. additional sluice from the backdrain to the River Fergus on the riverside of the existing embankment at 3 No. discrete locations on the riverbank.
- Construction of an emergency pumping platform to facilitate the pumping of flood water from the Clare Abbey flood plain to the River Fergus, if required in an emergency situation.

The general location of the proposed works is shown on Plate 3.1 overleaf.

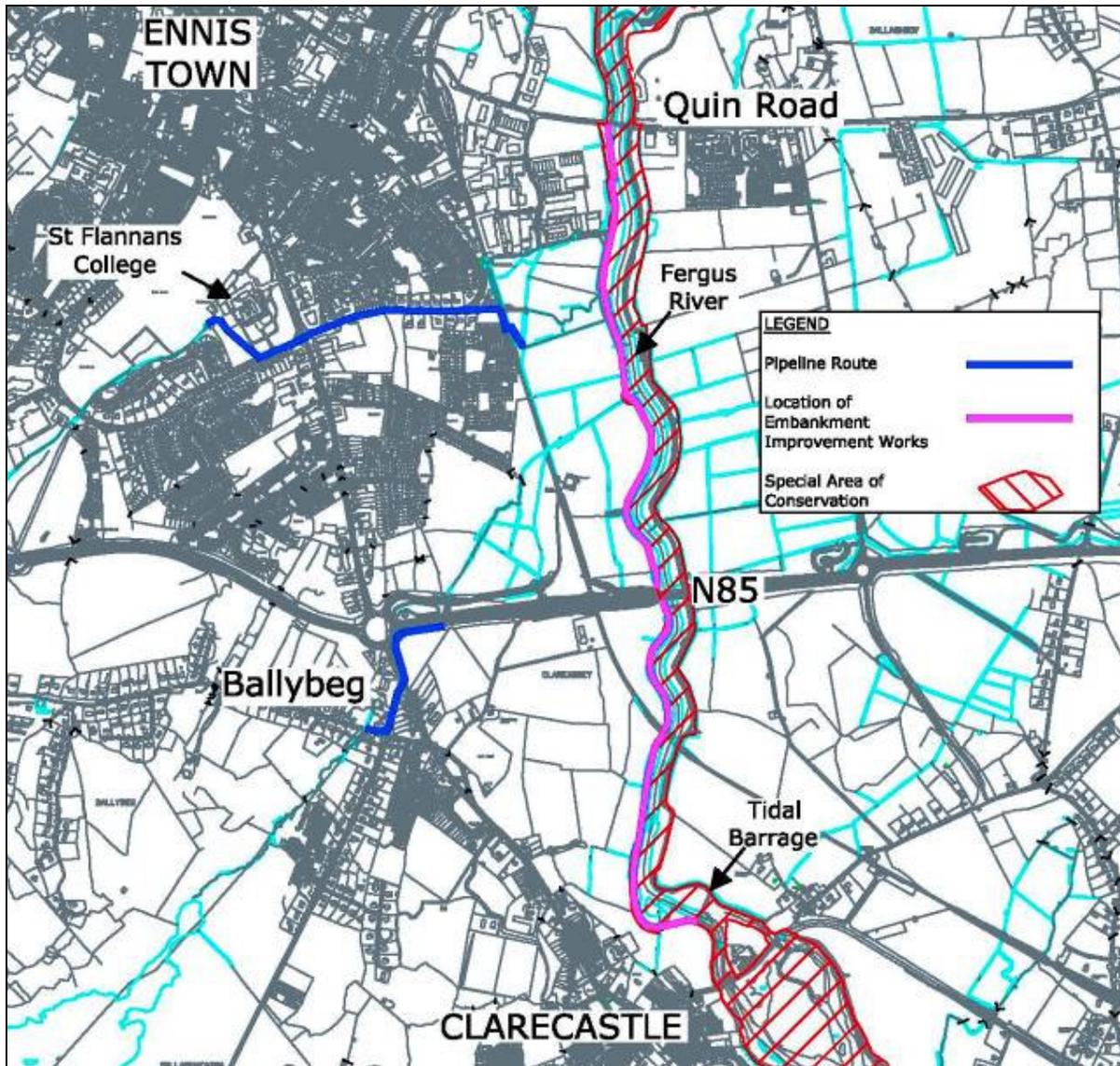


Plate 3.1 Location of Proposed Works

3.2 DESCRIPTION OF PERMANENT WORKS

A description of each element of the scope of the permanent works summarised above is provided in the sections that follow. Each element of the works is described further in the drawings which accompany the planning application and which are listed below:

100/BP	Overall Scheme Location Plan
101/BP	Proposed Overflow Culvert from St. Flannan's
102/BP	Plan and Longsection of Proposed St. Flannan's Culvert
103/BP	Proposed Overflow Structure at Swallow-hole
104/BP	Proposed Outfall Structure on St. Flannan's Culvert
105/BP	Proposed Overflow Culvert from Ballybeg
106/BP	Plan and Longsection of Proposed Ballybeg Culvert
107/BP	Proposed Overflow Structure on Ballybeg Stream
108/BP	Proposed Outfall Structure on Ballybeg Culvert
109/BP	Location Plan and Site Plan of Proposed Emergency Pumping Station

110/BP	Plan and Sections of Proposed Emergency Pumping Station
111/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 1 of 2)
112/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 2 of 2)
113/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 1 of 3)
114/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 2 of 3)
115/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 3 of 3)
116/BP	Indicative Sluice Design
117/BP	Site Compound, Access Routes and Extent of Works Area

These drawings should be read in conjunction with this Natura Impact Statement.

3.2.1 Proposed Flood Overflow Culverts

3.2.1.1 St. Flannan's Flood Overflow Culvert

During November 2009, following an exceptionally prolonged and intense wet spell, St. Flannan's College and built up areas in its environs experienced severe flooding from the St. Flannan's Stream (also known as the Edenvale River and locally known as "The Haun"). This flooding, which was reported to be the worst in living memory, forced the college to close for several days in addition to flooding or cutting off access to a number of homes in the Ard Aoibhinn and Honeywell estates and the Toberteascain and St. Flannan's Drive areas. Furthermore, important town access roads in the area were impassable and an electricity supply substation at the college had to be switched off as a precaution due to the high flood levels.

St. Flannan's Stream, which has a catchment of less than 5km², upstream of the college, drains to a sink or swallow-hole located at the edge of the college sports field. The swallow hole has been proven to be connected to springs located 880m east at Toberteascain via an underground karst conduit system. When the capacity of this underground system is exceeded, St. Flannan's Stream backs up and begins to flood the lands in the vicinity of the swallow-hole. Flooding around the swallow-hole at St. Flannan's is reported to be a regular occurrence, following prolonged wet spells and generally in winter when groundwater levels are high (Hydro Environmental Ltd, 2010b).

During severe flood events, the resultant high water levels overtop a wall downstream of the swallow-hole and floodwaters flow through the college campus and buildings towards a low point located at the front of the college where further overland flow is blocked by the natural stone boundary wall between the college grounds and the Limerick Road. During the period of 18th to 21st November 2009, the flood water level overtopped the Limerick Road wall, cascading over it and crossing the Limerick Road and flowing downhill through the Ard Aoibhinn housing estate (flooding a number of homes there). From Ard Aoibhinn, floodwater flowed through properties to reach the Toberteascain Stream. From there the flood waters entered the Clare Abbey flood plain and backdrain system which was in flood. During this period the high water levels in the Clare Abbey floodplain, due to the combination of high inflow from the Ballybeg and St. Flannan's Streams and high flood levels in the Fergus Lower, posed a severe risk to the existing low lying housing and industrial estates between Quin Road and Clare Abbey.

It was subsequently recommended in the "Flood Alleviation Feasibility Report St. Flannan's (Edenvale) Stream, Ennis, Co. Clare." (Hydro-Environmental, 2010) that a flood overflow culvert be constructed from the swallow hole at St. Flannan's College to the Clare Abbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the suburbs of Ennis town to the floodplain at Clare Abbey, through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters from the swallow-hole at St. Flannan's Stream over an overflow weir to a dedicated overflow culvert which will cross St. Flannan's grounds and follow St Flannan's Drive, across the Limerick Road and down Toberteascain Road to the Clare Abbey floodplain where it will discharge to the existing backdrain channels. Works required include the construction of a concrete overflow weir structure adjacent to the swallow-hole, laying 1,135m of 1200mm diameter culvert, and the construction of associated manholes and chambers. A crossing under the Ennis Railway Line will also be required.

Drawing No. 101/BP shows the route of the proposed flood overflow culvert. A headwall is required at the outfall of the culvert to the drain in the floodplain. This headwall will reduce the risk of erosion of the ground at this outfall.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 8.0mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment or on the hydrology of St. Flannan's Stream.

It is noted that this culvert is solely for the purpose of conveying floodwater from the area around the swallow-hole and will not come into operation until the groundwater capacity has been exceeded to such a level that it threatens to flood property and transport infrastructure.

Details of the works proposed as part of the St. Flannan's flood overflow culvert are shown in Drawing Nos. 101/BP, 102/BP, 103/BP and 104/BP.

3.2.1.2 Ballybeg Flood Overflow Culvert

The Ballybeg Stream is a small stream which outfalls from Ballybeg Lough and disappears underground via a swallow-hole in the rear garden of a private dwelling, 100m south of the Limerick Road between Ennis town and Clarecastle town. The stream re-emerges on the far side of the N85 road some 380m away. The swallow-hole has limited capacity which may have deteriorated in recent years, resulting in flood levels surcharging upstream of it and inundating surrounding properties and roads. Extreme flooding has occurred in this area during the 1995, 1999 and in November 2009 flood events. The nature of the system is such that flooding can prevail for many weeks with roads and house entrances cut off. The November 2009 event saw the most dramatic flooding of recent history with the Ballybeg Stream backing up and inundating large areas of agricultural land and private properties. Two properties were flooded and a further 12 dwellings saw flood waters reaching the driveway and footpath surrounding their houses. A peak flood level of 4.3mO.D. at the swallow-hole, rising to 4.45mO.D. immediately upstream of the Ballybeg Road culvert was observed.

A site visit in early January, approximately 5 weeks after the peak of the flood, found that water levels were still relatively elevated indicating that the swallow-hole may have become partially blocked. There is a strong possibility that a less severe flood in the future could result in more extensive damage due to the deterioration of the underground pathway.

It was recommended in the report "Ballybeg Stream Limerick Road, Ennis - Proposed Flood Relief Scheme" (Hydro-Environmental, 2010) that a flood overflow culvert be constructed from the swallow hole in Ballybeg to the Clare Abbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters over an overflow weir to a dedicated flood overflow culvert and open drain which will convey the floodwaters from the Ballybeg Stream to the culvert under the N85 which drains to the Clare Abbey floodplain. This proposed overflow structure is located in the townland of Ballybeg, adjacent to the Ballybeg Stream and just downstream of the bridge on the R475 road. Its function is to divert flow from the Ballybeg Stream to a proposed 1200mm overflow culvert once the water level in the stream reaches a height of 3.20mOD, just upstream of the swallow hole. The total length of the proposed flood overflow culvert and open drain is 522m.

Details of the proposed flood overflow culvert and associated overflow weir and headwall are described in Drawing Nos. 105/BP, 106/BP, 107/BP and 108/BP.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 3.2mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment or on the hydrology of Ballybeg Stream.

3.2.2 Proposed Rehabilitation of Existing Earthen Flood Defence Embankment and Berm Construction

The existing flood defence earthen embankment was constructed in the 1950's and runs from the Quin Road to the tidal barrage at Clarecastle. It is 2.7km in length and has an existing crest level ranging from 2.23mOD to 4.23mOD. The width of the existing embankment ranges from 1.5m to 2.5m, with a backdrain running parallel to the embankment on the landward side which facilitates drainage from the Clare Abbey floodplain to the river through the existing sluices. Over the years, the existing flood defence earthen embankment has reduced in height due to settlement. Some of the existing sluices are not providing the non-return function for which they were designed, which is allowing water from the River Fergus to pass under the existing embankment into the flood plain at high tide.

The main aim of the proposed embankment rehabilitation works is to raise the crest level of the existing embankment where it has settled and to replace the existing malfunctioning sluices with new sluices fitted with non-return valves.

It is proposed to increase the crest level of this embankment to 4.0mOD which includes an allowance for potential future embankment settlement. Because the existing level of the embankment is being raised, the width of the embankment will also have to increase to provide stability. All of this increase in the width of the embankment footprint will take place to the landward side of the existing embankment. The side slopes of the embankment will be constructed at a slope of 1:2.5 which will result in the embankment footprint increasing on the landward side throughout the 2.74km length. The finished footprint of the proposed embankment will be 4.1hA, representing a 1.9hA increase on the existing footprint of 2.2hA.

As the embankment footprint will increase, the existing manmade backdrain on the landward side of the existing embankment will have to be realigned to accommodate the increase in the embankment footprint, which will encroach on the location of the existing backdrain. The proposed backdrain works are described in Section 4.2.3 below.

The proposed embankment profile will be formed by placing imported cohesive material on the crest and the landward side of the existing embankment to form a consistent cross-section along the length of the embankment. The cross-sections shown on Drawing Nos. 113/BP, 114/BP and 115/BP show how the existing embankment will be integrated into the proposed embankment at typical sections along the length of the embankment. In order to reduce seepage through the proposed embankment, cohesive material will be used to form the proposed embankment cross-section. A sustainability assessment has been carried out to

determine whether material excavated for the backdrain (discussed below) would be suitable for re-use in the proposed embankment. It has been determined; however, that the existing material on site is unsuitable for this purpose and therefore, the cohesive material required will have to be sourced elsewhere. It will be the responsibility of the Contractor appointed to construct the scheme to source this material, subject to the appropriate permissions and permits being in place. The volume of cohesive material that will need to be imported is 65,000m³. The excavated material will be utilised to form a surface layer of soil over the cohesive material and the geogrid.

In order to minimise the risk of erosion from water and wind action, a geogrid will be placed over the entire embankment profile and will be covered by the excavated material. The embankment will also be seeded with an annual nurse grass seed crop and will be allowed to naturally recolonise with native vegetation. The excavated material to be utilised to form the surface layer will also contain the seedbank of native vegetation present along the embankment and backdrain which will assist the process of natural recolonisation.

Due to space constraints at the riverbank under the N85 road bridge, it will not be possible to upgrade the existing embankment at this location. Along this section, a flood wall will need to be constructed on the landward side of the existing embankment. Due to the ground conditions in this area, it is likely that the wall will need to be sheet-piled. The flood wall is required over a length of 80m and will have a crest height of 3.7mOD.

For stability reasons, a berm is also proposed on the landward side of the upgraded embankment along certain sections as shown on the cross-sections (Drawing Nos. 113/BP, 114/BP and 115/BP). The berm will also be seeded with an annual nurse grass seed crop and will be allowed to naturally recolonise with native vegetation. The excavated material from the excavation of the backdrain which will be utilised to form the surface layer which will also contain the seedbank of native vegetation present along the embankment and backdrain which will assist the process of natural re-colonisation.

No embankment works are proposed on the River Fergus channel itself. The closest point of the existing flood defence earthen embankment to the river channel is 3.0-4.0m and on average 10m and all embankment improvement works will be carried out from the landward side of the existing embankment.

Post upgrade works on the embankment, the lands on the landward side of the embankment will continue to remain subject to frequent periodic shallow inundation. This is due to the fact that the water level in the River Fergus fluctuates over the course of the tidal cycle, as a result of the tidal barrage located downstream at Clarecastle. When the barrage closes on a rising tide, the River Fergus cannot discharge to the estuary therefore the water level in the river rises. Once the water level in the River Fergus becomes higher than the water level in the floodplain, water cannot discharge from the landward side of the embankment to the river and must be stored on the landward side until levels in the River Fergus fall to below the water level in the floodplain on the ebbing tide. At this point, water from the landward side of the embankment will continue to discharge to the River Fergus as is currently the case.

Therefore the proposed works on the embankment will not have any effect on the existing hydrogeological regime of the catchment.

See Drawing Nos. 111/BP, 112/BP, 113/BP, 114/BP and 115/BP for details of the proposed embankment upgrade.

3.2.3 Proposed Backdrain Works

A manmade backdrain is located on the landward side of the existing embankment along the majority of the length of the existing embankment. The purpose of the backdrain is to collect water from the floodplain and direct it to the sluice gate locations to discharge to the River Fergus when the water levels allow. It also collects runoff from the landward slope of the embankment itself.

During the rising tide in the Fergus Estuary, the tidal barrage at Clarecastle (located at the downstream end of the Project) closes, such that the Lower River Fergus is prevented from discharging to the sea. As a result, the water level in the Lower River Fergus rises and at the point at which the water level in the river is higher than the water level in the backdrain, floodwaters cannot discharge to the river and must be stored in the backdrain and in the floodplain. During the ebbing tide, the tidal barrage gradually opens allowing the river to discharge to the estuary reducing the water level in the lower River Fergus. Once the level of the lower River Fergus falls below the level of the floodwaters in the backdrain and in the floodplain, these floodwaters can once again discharge to the river via the sluice gates located at intervals along the existing embankment.

The proposed increase to the footprint of the embankment is such that the toe of the proposed embankment will encroach on the footprint of the existing embankment along all but approximately 1km of the length of the embankment. For this reason, the existing backdrain will need to be infilled over approximately 1.75km of its length. The total area of the existing manmade backdrain affected is 0.53ha.

A new backdrain will be excavated on the landward side of the proposed embankment to facilitate the discharge of floodwaters to the river via the sluices as is currently the case (described in Section 3.2.4 below). The new backdrain will have a similar capacity to the existing backdrain. The volume of material to be excavated to form the new backdrain will be approximately 11,000m³. This excavated material will be re-used in the formation of the berm on the landward side of the upgraded embankment along certain sections as shown on the cross-sections (Drawing Nos. 113/BP, 114/BP and 115/BP).

This backdrain will continue to convey water from the flood plain and discharge it to the river via the replaced and additional sluice described below, thereby maintaining the existing hydrological regime, whereby floodwaters are stored in the backdrain and in the Clare Abbey floodplain when the barrage is closed during high tide, following which the floodwaters discharge to the River Fergus as the tide recedes and the tidal barrage opens.

For geotechnical reasons, it will not be possible to construct a new backdrain along a 350m length of embankment located between Section 21 and 29 (see Drawing No.111/BP) as it could lead to destabilisation of the proposed embankment. An infiltration trench constructed using granular material and porous pipe will be constructed on the landward side of this section of embankment in lieu of the existing backdrain. This will result in the permanent loss of backdrain habitat at this location. The volume of imported granular material required will be approximately 11,000m³.

Details of the proposed backdrain works are shown on the proposed embankment cross-sections on Drawing Nos. 113/BP, 114/BP and 115/BP.

As the new backdrain will have a similar capacity to the existing backdrain, the proposed backdrain works will not have any effect on the existing hydrogeological regime of the catchment.

3.2.4 Proposed Sluice Works

There are 5 no. existing sluice gates located along the existing embankment between the Quin Road and the tidal barrage at Clarecastle. The existing sluices are generally 600mm diameter pipes fitted with a flap gate on the outlet at the riverbank. A number of these existing sluice gates are not functioning properly as the capacity of the pipe through the embankment is too small to allow the backdrain to discharge to the river efficiently and the flap gates are malfunctioning allowing the River Fergus to flow into the floodplain during high water levels in the river.

Existing Sluice Gate No. 1, located in the vicinity of the Quin Road Business Park at the northern end of the embankment, has been installed in recent years and appears to be functioning adequately. No works are proposed at this location.

Existing Sluice No. 2 is located between Sluice No. 1 and the N85 road. This sluice does not have sufficient discharge capacity and it is therefore proposed to replace Sluice No. 2 with a new sluice at the same location. The existing pipework and flap gate will be removed and 2 No. new 900mm diameter pipes will be constructed through the proposed embankment at the same location. A precast headwall will be installed on both the landward and the riverside of the embankment to reduce the risk of erosion in the vicinity of the pipeline. The outlet ends of the new pipelines will be fitted with non-return valves. These non-return valves will be of the duckbill valve type, an example of which would be the proprietary “tideflex” valve. This type of valve is much less prone to malfunction than the existing flap gates which allow the river to enter the floodplain via the sluices.

Similar to Sluice No. 2, existing Sluice No. 3 needs to be replaced with 2 No. new 900mm diameter pipes fitted with non-return duckbill valves at the same location as the existing sluice. Pre-cast headwalls will also be required as per proposed Sluice No. 2.

The existing Sluice No. 4 was installed recently and appears to be functioning adequately. It is not proposed to carry out any sluice works at this location.

There is currently no sluice provided to the section of floodplain between the N85 bridge and the railway line that traverses the floodplain and it is therefore proposed to construct a new sluice just upstream of the railway line. This new sluice, Sluice No. 5, will consist of a 900mm diameter pipe which will be constructed through the embankment, and will terminate in a non-return duckbill type valve. A headwall will be required on either side of the embankment.

Existing Sluice No. 6 is located at the downstream end of the existing embankment. This sluice appears to be functioning adequately and it is not proposed to carry out any works to the sluice at this location.

In summary, works are required at the location of the existing Sluice No. 2 and Sluice No. 3 and at the location of the proposed Sluice No. 5. The works proposed at these three discrete locations are the only works pertaining to the project that are required on the riverside of the existing embankment. All concrete components i.e. pipes and headwalls will be pre-cast. The foundations will consist of clean inert blinding or compacted stone material. The non-return valves will be fitted inside of the downstream end of the pipes. An access chamber will be provided on the landward side of the embankment at each sluice where works are required, to facilitate future valve maintenance, without needing to access the riverbank. The locations of the proposed sluice works and a typical detail of the sluice is provided in Drawing No. 116/BP.

This pipework, headwalls and access chamber may need to be piled depending on the actual ground conditions encountered at the locations of each of the sluices.

Post upgrade and installation of the sluice gates, the backdrain will continue to convey water from the flood plain and discharge it to the river via the replaced and additional sluice, thereby maintaining the existing hydrological regime, whereby floodwaters are stored in the backdrain and in the Clare Abbey floodplain when the barrage is closed during high tide, following which the floodwaters discharge to the River Fergus as the tide recedes and the tidal barrage opens. Therefore the proposed works will not have an effect on the existing hydrogeological regime of the catchment.

3.2.5 Proposed Emergency Pumping Station

It was recommended in the report entitled “Clare Abbey Flood Plain River Embankments Upgrade Works Feasibility Study” (Hydro Environmental Ltd, 2010c) that infrastructure be put in place to facilitate the installation of emergency over-pumping from the Clare Abbey back drains / flood plain during extreme flood events when free discharge through the sluice gates from the Clare-Abbey flood plain is prevented. It is therefore proposed to construct an emergency pumping station as part of the Project, in the vicinity of the proposed embankment upgrade.

The emergency pumping station will consist of a reinforced concrete overflow sump and provision for the installation of axial flow pumps at times of exceptional flood. The overflow will divert flood water from the backdrain to the pumping station once the level reaches 2.2mOD. The existing ground level in the Clare Abbey floodplain typically varies from approximately 1mOD to 1.5mOD.

The water level at which the pumps would come into operation is set so that pumping can be initiated only at the level at which the flood waters threaten to inundate infrastructure and property. The pumping station will not be brought into operation during normal winter flooding. It is intended that the pumping station would only be brought into operation in a flood event of similar or larger magnitude to the event of November 2009. During the normal course of events, the pumps will not be installed in the pumping station; rather pumps will only be installed at times of potential flood risk. It is noted that during previous flood events, including November 2009, temporary pumps had to be brought into operation to reduce the risk to property and infrastructure. This situation is not sustainable, due to the health and safety risk to personnel installing and operating temporary pumps during high water levels on the Clare Abbey floodplain adjacent to the River Fergus and the difficulty with sourcing pumps due to demand during such events.

In the event that the flood level in the floodplain starts to exceed 2.2mOD, 2 No. axial flow pumps, with a combined capacity of 3m³/sec, will pump the water from the pump sump into the River Fergus, making it possible to begin draining the flood plain before the river recedes to such a level to allow the sluice gates to become operational.

The construction of this pumping station will not result in any in-stream works, with the aforementioned pumps discharging onto a proposed rock armour apron to be constructed on the flood defence embankment. The location of the pumping station and rock armour apron is shown on Drawing No.117/BP and in Plate 3.1 below.

It is not considered that the proposed operation of the pumping station will have an effect on the existing hydrogeological regime of the catchment.

3.3 DESCRIPTION OF TEMPORARY WORKS

The sections that follow describe the temporary works that are likely to be involved in the construction of each of the permanent works elements described above and in the planning drawings. It is noted that the temporary works and construction methodologies described below are based on methodologies used previously on similar projects, but, until a Contractor is appointed to carry out the construction phase of this project and the temporary works design is completed (by the Contractor), it is not possible to say with absolute certainty the methodologies that will apply. However, items such as the locations of construction site compounds, access routes, haul roads etc and recommended ecological avoidance and mitigation measures will be written into the Contract as Works Requirements to which the Contractor will be required to adhere.

It is intended that the design and construction methodology of the proposed works for the Ennis South Flood Relief Scheme will have, where practically feasible, minimal impacts on the existing environment during the site clearance and construction phase.

All existing services in the vicinity of the proposed works have been investigated in order to avoid any potential negative impacts on the environment.

3.3.1 Site Investigation

Site investigation was undertaken in order to acquire the necessary information to inform the detailed design for the Project and was completed in January 2012. Site investigation was the subject of a separate ecological assessment report entitled "Ecological Summary of Site Investigation Works on the Ennis South Flood Relief Project (Ryan Hanley, 2011) undertaken in consultation with National Parks and Wildlife Service (NPWS). Removal of Scrub (WS1) vegetation along the existing flood defence earthen embankment was undertaken to facilitate access for Site Investigation works. Potential impacts arising from site investigation works will not be considered further in this Natura Impact Statement.



Plate 3.1 Location of Site Compound and Pumping Station

3.3.2 Site Compound

A construction site compound will be required for the provision of welfare facilities for construction workers, car parking, site offices and storage of plant and materials. The construction compound will be located in a previously disturbed hard stand area immediately to the north of the N85 road bridge. The location of this compound is shown on Drawing No.117/BP and on Plate 3.1.

3.3.2 Proposed Flood Overflow Culverts

The majority of the route of each of the proposed flood overflow culverts are located in road or road verge and will generally be constructed within made ground above rock level.

As described earlier, an overflow weir will be required at the upstream ends of each of the culverts to ensure that the culverts will only come into operation once a particular flood water level is exceeded. The construction methodology for the flood relief works i.e. overflow structures, culverts, headwalls relating to both St. Flannan's and Ballybeg Streams will be similar.

These overflow weirs will be constructed using reinforced concrete. The overflow structures will be constructed during the summer months in low flow conditions and when the swallow-holes are dry. As St. Flannan's Stream is ephemeral, the location of the proposed overflow at St. Flannan's is generally dry during the summer months therefore damming or dewatering of the excavation is unlikely to be required. At the Ballybeg overflow structure, which is located on the bank of the Ballybeg Stream upstream of the swallow-hole, works will be carried out during low flow conditions in the stream. A small section of the stream will be dammed and pumped out in order to provide dry working conditions for excavation of the formation for the overflow structure.

The construction methodology in the case of both of the overflow structures will generally involve excavation of the riverbank, blinding of the formation, the fixing of steel reinforcement, the placing of formwork and the pouring of concrete. The type of plant that is likely to be used in the construction works includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and poker vibrators. Precast concrete headwalls will be provided at the downstream end of each of the flood overflow culverts. These will be placed in the same manner as described for the headwalls to the sluices above.

The culverts will be constructed using an "open cut" methodology, whereby a trench will be excavated in the road to the depth shown on the longitudinal sections. Based on the ground conditions encountered during the site investigation, a substantial amount of rock breaking will be required to excavate the trenches to the required levels. During site investigation along the route of the proposed culverts, the closest points at which rock was identified to the River Fergus was at 0.325km (Rotary Core No. 10) and 0.63km (Rotary Core No. 15).

The base of the trenches will be bedded with granular material, following which the precast culvert section will be placed in the trench and surrounded in granular material. The remainder of the trench will be backfilled and the surface reinstated to its original condition.

Drawing Nos. 101/BP to 108/BP provide details of the proposed overflow culverts and associated works.

3.3.3 Proposed Upgrade of Existing Earthen Flood Defence Embankment and Haul Roads

As described above, all works involved in the construction of the rehabilitation works to the existing embankment will take place on the landward side of the existing embankment. In order for machinery to access the landward side of the existing embankment, a haul road will be required along the length of the existing embankment.

Any temporary access roads or haul roads required for the Project will be constructed within the works area outlined in blue on Drawing No.117/BP.

This haul road is likely to be designed as a “floating road” and so will not involve the removal of the existing ground, apart from the stripping of the topsoil. Where native vegetation is present i.e. Reed and large sedge swamp (FS1), Wet Grassland (GS4) the topsoil containing the seedbank will be stored for reuse post-construction. A geotextile material will be laid on the ground over which well graded granular fill will be placed in layers and compacted. The geotextile is required due to the soft nature of the existing ground and to prevent granular material settling into the undisturbed ground below. This haul road will be completely removed and reinstated following completion of the works. All construction traffic involved in the embankment upgrade, and associated works, will be confined to the haul road and the works area which will be fenced off from all other adjacent Scrub (WS1), Wet grassland (GS4), Reed and large sedge swamp (FS1) and Improved Agricultural Grassland (GA1) habitats.

The construction of the proposed embankment and berm will involve the removal of Reed and large sedge swamp (FS1), Scrub (WS1) and a number of scattered semi- and mature Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), and Willow (*Salix* sp.) trees present along and adjacent to the existing flood defence earthen embankment and backdrain and the placement and compaction of cohesive material, such as clean inert clay, to the top and landward slopes of the existing embankment and to the existing backdrain to form the design cross-section detailed in the drawings. It may be necessary to dewater the existing backdrain using submersible pumps as work progresses, depending on the level of water in the River Fergus at the time and weather conditions.

Once the clay has been placed and compacted, a layer of geogrid will be placed on the embankment and berm, over which a layer of clean inert sub-soil from the backdrain excavation will be placed. This subsoil will be re-vegetated as soon as possible after construction with an annual nurse grass seed crop and will be allowed to naturally re-colonise with native vegetation. The excavated material from the backdrain which will also contain the seedbank of native vegetation present along the embankment and backdrain will increase the rate of natural recolonisation.

Works will take place in a sequential manner e.g. the construction works will start at the upstream end of the existing embankment at the Quin Road Business Park and continue to the downstream end at the tidal barrage in Clarecastle. It is also possible that embankment works may be carried out from either end of the existing embankment extents simultaneously, to reduce the overall programme of works. In this situation, a machine would commence at each end of the existing embankment and work towards the midpoint of the existing embankment. No more than two crews will work on the embankment simultaneously to reduce the impact of potential temporary noise and visual disturbance.

The type of plant to be used in the construction of the embankment will most likely include tracked excavators, wheeled loaders, dozers and vibratory compactors, operating from the landward side of the existing embankment.

At the location of the proposed flood wall in the vicinity of the N85 road bridge, a different methodology will be required. The construction methodology here will include excavation of the existing ground for foundations, sheet piling, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete. Sheet piling is required here due to the soft ground conditions in this area and as a cut-off measure to prevent flood water passing underneath the N85 road bridge foundation. It is noted that the wall will be constructed on the landward side of the existing embankment.

The type of plant that is likely to be used in the construction of the flood wall includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and a poker vibrator, operating from the landward side of the existing embankment.

Site Investigation has identified that bedrock is unlikely to be encountered during these works.

3.3.4 Proposed Backdrain Works

As described above all works on the existing and proposed backdrains will take place on the landward side of the existing embankment. Once the proposed embankment profile is completed and the backdrain has been infilled along the entire length, the excavation of the proposed backdrain will commence. This will result in the infilling of marginal vegetation along the existing backdrain and Reed and large sedge swamp (FS1).

Where native vegetation is present i.e. Reed and large sedge swamp (FS1) and on the marginal areas of the backdrain the topsoil containing the seedbank will be stored for reuse post-construction. All construction traffic involved in the proposed backdrain will be confined to the haul road and the works area which will be fenced off from all other adjacent Scrub (WS1), Wet grassland (GS4), Reed and large sedge swamp (FS1) and Improved Agricultural Grassland (GA1) habitats.

This excavation will involve the removal of existing material to attain the widths, depths and gradients shown on the embankment cross-section drawings. The new backdrain will be similar in nature to the existing backdrain and will be excavated using a tracked machine, with the exception of the 350m length of channel.

The material excavated to form the new backdrain will be re-used to form a berm along the landward toe of the embankment which is required along some sections of the embankment to improve embankment stability.

As described above, it will not be possible to maintain an open backdrain along a 350m length of embankment between Sluice No.s 3 and 4 as the construction of an open backdrain in this area has the potential to de-stabilise the embankment. In this area, an infiltration trench will be constructed on the landward side of the embankment. This will involve the construction of a trench which will be lined with a geotextile. Porous pipe will be placed in the bottom of the trench, which will then be filled to above ground level with imported granular material. The plant required to construct the infiltration trench will be similar to that required for the construction of the remainder of the backdrains as discussed above.

3.3.5 Proposed Sluice Works

As described above, works are required at 3 No. discrete locations on the riverside of the existing embankment where existing sluice gates require replacement or where a new sluice is required.

Minimal interference of native vegetation i.e. Reed and large sedge swamp (FS1) will be undertaken and all construction traffic involved will be confined to embankment and the works area which will be fenced off from all other adjacent Scrub (WS1), Wet grassland (GS4), Reed and large sedge swamp (FS1) and Improved Agricultural Grassland (GA1) habitats. Post-construction any disturbed Reed and large sedge swamp (FS1) will be allowed to naturally re-colonise the riverbank.

Minor in-stream works will be required at these three locations and all concrete components i.e. pipes and headwalls will be pre-cast. The foundations will consist of clean inert blinding or compacted stone material.

As part of the construction of the proposed embankment described above, the existing sluice pipework will be removed and a new 900mm pipe will be laid through the embankment. This pipework may need to be piled depending on the actual ground conditions encountered at the locations of each of the sluices. If this is the case, a piling rig will be required to drive a number of pre-cast concrete piles in tandem with the construction of the embankment. It is anticipated that the piles will be pushed through soft ground with limited force until they reach a firm substratum (i.e. compacted gravels or rock).

A new non-return valve will be inserted within this pipeline on the landward side of the embankment. The precast headwall will be placed and backfilled on the landward face of the embankment, behind which an access chamber will be constructed. The headwalls and access chamber may also need to be piled as for the proposed pipework. As above it is anticipated that the piles will be pushed through soft ground with limited force until they reach a firm substratum (i.e. compacted gravel or rock).

The construction of the access chamber on the landward side of the embankment will involve excavation of the existing ground for foundations, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete.

A concrete precast headwall will be required at the upstream and downstream end of this pipework to prevent erosion of the riverbank. The provision of the headwall to the downstream end of the pipeline will require minor in-stream works in the River Fergus in order to found and install the headwall. During low water conditions, a small area in the vicinity of the proposed headwall will be dammed using sandbags and dewatered by pumping. The extent of instream habitat to be dammed will be minimised in so far as possible and is likely to be less than 20m² in area. Once the area has been dewatered, a foundation will be excavated and blinded. The headwall itself will be pre-cast concrete and will be dropped into place and backfilled once the foundation has been formed. This operation is likely to be carried out within 1 day at each location.

The plant required to construct the replacement and proposed sluices will be similar to the plant described in relation to the embankment and backdrain works. No plant or machinery will be required in-stream.

3.3.6 Proposed Emergency Pumping Station

The proposed emergency pumping station will consist of a concrete sump which will be set-up for rapid installation of axial flow pumps in the event of an extreme flood event that is threatening property and infrastructure. The proposed pumping station platform will be located within the proposed embankment and will be constructed using reinforced concrete. The works will initially involve the construction of a 1m deep (approximately) excavation in the vicinity of the N85 road bridge. Due to ground conditions in the area, the structure will need to be piled and the excavation is likely to require dewatering.

The construction methodology here will include excavation of the existing ground for foundations, driving of a number of precast piles, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete. It is anticipated that the sheet-piles will be pushed through soft ground with limited force until they reach a firm substratum (i.e. rock) at approximately 17m below ground.

The type of plant that is likely to be used in the construction works includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and poker vibrators, operating on the landward side of the existing embankment.

3.4 OPERATION AND MAINTENANCE OF THE WORKS

Once the proposed embankment construction works (including embankments, backdrain and sluice gates) are completed no further resource or inputs are required in relation to the operation of the embankment. The embankment and the backdrain will need to be inspected periodically to ensure its integrity, particularly following a flood event. Minor maintenance works may be required following inspections, for example, vegetation trimming, restoration of the design crest level locally, localised clearance of drains etc. It is anticipated that routine maintenance activities such as those outlined, may take place over less than one week every 2 – 3 years.

The proposed sluice gates have been designed such that the non-return valves can be inspected and accessed from the landward side through the provision of access chambers.

During the operation phase of the project, noise may be produced in the event that the emergency pumping station is required to come into operation during an extreme flood event on the River Fergus. This noise will be temporary in nature. Pumping is only likely to be required at a maximum for a period of a few days every 5 to 10 years. In the event that floodwaters need to be pumped to the river, there will be no difference in the quality of the water being discharged to the river, whether it is pumped or flows by gravity in the existing case or in the future.

In relation to maintenance of the flood overflow culverts, access manholes will be provided for maintenance purposes; therefore no excavation activities will be required to facilitate future maintenance. The only intended substance that will be conveyed in these culverts is floodwaters. The floodwater will be collected at the source of the flooding, and so will be of the same quality as the groundwaters or surface waters discharging to the Clare Abbey floodplain during the normal course of events.

3.5 Summary of the Likely Effects

There is no surface water abstraction proposed as part of these works.

Surface water discharge is proposed via the pumping station however, this discharge will consist of flood waters from the Clare Abbey floodplain only.

There will be no additional surface water runoff from the proposed development sites with the exception of the hard surface area or the reinforced concrete associated with the pumping station, as all green field areas are to be restored to their former vegetation type and cover post-construction and road surfaces will be restored to their former surface dressing type following the installation of the storm overflow culverts.

No groundwater abstraction or discharge is proposed.

No blasting activities are proposed.

Piling activities which could result in vibration related impacts are required at the proposed pumping station and may be required at the location of the sluice gates. However, significant vibration levels are not anticipated given the nature of the soft ground conditions.

It is expected that significant rock will be encountered during the laying of the new flood overflow culverts which will require rock breaking activities. During site investigation along the route of the proposed culverts, the closest points at which rock was identified to the River Fergus was at 0.325km (Rotary Core No. 10) and 0.63km (Rotary Core No. 15) from the river.

Temporary loss of instream habitat is anticipated at the location of the backdrain, 3 No. sluice gates at the River Fergus and at the location of the overflow weir at Ballybeg Stream. St. Flannan's Stream is generally dry in summer.

Temporary loss of terrestrial habitats within the proposed works area of the backdrain, embankment, haul road, sluice gates and storm overflow culverts is anticipated.

Permanent loss of instream habitat of a 350m long stretch of backdrain which will be piped underground is anticipated.

Temporary noise, visual, light and dust related impacts are also anticipated, along with the potential for the accidental release of suspended solids, and spillage of hydrocarbons during works.

4. ECOLOGICAL CHARACTER OF THE PROPOSED SITE

Ennis town is located on the River Fergus, Co. Clare. The proposed Project lies within the administrative area of both Clare County Council and Ennis Town Council.

The proposed Project is located within the Osi 10km grid square R37.

Based on the findings of the River Habitat Corridor Survey, habitat mapping was prepared of the habitats within and adjacent to the proposed Project (see Appendix E: Drawing Nos. 2188 HAB/1 to 6.) Detailed descriptions of these habitats are presented within the River Habitat Corridor Survey report (see Appendix B). These drawings should be read in conjunction with the description of the habitats outlined within the NIS.

4.1 Ballybeg Stream

Ballybeg Stream is a Depositing/lowland river (FW2) that is located in the townland of Ballybeg in the southern suburbs of Ennis town, Co. Clare. It terminates as a large ponding water body classified as a small ponding waterbody (FL8) where it disappears underground via a karst swallow-hole (see Drawing No. 104/BP). The ponding waterbody at the entrance to the swallow-hole is approximately 20m x 5m in area with a floating and emergent macrophyte assemblage of the ponding waterbody dominated by Frogbit (*Hydrocharis morsus-ranae*), Common Water Plantain (*Alisma plantago-aquatica*), the non-native invasive species Curly-leaf Pondweed (*Potamogeton crispus*) and Canadian Pondweed (*Elodea canadensis*), while the species rich marginal vegetation consisted of Water Mint (*Mentha aquatica*), Water Figwort (*Scrophularia auriculata*), Water Dock (*Rumex hydrolapathum*), Water Forget-me-not (*Myosotis scorpioides*), Hemlock Water dropwort (*Oenanthe aquatica*), Branched Bur-reed (*Sparganium erectum*), Meadowsweet (*Fillipendula ulmaria*), Reed Canary Grass (*Phalaris arundinacea*), Angelica (*Angelica sylvestris*), Yellow Flag (*Iris pseudacorus*) and Marsh Woundwort (*Stachys palustris*). The ponding water body has potential for Common Frog (*Rana temporaria*) and Smooth Newt (*Triturus vulgaris*). Numerous structures were noted in the margins around the stream such as piles of stone from construction and demolition waste and branches of trees from tree cutting which would form suitable hibernacula or overwintering sites for Smooth Newt. European Eel (*Anguilla anguilla*) are also known to occur in the pond (based on information provided by a local landowner). It is likely that the stream and pond also supports Brook Lamprey (*Lampetra planeri*). The swallow-hole was also found to support a number of Dragon- and Damselfly species.

For further details on the ecology of Ballybeg Stream refer to Appendix B.

4.2 St. Flannan's Stream

St. Flannan's Stream is a Depositing/lowland river (FW2) that is located in the grounds of St. Flannan's College just off the Limerick Road in Ennis town, Co. Clare. It also terminates as a ponding water body classified as a small ponding waterbody (FL8) where it disappears underground via a karst swallow-hole (see Drawing No. 102/BP). The channel was found to contain a low diversity and low cover of in-stream macrophytes. The macrophyte assemblage was found to be dominated by Fool's Watercress (*Apium nodiflorum*), Duckweed (*Lemna minor*) and localised Reed Canary Grass (*Phalaris arundinacea*), while the emergent/marginal zone was dominated by Water Mint (*Mentha aquatica*), Water Figwort (*Scrophularia auriculata*), Angelica (*Angelica sylvestris*), Meadowsweet (*Fillipendula ulmaria*) and Marsh Woundwort (*Stachys palustris*). The stream and the swallow-hole are bound by a Tree-line (WL2). The high canopy layer surrounding the stream and pond is dominated by the non-native species Horse Chestnut (*Aesculus hippocastanum*), the non-native invasive species Sycamore (*Acer pseudoplatanus*) and a low canopy of tall shrubs dominated by Willow (*Salix* spp.) and trailing and climbing species consisting of Bramble (*Rubus fruticosus*) and Ivy (*Hedera helix*). The trees have potential for bat roosts. The ponding water body has good

potential for Common Frog (*Rana temporaria*) and European Eel (*Anguilla anguilla*). It is likely that the stream and pond also supports Brook Lamprey (*Lampetra planeri*).

For further details on the ecology of St. Flannan's Stream refer to Appendix B.

4.3 Backdrain and River Fergus

The existing flood defence earthen embankment and adjacent backdrain can be categorised as an Earthbank (BL2) and a Drainage ditch (FW4)/Tidal River (CW2), respectively between Doorra Bridge on the Quin Road (regional road R469), to the Clarecastle Tidal Barrage, at Ennis Co. Clare.

4.3.1 Flood Defence Earthen Embankment

The existing flood defence earthen embankment (and associated backdrain) was constructed in 1954.

The flood defence earthen embankment is dominated by ruderal, pioneer and agricultural grassland species (see Plates 4.1 and 4.7) with patches of Willow (*Salix* spp), Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*) Scrub (WS1). Individual scattered semi-mature and mature trees e.g. Willow and Hawthorn were also recorded present along with a Hawthorn, Willow and Blackthorn Scrub (WS1) and a Tree-line (WL2) dominated by *Leylandii*. At the base of the embankment Reed and tall sedge swamp (FS1) vegetation is present on both sides i.e. along the riverbank and along the backdrain (in patches). There are also numerous Drainage ditches (FW4) from the adjoining improved agricultural grassland on the Clare Abbey floodplain which flow into the backdrain.

No rare or protected plant species were recorded during the site surveys of the embankment. For further details on the ecology of the embankment refer to Appendix B.

4.3.2 Backdrain and Drainage Ditch habitats

The backdrain has been categorised as a Tidal river (CW2) (see 4.1). The macrophyte assemblage of the backdrain varies in species richness along its length. The most species rich instream macrophyte vegetation was identified at Sluice Gate No. 4, while the most species rich marginal vegetation was recorded along a narrow strip of habitat between Sluice Gates No. 3 and 4 (see Plate 4.2).

While the backdrain does not have potential to support Common Frog (*Rana temporaria*), there is potential for this species to occur in the adjoining Drainage ditch (FW4) habitats which run parallel to the backdrain.

European Eel (*Anguilla anguilla*) were recorded from the backdrain at Sluice Gate No. 4. It is likely that the backdrain also supports lamprey (*Lampetra* sp.).

The backdrain was also found to support a number of dragon- and damselfly species.

For further details on the ecology of the backdrain refer to Appendix B.

4.3.3 River Fergus

The River Fergus has been categorised as a Tidal river (CW2) with a mainly freshwater influence at the location of the proposed works. It is tidally influenced with daily flow reversals and occasional saline incursion. It is approximately 20-30m wide (see Plate 4.8). The river corridor forms part of the Lower River Shannon SAC (Site Code: 0002165) and enters the River Shannon and River Fergus Estuaries SPA (Site Code: 004077) 0.25km downstream of the works at Clarecastle.

Down stream of the works at the tidal barrage it begins to form an estuarine complex of Mudshores (LS4), Wet Grassland (GS4), Tall Sedge and Reed Swamp (FS1) and Marsh (GM1).

The riverbanks exhibit a 20m wide strip of emergent Tall sedge and reed Swamp (FS1) dominated by marginal Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*) and localised Greater Pond Sedge (*Carex riparia*) enclosed on both sides by the existing flood defence earthen embankments.

The immediately adjoining fields on either bank are dominated by Improved Agricultural Grassland (GA1) and are of low ecological value (See Plate 4.3). Frequent patches of Scrub (WS1), Drainage ditches (FW4), Tree-lines (WL2), Reed and tall sedge swamp (FS1) (see Plate 4.4), disturbed Wet Grassland (GS4) (see Plate 4.5), Dry meadows and grassy verges (GS2) (see Plate 4.5) and Recolonising Bare ground (ED3) (see Plate 4.6) were recorded present.

The River Fergus supports rare, nationally scarce and localised plant species. Of these species Reed Sweet-grass (*Glyceria maxima*) and Greater Pond Sedge (*Carex riparia*) were recorded present during the site survey of the backdrain (see Appendix B). Of the remaining species identified during site surveys, Frogbit (*Hydrocharis morsus-ranae*) recorded at the swallow-hole on Ballybeg Stream also has restricted range in Ireland, being confined to central and east Ireland.

The River Fergus in general is an important salmon and trout fishery with game fishing for Atlantic Salmon (*Salmo salar*), Sea trout and Brown Trout (*Salmo trutta*). A limited amount of coarse angling also takes place on the Fergus. It also supports an number of Irish Red Data Listed salmonids i.e. Twaiter Shad (*Allosa fallax fallax*) and Smelt (*Osmerus eperlanus*).

The River supports internationally important waterbird populations. The River Fergus at the location of the proposed works provides habitat for Mute Swan (*Cygnus olor*), Cormorant (*Phalacrocorax carbo*) and Grey Heron (*Ardea cinerea*). Cormorant (*Phalacrocorax carbo*), Mallard (*Anas platyrhynchos*) and Grey Heron (*Ardea cinerea*) were recorded during the site survey along with Kingfisher (*Alcedo atthis*). The adjacent fields also hold a typical assemblage of common Irish farmland and hedgerow birds. Some additional species also occur as a result of the various semi-natural habitats in the general vicinity.

The riverside habitats (scrub, grassland, hedgerows) may be utilised by a number of mammal species such as Wood Mouse (*Apodemus sylvaticus*), Pygmy Shrew (*Sorex minutus*), Badger (*Meles meles*), Fox (*Vulpes vulpes*), Stoat (*Mustela erminea*), Otter (*Lutra lutra*), Irish Hare (*Lepus timidus hibernicus*) and non-native mammals such as Hedgehogs (*Erinaceus europaeus*). However, Badger are unlikely to be found in the wetland habitats adjacent to the river. Signs of Otter (*Lutra lutra*) and sightings of Common Frog (*Rana temporaria*) were recorded during site surveys.

For further details on the ecology of the River Fergus refer to Appendix B.



Plate 4.1 – Example of backdrain habitat with fringing Reed and large sedge swamp (FS1) and the embankment colonised by ruderal, pioneer and agricultural weedy species to the rear



Plate 4.2 – Location of Sluice Gate No. 3: Drainage Ditch (FW4) leading up to the backdrain habitat with the embankment to the rear



Plate 4.3 – Adjacent Improved agricultural grassland habitat



Plate 4.4 – Adjacent Reed and large sedge swamp (FS1) and backdrain in the foreground with Dry meadow and grassy verge (GS2) in the middle ground.



Plate 4.5 – Adjacent disturbed Wet Grassland (GS4)



Plate 4.6 – Recolonising bare ground (ED3) at the N85 road bridge and the location of Sluice Gate No. 4.



Plate 4.7 – Typical ruderal, pioneer and agricultural species of the embankment.



Plate 4.8 – Typical stretch of the River Fergus within the zone of influence of the Project

5. NATURA 2000 SITES

A distance of 15km as per Scott Wilson et al. (2006) has been adopted as the extent of the buffer zone for the proposed Ennis South Flood Relief Scheme. There is a number of Natura 2000 sites located within 15km of the proposed Ennis South Flood Relief Scheme.

These Natura 2000 sites are detailed in Table 5.1 below. In addition there are a number of pNHAs also within the 15km buffer zone (see Table 5.2).

Table 5.1 Locations of Natura 2000 sites

Site Name	Site Code	Direction	Distance from the Project
Lower River Shannon SAC	002165	N/A	0km
River Shannon & River Fergus Estuaries SPA	004077	South	0.25km downstream
Newhall and Edenvale Complex SAC	002091	East	2.38km by land 3.35km upstream
Pouladatig Cave SAC	000037	East	4.5km by land
Ballyallia Lake SAC	000014	North	2.61km by land and 6.56km upstream
Ballyallia Lough SPA	004041	North	6.0km by land and 7.0km upstream
Toonagh Estate	002247	Northwest	6.64km by land
Lough Gash SAC	000051	Southeast	7.64km by land
Dromore Woods and Lough SAC	000032	North	6.83km by land

Table 5.2 Locations of pNHAs

Site Name	Site Code	Direction	Distance from the Project
Cahircalla Wood	001001	East	2.73km by land
Lough Cleggan	001331	North	5km by land
Ballyallia Lake	000014	North	2.61km by land and 6.56km upstream
Fergus Estuary and Inner Shannon	002048	South	0.25km by water
Dromore Woods and Lough	000032	North	6.83km by land
Dromoland Lough	001008	Southeast	4.77km by land
Pouladatig Cave	000037	East	4.42km by land
Newhall and Edenvale Complex	002091	East	2.38km by land 3.35km upstream
Lough Gash	000051	Southeast	7.64km by land
Ballycor Lough	000015	Southeast	7.87km by land
Newpark House	000061	Northeast	1.84km by land

5.1 SUMMARY OF INITIAL SCREENING

There are 9 No. Natura 2000 sites located within 15km of the proposed development sites.

The proposed works on the existing flood defence earthen embankment and sluice gates are located within and adjacent to the Lower River Shannon SAC and 0.25km upstream of the River Shannon and River Fergus Estuaries SPA (see Plate 5.1 overleaf).

The Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are therefore inside the 5km buffer zone for freshwaters as per the DoEHLG Circular L8/08.

While there is connectivity via surface water between Ballyallia Lake SAC and Ballyallia Lough SPA and the proposed works these Natura 2000 sites are located upstream of the works. In addition, as the proposed flood overflow culverts will only convey floodwater that would previously have flowed overland to the same discharge point, no change in the existing hydrological regime is anticipated. There is also no discernible connectivity via water between Lough Gash SAC and the proposed works. Ballyallia Lake SAC, Ballyallia Lough SPA and Lough Gash SAC are also located 2.61km, 6.0km and 7.87km from the proposed works by land. Given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land, (4) location upstream of the works in relation to Ballyallia Lake SAC and Ballyallia Lough SPA; there is no known vector, pathway or conduit for pollution or disturbance related impacts between the proposed works and Lough Gash SAC, Ballyallia Lake SAC and Ballyallia Lough SPA.. Therefore the proposed works are highly unlikely to have any significant direct or indirect effects on the Lough Gash SAC, Ballyallia Lake SAC, Ballyallia Lough SPA. As a result, potential impacts to these Natura 2000 sites are not considered further in this Natura Impact Statement.

There is no connectivity via surface water between Dromore Woods and Lough SAC, Toonagh Estate, Pouladatig Cave SAC and the proposed works. While there is connectivity via groundwater between Newhall and Edenvale Complex SAC and the proposed works, this Natura 2000 site is located upstream of the proposed works. In addition, as discussed above, the proposed flood overflow culverts will only convey floodwater that would previously have flowed overland to the same discharge point, therefore no change in the existing hydrological regime and on the upstream water levels in the Newhall and Edenvale Complex SAC is anticipated. In addition, these Natura 2000 sites are also located 6.83km, 6.64km, 4.42km and 2.38km away by land. Therefore, given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land there is no known vector, pathway or conduit for pollution between the proposed works and these Natura 2000 sites. Therefore the proposed works are highly unlikely to have any significant direct or indirect impacts as a result of pollution on Newhall and Edenvale Complex SAC, Pouladatig Cave SAC, Toonagh Estate and Dromore Woods and Lough SAC provide roosting sites for populations of Lesser Horseshoe Bat (*Rhinolophus hipposideros*), a Qualifying Interests for these SACs. However, while there is no potential pathway or conduit for pollution related impacts on the roosts of Lesser Horseshoe Bat (*Rhinolophus hipposideros*) within these SACs there is potential for indirect disturbance related impacts on this Annex II and Annex IV species within its foraging range (i.e. 5km) outside of the SACs. Newhall and Edenvale SAC, Pouladatig Cave SAC, Toonagh Estate and Dromore Woods and Lough SAC are located 2.38km, 4.42km, 6.64km and 6.83km, respectively away by land. Therefore the proposed works are within foraging range (i.e. 5km) of the Lesser Horseshoe Bat (*Rhinolophus hipposideros*) populations at Newhall and Edenvale SAC and Pouladatig Cave SAC. A Lesser Horseshoe Bat roost has also been identified in Ennis town by Scott Cawley (Julie Fossitt, pers. comm.)

There are 11 no. pNHAs within 15km of the proposed works. Potential impacts on the river Fergus Estuary and Inner Shannon pNHA, Lough Gash pNHA, Dromore Woods and Lough pNHA, Pouladatig Cave pNHA,

Newhall and Edenvale Complex pNHA (and ²Newpark House pNHA located 1.84km away by land) are as above for the relevant overlapping Natura 2000 sites. In addition any proposed avoidance and mitigation measures in respect of the overlapping Natura 2000 sites will also serve to protect the pNHAs.

As Lough Gleggan pNHA, Dromoland Lough pNHA, and Ballycor Lough pNHA are located 5km, 4.77km and 7.87km away by land the assessment for the potential of any significant effects on these pNHAs are as above for Lough Gash SAC.

There is also no connectivity via water between Cahircalla Wood pNHA and the proposed works which are located 2.73km to the east of the woodland. Therefore, given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land there is no known vector, pathway or conduit for pollution between the proposed works and this pNHA. Therefore the proposed development is highly unlikely to have any significant direct or indirect impacts on Cahircalla Wood pNHA. As a result, potential impacts to this pNHA are not considered further as part of this Natura Impact Statement.

In this regard, the Natura Impact Statement will proceed with regard to Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, Newhall and Edenvale SAC and Pouladatig Cave SAC (and Newpark House pNHA).

² This pNHA supports a roost for Lesser Horseshoe Bat (*Rhinolophus hipposideros*), therefore the findings of the initial screening are as for the other Natura 2000 sites within 5km of the works i.e. Newhall and Edenvale SAC, Pouladatig Cave SAC.

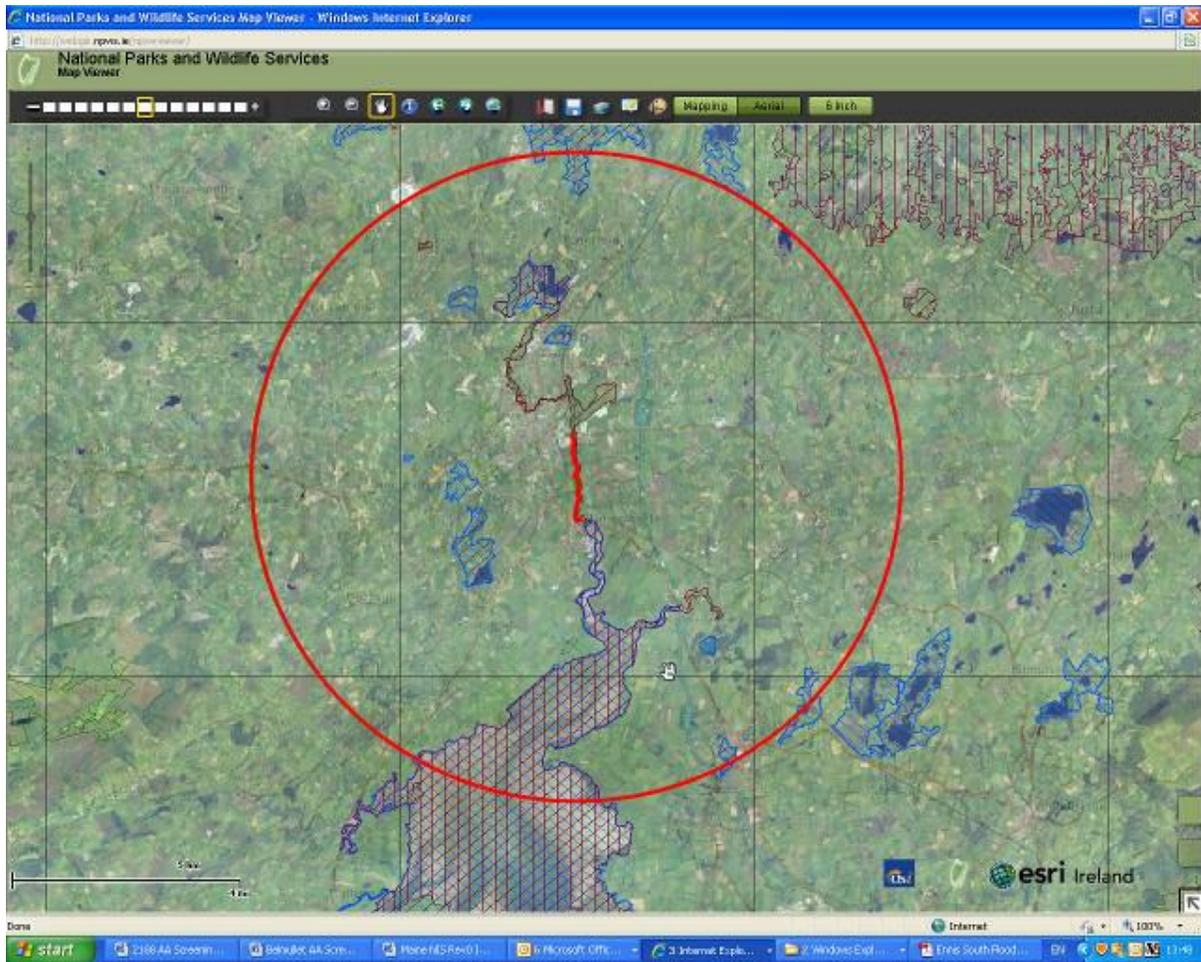


Figure 5.1: 15km buffer zone centred on the project (in red). (Blue = pNHAs, Purple = SACs and SPAs)
 (Source: www.npws.ie)

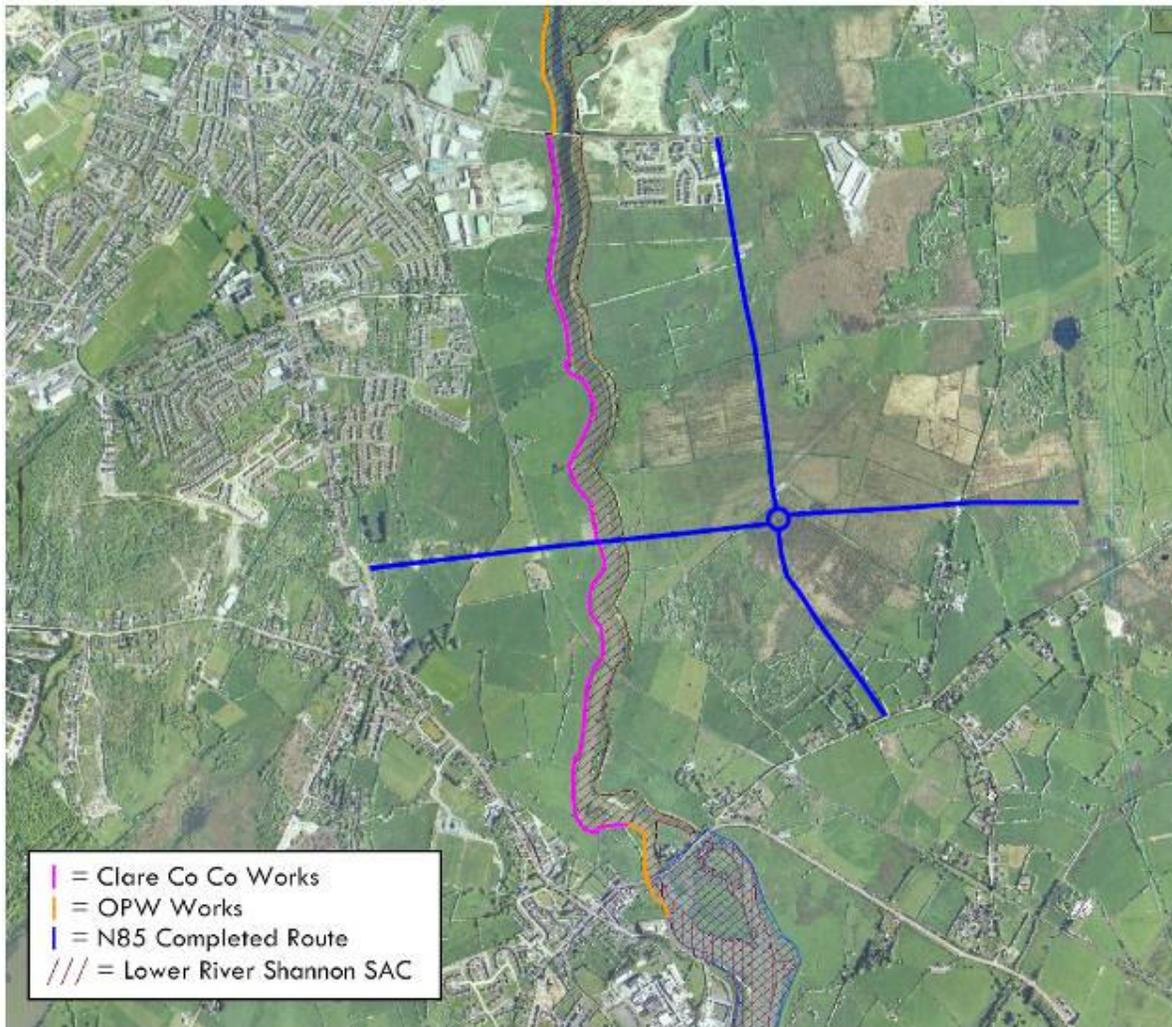


Figure 5.2 Location of Proposed Works relative to Natura 2000 sites

5.2 CONSERVATION OBJECTIVES OF NATURA 2000 SITES

This section describes the Conservation Objectives, Qualifying Interests and Special Conservation Interests of the Natura 2000 sites and pNHAs which may be affected by the proposed Ennis South Flood Relief Scheme.

5.2.1 Lower River Shannon cSAC (Site Code: 002165)

The current conservation objective for the Lower River Shannon cSAC is:

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected (see Tables 5.3 and 5.4 overleaf):

Table 5.3 Lower River Shannon cSAC Habitats of Qualifying Interests

Code	Qualifying Habitats
1150	Coastal Lagoons*
6410	Molinia Meadows on Chalk and Clay (Eu-Molinion)
1130	Estuaries
1140	Mudflats and Sandflats not covered by water at low tide
1330	Atlantic Salt Meadows (<i>Glauco-puccinellietalia</i>)
1410	Mediterranean Salt Meadows (<i>Juncetalia maritima</i>)
1310	<i>Salicornia</i> and other annuals colonizing mud and sand
1110	Sandbanks which are slightly covered by seawater at all times
1220	Perennial vegetation of stony banks
1230	Vegetated seacliffs of the Atlantic and Baltic coasts
1170	Reefs
1160	Large Shallow inlets and bays
3260	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>CallitrichoBatrachion</i> Vegetation
91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> , <i>AlnoPadion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i> *

* denotes priority Annex I habitat

Table 5.4 Lower River Shannon cSAC Species of Qualifying Interest

Species code	Species name
1106	Salmon (<i>Salmo salar</i>) in freshwater
1095	Sea Lamprey (<i>Petromyzon marinus</i>)
1099	River Lamprey (<i>Lampetra fluviatilis</i>)
1355	Otter (<i>Lutra lutra</i>)
1349	Bottlenose Dolphin (<i>Tursiops truncatus</i>)
1029	Freshwater Pearl Mussel (<i>Margaritifera margaritiera</i>)

The Lower River Shannon cSAC is a very large site which stretches approximately 120km along the Shannon Valley from Killaloe to Loop Head/ Kerry Head. The site encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon, Feale and Mulkear Catchments, and the marine area between Loop Head and Kerry Head.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats included in Annex I of the E.U. habitats directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, *Salicornia* mudflats, sandbanks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays, all habitats listed on Annex I of the EU Habitats Directive.

This site is also selected for the following species listed on Annex II of the same Directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Twaite Shad, Freshwater Pearl Mussel, Atlantic Salmon and Otter. The fish species recorded in the Irish Red Data List are also recorded within the SAC and include Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis*).

A number of species of plant which are listed in the Irish Red Data List are also present in the SAC and include: Triangular Club Rush (*Scirpus triquetrus*), Opposite-leaved Pondweed (*Groenlandia densa*), Meadow Barley (*Hordeum secalinum*), Hairy Violet (*Viola hirta*), Golden Dock (*Rumex maritimus*), Bearded Stonewort (*Chara canescens*) and Convergent Stonewort (*Chara cf. connivens*).

The Lower River Shannon SAC is one of the most important sites in Ireland for over wintering waterfowl and several of these species are included in Annex I of the EU Birds Directive. They include; Great Northern Diver, Whooper Swan, Pale-bellied Brent Goose, Golden Plover and Bar-tailed Godwit. Past records show three separate flocks of Greenland White-fronted Goose using the area but none have been recorded since 1993/94. This is the most important site in Ireland for populations of waders including lapwing, dunlin, snipe and redshank and also provides an important staging ground for black-tailed godwit and greenshank. Indeed the Shannon and Fergus estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus rivers to the mouth of the Shannon Estuary and support more waders and waterfowl than anywhere else in the country (NPWS, 2005). A number of species included on Annex I of the EU Birds Directive breed within the site and they include; Peregrine Falcon, Sandwich Tern, Common Tern and Kingfisher. Other breeding birds of note include Kittiwake and Guillemot (NPWS, 2005). The remaining ecological information on protected species contained within the Natura 2000 Data Form for the Lower River Shannon cSAC is summarised in Tables 5.5 to 5.6 (NPWS, 2011).

Table 5.5: Important Waterbirds of the Lower River Shannon SAC

Code	Species Name (Common Name)
A003	<i>Gavia immer</i> (Great Northern Diver)
A001	<i>Gavia stellata</i> (Red- throated Diver)
A010	<i>Calonectris diomedea</i> (Corys Shearwater)
A037	<i>Cygnus columbianus bewickii</i> (Bewicks Swan)
A038	<i>Cygnus cygnus</i> (Whooper Swan)
A046	<i>Branta bernicla hrota</i> (Pale-bellied Brent Goose)
A140	<i>Pluvialis apricaria</i> (Golden Plover)
A157	<i>Limosa lapponica</i> (Bar-tailed Godwit)
A103	<i>Falco peregrinus</i> (Peregrine Falcon)
A015	<i>Oceanodroma leucorhoa</i> (Leach's Storm Petrel)
A098	<i>Falco columbarius</i> (Merlin)
A191	<i>Sterna sandvicensis</i> (Sandwich Tern)
A193	<i>Sterna hirundo</i> (Common Tern)
A194	<i>Sterna paradisaea</i> (Arctic Tern)
A346	<i>Pyrrhocorax pyrrhocorax</i> (Chough)
A229	<i>Alcedo atthis</i> (Kingfisher)
A157	<i>Limosa lapponica</i> (Bar-tailed Godwit)
A395	<i>Anser albifrons flavirostris</i> (Greenland White-fronted Goose)

Table 5.6: Other Species of Flora and Fauna of Importance

Species Name (Common Name)
<i>Scirpus triquetrus</i> (Triangular Club Rush)
<i>Groenlandia densa</i> (Opposite-leaved Pondweed)
<i>Hordeum secalinum</i> (Meadow Barley)
<i>Viola hirta</i> (Hairy Violet)
<i>Rumex maritimus</i> (Golden Dock)
<i>Mentha pulegium</i> (Pennyroyal)
<i>Agrostemma githago</i> (Corn Cockle)
<i>Chara canescens</i> (Bearded Stonewort)
<i>Chara connivens</i> (Convergent Stonewort)
<i>Osmerus eperlanus</i> (European Smelt)
<i>Coregonus autumnalis</i> (Pollan)
<i>Eleocharis parvula</i> P to 1950s (Dwarf-Spike Rush)
<i>Limonium recurvum</i> subsp. <i>Pseudotran</i> Western Sea Lavender
<i>Atropa belladonna</i> (Deadly Nightshade)
<i>Leucojum aestivum</i> (Summer Snowflake)
<i>Thymosia guernei</i> (a sponge species)
<i>Paracentrotus lividus</i> (Purple Sea Urchin)
<i>Diazona violacea</i> (Football Sea Squirt)
<i>Archidistoma aggregatum</i> (a tunicate species)

5.2.2 River Shannon and River Fergus Estuaries SPA (Site Code: 004077)

The current conservation objective of this site is:-

To maintain the favourable conservation status of the Qualifying Interests of the SAC, or the Special Conservation Interests of the SPA (see Table 5.7).

Table 5.7: River Shannon and River Fergus Estuaries SPA Special Conservation Interests

Code	Species Name (Common Name)	Status
[A017]	Cormorant (<i>Phalacrocorax carbo</i>)	Breeding + Wintering
]A046]	Light-bellied Brent Goose (<i>Branta bernicla hrota</i>)	Wintering
[A048]	Shelduck (<i>Tadorna tadorna</i>)	Wintering
[A050]	Wigeon (<i>Anas penelope</i>)	Wintering
[A052]	Teal (<i>Anas crecca</i>)	Wintering
[A054]	Pintail (<i>Anas acuta</i>)	Wintering
[A056]	Shoveler (<i>Anas clypeata</i>)	Wintering
[A062]	Scaup (<i>Aythya marila</i>)	Wintering
[A137]	Ringed Plover (<i>Charadrius hiaticula</i>)	Wintering
[A140]	Golden Plover (<i>Pluvialis apricaria</i>)	Wintering
[A141]	Grey Plover (<i>Pluvialis squatarola</i>)	Wintering

[A142]	Lapwing (<i>Vanellus vanellus</i>)	Wintering
[A143]	Knot (<i>Calidris canutus</i>)	Wintering
[A149]	Dunlin (<i>Calidris alpina</i>)	Wintering
[A156]	Black-tailed Godwit (<i>Limosa limosa</i>)	Wintering
[A157]	Bar-tailed Godwit (<i>Limosa lapponica</i>)	Wintering
[A160]	Curlew (<i>Numenius arquata</i>)	Wintering
[A162]	Redshank (<i>Tringa totanus</i>)	Wintering
[A164]	Greenshank (<i>Tringa nebularia</i>)	Wintering
[A179]	Black-headed Gull (<i>Chroicocephalus ridibundus</i>)	Wintering
[A999]	Wetlands & Waterbirds	

The estuaries of the River Shannon and River Fergus SPA form the largest estuarine complex in Ireland. The site comprises all of the estuarine habitat west from Limerick City and south from Ennis, extending west as far as Killadysert and Foynes on the north and south shores respectively of the River Shannon (a distance of some 25 km from east to west). Also included are several areas in the outer Shannon estuary, notably Clonderalaw Bay and Poulasherry Bay, as well as the intertidal areas on the south shore of the Shannon between Tarbert and Beal Point. There is a vast array of plants within the area that makes up the River Shannon and River Fergus Estuaries SPA however none are listed on Annex II of the EU Habitats Directive. However the floral biodiversity of the site is crucial to the well being of the avifauna for which the area was designated. There is one species of plant of national importance which grows at the site; Triangular Club-rush (*Scirpus triquetrus*) is present and is a species listed in the Irish Red Data List.

The site is the most important coastal wetland in the country and regularly supports in excess of 50,000 wintering waterfowl, which is a concentration easily of international importance. The site has internationally important populations of Dunlin (*Calidris alpina*), Black-tailed Godwit (*Limosa limosa*) and Redshank (*Tringa totanus*). 16 other species have populations of national importance and they include: Cormorant (*Phalacrocorax carbo*), Whooper Swan (*Cygnus cygnus*), Greylag Goose (*Anser anser*), Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*), Teal (*Anas crecca*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Scaup (*Aythya marila*), Golden Plover (*Pluvialis apricaria*), Grey Plover (*Pluvialis squatarola*), Lapwing (*Vanellus vanellus*), Knot (*Calidris canutus*), Bar-tailed Godwit (*Limosa lapponica*), Curlew (*Numenius arquata*) and Greenshank (*Tringa nebularia*). Golden Plover, Bar-tailed Godwit and Whooper Swan are all listed on Annex I of the EU Birds Directive.

The site is the most important site in the country for species such as Dunlin, Grey Plover, Lapwing, Redshank and Shelduck and important migrants which utilise the SPA include Brent Goose (*Branta bernicla*), Greenland White-fronted Goose (*Anser albifrons flavirostris*), Black-tailed Godwit (*Limosa limosa*) and Whimbrel (*Numenius phaeopus*) (NPWS, 2005b).

5.2.3 Newhall and Edenvale Complex cSAC (Site Code: 002091), Pouladatig Cave cSAC (Site Code: 00037) and Newpark House pNHA (Site Code: 00061)

The Newhall and Edenvale Complex cSAC is made up of several different caves and other structures which are significant bat roost sites for the Lesser Horseshoe Bat (*Rhinolophus hipposideros*), listed on Annex II of the EU Habitats Directive. The area surrounding the caves is also an ideal foraging area for this bat species. This is considered one of the most important sites in Europe for the Lesser Horseshoe Bat.

Pouladatig cSAC is made up of a single cave with a stream running through it and is considered a safe hibernation site for the Lesser Horseshoe Bat.

Newpark House pNHA is a guesthouse which has outbuildings which are used by the Lesser Horseshoe Bat. The site is considered an internationally important nursery site.

The conservation objective of these Natura 2000 sites are:-

To maintain or restore the favourable conservation condition of the Annex I habitats and/ or the Annex II species for which the SAC has been selected (see Table 5.8).

Table 5.8 Newhall and Edenvale Complex cSAC (Site Code: 002091), Pouladatiig Cave cSAC (Site Code: 00037) Species and Habitats of Qualifying Interest

Species code	Species name
1303	Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)
8310	Caves not open to the public

5.3 PRESENCE OF QUALIFYING INTERESTS AND SPECIAL CONSERVATION INTERESTS IN THE ZONE OF INFLUENCE OF THE WORKS AREA.

5.3.1 Qualifying Interests

ANNEX I HABITATS

Annex I habitats were not recorded present within the works area for the Project. The Annex I habitats ‘Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation 3260’ and ‘Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, *Ano-padion*, *Alnion incanae*, *Salicion albae* 91E0’ are known to be present within and along the River Fergus upstream of the works area (Aquafact, 2011).

A number of Annex I habitats listed as Qualifying Interests for the Lower Shannon SAC are located downstream in the zone of influence of the works e.g. ‘Estuaries 1130’. Details of potential Annex I habitats downstream of the proposed works which may be impacted by the Project are detailed in Table 5.9.

ANNEX II SPECIES

The Annex II species known to be present within the zone of influence of works and listed as Qualifying Interests for the Lower Shannon SAC are: Otter (*Lutra lutra*), Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*) and Atlantic Salmon (*Salmo salar*) (see Table 5.9).

Atlantic Salmon

The River Fergus catchment is classified as an important system for Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*). McGinnity et al. (2003) details the Owenea River as one of 173 national Atlantic Salmon and Sea Trout migratory systems and accounts for 1.12% of the national accessible spawning habitat for the species.

While Atlantic Salmon are present in the River Fergus, the findings of the survey of the backdrain, Ballybeg and at St. Flannan’s streams recorded the absence of suitable spawning habitats for Atlantic Salmon within the works area because of the limited gravels found to be present (see Appendix B).

The overall national conservation status of this species has been assessed as bad (NPWS, 2008).

Otter

Otter (*Lutra lutra*) are widespread within the Lower River Shannon cSAC. Otter tracks, scat and a slide were identified under the railway bridge at Clare Abbey and at one location on the existing flood defence earthen embankment (see Appendix B). Nesting holts could potentially be present in the existing flood defence earthen embankment, however, none were recorded during the survey. Ballybeg and St. Flannan's Stream are considered unlikely to support Otter due to the absence/abundance of suitable prey items/food source.

The conservation status of this species is dependent on fish stocks, which are ultimately dependent on water quality. The conservation status of this species within the Lower River Shannon cSAC is not currently available; however, the overall national conservation status is evaluated as being 'Inadequate' (NPWS 2008). Otters are considered 'Near Threatened' by Marnell et al. (2009).

Sea, River (& Brook) Lamprey

All three of the species have been confirmed present in the River Fergus in the footprint of the works according to the "River Fergus, Lower Ennis Certified Drainage Scheme- Supplementary Ecological Assessment" (Ecofact, 2009). Lamprey larval burrows are characteristically found at eddies or backwaters, on the inside of bends or behind obstructions, where current velocity is below that of the main stream and where organic material tends to accumulate (Kelly & King, 2001). They favour partially shaded areas, and the presence of aquatic plants. While Sea Lamprey (*Petromyzon marinus*) would not use the backdrain because of limited coarse substrata for spawning, the smaller River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*) would most likely use the existing sluices and backdrain because of the presence of fine silt and sand in the channel. Potential for Brook Lamprey (*Lampetra planeri*) was also recorded at the location of the existing sluices within the backdrain during the site survey and at Ballybeg and St. Flannan's Streams. No lamprey were however found present during surveys.

The overall national conservation status of River and Brook Lamprey has been assessed as good (NPWS, 2008).

Table 5.9: Qualifying Interests of the Lower River Shannon cSAC within the zone of influence of the works

	Code	Qualifying Interest	Zone of Influence	Recorded during site surveys
Annex I Habitats	1150	Coastal lagoons*	✓	
	6410	<i>Molinia</i> Meadows on Chalk and Clay (Eu-Molinion)		
	1130	Estuaries	✓	
	1140	Mudflats and Sandflats not covered by water at low tide	✓	
	1330	Atlantic Salt Meadows (<i>Glauco-puccinellietalia</i>		
	1410	Mediterranean Salt Meadows		
	1310	<i>Salicornia</i> and other annuals colonizing mud and sand	✓	
	1110	Sandbanks which are slightly covered by seawater at all times	✓	
	1220	Perennial vegetation of stony banks		
	1230	Vegetated sea cliffs of the Atlantic and Baltic		

	Code	Qualifying Interest	Zone of Influence	Recorded during site surveys
		coasts		
	1170	Reefs		
	1160	Large Shallow inlets and bays	✓	
	3260	Floating Vegetation of <i>Ranunculus</i> of Plane, Submountainous Rivers	✓	
	91E0	Residual Alluvial Forests (<i>Alnion glutinoso-incanae</i>)*		
Annex II Species	1349	Bottlenose Dolphin <i>Tursiops</i> sp.		
	1355	<i>Lutra lutra</i> (Otter)	✓	✓
	1095	<i>Petromyzon marinus</i> (Sea Lamprey)	✓	
	1099	<i>Lampetra fluviatilis</i> (River Lamprey)	✓	*
	1096	<i>Lamptera planeri</i> (Brook Lamprey)	✓	*
	1106	<i>Salmo salar</i> (Atlantic Salmon)	✓	
	1029	<i>Margaritifera margaritifera</i> (Freshwater Pearl Mussel)		

* Not recorded during site survey, but potential for lamprey is present in the form of suitable habitat within the backdrain, Ballybeg Stream and St. Flannan’s Stream.

Lesser Horseshoe Bat

The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is listed as the Qualifying Interest for Newhall and Edenvale Complex cSAC (Site Code: 002091), Pouladatig Cave cSAC (Site Code: 00037) (and Newpark House pNHA Site Code: 00061). According to Aquafact (2011) Lesser Horseshoe Bats are present in the general area (of the River Fergus); however, this species will not use the River Fergus above Cusack Park due to the presence of lighting on the sports ground. The proposed works are located downstream of Cusack Park, therefore, Lesser Horseshoe Bats may utilise the River Fergus corridor in the footprint of the works as a commuting/foraging route (see Table 5.10).

As discussed above, the known roosting sites of the Lesser Horseshoe Bats within the Natura 2000 sites are not within the zone of influence of the works. A Lesser Horseshoe Bat roost has however recently been recorded in a building in Ennis town by Scott-Cawley (Julie Fossitt, pers. comm.) outside of the footprint of the works.

While there are a number of semi- and mature Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and Willow (*Salix* sp) trees recorded along the southern end of the flood defence embankment, these are not considered suitable for bat roosts. The railway bridge and the N85 road bridge are also considered unsuitable for bats due to the absence of suitable roosting sites. No bat boxes were identified on the N85 road bridge structure during the site survey, however, the use of bat boxes on the river bridge is described in the Environmental Impact Statement (EIS) for the N85 (Babtie Pettitt Ltd., 2000).

A Tree-line (WL2) of mature Horse Chestnut (*Aesculus hippocastanum*) and Sycamore (*Acer pseudoplatanus*) trees runs parallel to St. Flannan’s Stream on the grounds of St. Flannan’s College outside of the proposed works area. There is potential for bats to utilise these trees for roosting.

The overall national conservation status of all ten bats species known to occur in Ireland has been assessed as good (NPWS, 2008).

Table 5.10: Qualifying Interests of the Newhall and Edenvale Complex cSAC and Pouladattig Cave cSAC within the zone of influence of the works

	Code	Qualifying Interest	Zone of Influence	Recorded during site surveys
Annex I Habitats	8310	Caves not open to the public		
Annex II Species	13.3	Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	✓	

5.3.2 Special Conservation Interests

Of the 21 species listed as Special Conservation Interests for the River Shannon and River Fergus Estuaries SPA, Cormorant (*Phalacrocorax carbo*) were the only species recorded during the site survey. However, this was expected due to the timing of the survey as the majority of species overwinter in Ireland, while a smaller number of species have both resident and overwintering populations in Ireland.

With the exception of Black-tailed Godwit (*Limosa limosa*) and other Special Conservation Interest species which will feed on grasslands, the majority of the Special Conservation Interest species of the River Shannon and River Fergus Estuaries SPA are not known to utilise the habitats adjacent to the proposed Ennis South Flood Relief Scheme, tending instead to remain along the lower reaches of the River Fergus and in the estuarine habitats downstream (Aquafact, 2009). These downstream habitats are however, within the zone of influence of the works of indirect impacts. Shelduck (*Tadorna tadorna*), Wigeon (*Anas penelope*) and Teal (*Anas crecca*) may, however, occasionally move up the River Fergus to feed (Aquafact, 2009).

Cormorants are categorised as diving wildfowl. They feed on fish (Crowe et al., 2009) and may overwinter at sea or inland. Potential suitable wintering habitat and foraging areas for this species was recorded on the River Fergus within and adjacent to the works area and this species was also recorded present.

Black-tailed Godwit are visual and tactile feeders which feed on a range of invertebrates, including bivalves, polychaete worms and shore crabs. They prefer to feed on muddier estuaries, but also feed in brackish pools and on nearby rough pasture. While on pasture, they feed on the larvae of crane fly (*Tipulidae*) and on the amphipod *Corophium volutator*. They breed in lowland wet grassland and marshes. Nine breeding sites were identified in Ireland during the last breeding atlas. More recently, birds were present during the breeding season between 1996 and 1999 inclusive, though breeding was not proven. In winter they are known to utilise a variety of habitats, both inland (particularly grassland and river deltas) and coastal (particularly estuaries), though seldom seen along non-estuarine coast. Suitable wintering habitat for this and other similar species was recorded in the Improved Agricultural Grassland (GA1) adjacent to the proposed works area.

Small seeds predominate in the diet of Teal, but *Enteromorpha* sp. and molluscs are also frequently taken. They occasionally feed on chironomid larvae where available, though usually only during the summer months. They generally feed by day where they are safe from shooting and nest near small freshwater lakes or pools and small upland streams away from the coast, and also in thick cover. In winter they are widespread on wetlands with good cover, such as reedbeds. Suitable wintering reedbed habitat in the form of Reed and large sedge swamp (FS1) for this species was recorded within the proposed works area.

Shelducks' chief prey source is *Hydrobia ulvae*, which is present in almost all estuaries, and often in large numbers. Spatial distribution is strongly influenced by the behaviour of this prey, particularly in relation to water depth. They possibly feed at night, detecting prey by tactile clues using their bills. The species breeds in open areas along seashores, larger lakes and rivers and nests in holes in river banks and trees, and occasionally in straw stacks or buildings. There has been a recent expansion in the range of the northwest European population, and birds in Ireland and Britain have been displaced from coastal breeding sites and are increasingly using inland sites. In winter they roost in sheltered estuaries or tidal mudflats. Suitable wintering habitat for this species was not recorded within the proposed works area.

Wigeon graze on sea grass and algae, particularly on *Zostera* spp. and *Enteromorpha* spp., and also feed regularly on grasslands and cereal crops. Wintering Wigeon are widespread - they occur on coastal marshes, freshwater and brackish lagoons, estuaries, bays and may also occur on inland wetlands, lakes, rivers and turloughs. Suitable wetland habitat for this species was recorded within the Improved Agricultural Grassland (GA1) adjacent to the proposed works area.

These species may be disturbed whilst feeding or roosting overwinter within the works area and in the adjacent wetland and agricultural lands as a result of temporary noise and visual disturbance from the proposed works.

The downstream estuarine habitats supporting the remaining waterbirds of Special Conservation Interests are also within the zone of influence of potential indirect impacts on water quality as a result of the proposed works.

Table 5.13: Special Conservation Interests of the River Shannon and River Fergus Estuaries SPA within the Zone of Influence of the Works

Code	Species Name (Common Name)	Status	Zone of Influence	Recorded during site surveys
[A017]	Cormorant (<i>Phalacrocorax carbo</i>)	Breeding + Wintering	✓	✓
[A046]	Light-bellied Brent Goose (<i>Branta bernicla hrota</i>)	Wintering	✓	
[A048]	Shelduck (<i>Tadorna tadorna</i>)	Wintering	✓	
[A050]	Wigeon (<i>Anas penelope</i>)	Wintering	✓	
[A052]	Teal (<i>Anas crecca</i>)	Wintering	✓	
[A054]	Pintail (<i>Anas acuta</i>)	Wintering	✓	
[A056]	Shoveler (<i>Anas clypeata</i>)	Wintering	✓	
[A062]	Scaup (<i>Aythya marila</i>)	Wintering	✓	
[A137]	Ringed Plover (<i>Charadrius hiaticula</i>)	Wintering	✓	
[A140]	Golden Plover (<i>Pluvialis apricaria</i>)	Wintering	✓	
[A141]	Grey Plover (<i>Pluvialis squatarola</i>)	Wintering	✓	
[A142]	Lapwing (<i>Vanellus vanellus</i>)	Wintering	✓	
[A143]	Knot (<i>Calidris canutus</i>)	Wintering	✓	
[A149]	Dunlin (<i>Calidris alpina</i>)	Wintering	✓	
[A156]	Black-tailed Godwit (<i>Limosa limosa</i>)	Wintering	✓	
[A157]	Bar-tailed Godwit (<i>Limosa lapponica</i>)	Wintering	✓	
[A160]	Curlew (<i>Numenius arquata</i>)	Wintering	✓	
[A162]	Redshank (<i>Tringa totanus</i>)	Wintering	✓	

[A164]	Greenshank (<i>Tringa nebularia</i>)	Wintering	✓	
[A179]	Black-headed Gull (<i>Chroicocephalus ridibundus</i>)	Wintering	✓	
[A999]	Wetlands & Waterbirds		✓	

5.3.3 Other Habitats and Protected Species

HABITATS

Habitats recorded within and adjacent to the works area include Wet Grassland (GS4), Reed and tall sedge Swamp (FS1), Recolonising Bare ground (ED3), Dry meadows and grassy verges (GS2), Improved agricultural grassland (GA1), Drainage ditches (FW4), Tidal Rivers (CW2), Depositing/lowland rivers (FW2), ponding waterbodies (FL8), Tree-lines (WL2), and Willow (*Salix* sp.), Blackthorn (*Prunus spinosa*) and Hawthorn (*Crataegus monogyna*) Scrub (WS1) and scattered semi-mature and mature Willow (*Salix* sp.), Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*) trees (see Appendix B for details).

INVERTEBRATES

Molluscs

At Sluice Gate No. 3, potential suitable habitat for Desmoulin's Whorl Snail (*Vertigo moulinsiana*), an Annex II species which favours tall monocotyledon vegetation stands such as Reed and Large Sedge Swamp (FS1) and Tall Herb Swamp (FS2) (Kileen, 2003) and *Mercuria similis* (an IRDB species) which favours brackish water and Tall Reed and Large Sedge (FS1) vegetation was recorded during the River Habitat Corridor Survey based on connectivity of the site with Ballybeg Lough via a Drainage ditch (FW4). A molluscan survey of the habitats within the works area was subsequently undertaken by Dr. Evelyn Moorkens. However, these species were not recorded within the works area or in the adjacent habitats of the backdrain. It should be noted that while Ballybeg Stream is connected to Ballybeg Lough suitable habitat for molluscs was not recorded at the location of the proposed works on the flood overflow culvert during the River Habitat Corridor Survey therefore a targeted molluscan survey was not undertaken on the stream.

In the disturbed Wet Grassland (GS4)/Reed and large sedge swamp (FS1) habitats adjacent to the backdrain between Sluice Gate No. 4 and Sluice Gate No. 5 the Moss Bladder Snail (*Aplexa hypnorum*) was, however, recorded. This species was once widespread but is now strongly declining due to loss of habitat, such as infilling of farm ponds and ditches (Kerney, 1999), and land drainage in general. The species likes late successional habitats, with a network of ditches and ephemeral ponds and pools. The species is listed as "vulnerable" on the Irish molluscan Red Data List (Byrne *et al.*, 2009) (see Appendix C).

Butterflies

The rare Marsh Fritillary (*Euphydryas aurinia*) butterfly, an Annex II species occurs 0.75km east of the site in a large area of wet grassland at Skehanagh (National Biodiversity Data Centre, 2011). However the absence of Devil's Bit Scabious (*Succisa pratensis*) (its larval food plant) in the habitats adjacent to the backdrain would indicate the habitat is sub-optimal for this species.

Dragon- and Damselflies and Beetles

The Banded Jewelwing (*Calopteryx splendens*) dragonfly was recorded present during site surveys on the backdrain at Sluice Gate No. 3. A number of other dragonflies and damselflies were also recorded during site surveys along the backdrain including a Moorland Hawker (*Aeshna juncea*), Amberwinged Hawker (*Aeshna grandis*), Common Blue Damselfly (*Enallagma cyathigerum*), Four-spotted Chaser (*Libellula quadrimaculata*) and a Ruddy Darter (*Sympetrum sanguineum*).

A Four-spotted Chaser (*Libellula quadrimaculata*) was also recorded during site surveys at the swallow-hole on Ballybeg Stream.

Dragonfly and damselfly larva were not recorded from the aquatic habitat of the backdrain species) during sampling indicating that the backdrain habitat does not support the early life stages of these species.

Water Beetles

Only two common beetles were recorded in the backdrain during sampling, *Dytiscus marginalis* and *Platambus* sp. (see Appendix B).

FISH

The critically endangered European Eel (*Anguilla Anguilla*) (Kottelat 2010) which is considered to be the most at threat fish species in Ireland in a recent Irish red listed publication (King et al. 2011) was confirmed present in the form of numerous small elvers in the backdrain at Sluice Gate No. 4 and is known to be present in Ballybeg Stream. Potential for this species was also recorded from St. Flannan's Stream (see Appendix B). European Eel (*Anguilla anguilla*) is considered to be a species at risk in Europe. The European Eel has EU protective status under the European Eel Regulation EC No. 1100/2007 to facilitate the recovery of the eel stocks since the large decline in the 1980's.

Smelt (*Osmerus eperlanus*), another Irish Red Data listed species has been recorded from the River Fergus downstream of Ennis town and spawning has been recorded from Clonroad (or Knox's bridge) Bridge and downstream to the tidal barrage at Clarecastle. These species or potential habitat for this species was not recorded from the backdrain.

Pollan (*Coregonus autumnalis pollan*) are also known occur in the Lower River Shannon SAC. Potential for Bolland was not recorded in the backdrain.

Brown Trout (*Salmo trutta*) are known to occur in the River Fergus. Potential for Brown Trout was recorded in the backdrain; but none were recorded during surveys.

Twaite Shad (*Allosa fallax fallax*) an Irish Red Data Listed while known from the River Fergus are not breeding in the River Fergus. Confirmed breeding sites are the River Barrow, Suir and Blackwater. Suitable habitat for this species was not recorded from the backdrain.

AMPHIBIANS AND REPTILES

It is likely that Common Frog (*Rana temporaria*) an Annex V species utilise the Drainage ditches (FW4) associated with the backdrain. Common Frog was confirmed present in the Wet Grassland (GS4) adjacent to the N85 road bridge.

Common Frog and Smooth Newt (*Trituris vulgaris*) are likely to utilise Ballybeg Stream and associated swallow-hole, while Common Frog are likely to utilise St. Flannan's Stream.

The Recolonising bare ground (ED3) adjacent to the embankment and the habitat at Ballybeg Stream contain suitable habitat to support Common Lizard (*Lacerta vivipara*); however, this species was not found during the course of the site surveys.

BIRDS

Several protected waterbird species including Mute Swan (*Cygnus olor*), Mallard (*Anas platyrhynchos*) and Grey Heron (*Ardea cinerea*) are known to utilise the River Fergus. Grey Heron (*Ardea cinerea*) and the Annex I species Kingfisher (*Alcedo atthis*) were recorded present in the grasslands habitats adjacent to the backdrain during the River Habitat Corridor Survey site survey in August 2012. Due to the

absence/abundance of suitable prey items/food resources the backdrain habitat is not considered suitable for Kingfisher. Suitable habitat for nesting Kingfisher was also not recorded during surveys of the embankment and backdrain within the proposed works area. Potential perching sites for Kingfisher were recorded on the riverside of the embankment during site surveys. Kingfisher are likely to utilise the River Fergus for nesting and as a commuting/foraging route. Two Grey Heron (*Ardea cinerea*) were noted feeding in the backdrain during surveys, while 20 No. Mallard (*Anas platyrhynchos*) were recorded in the River Fergus.

BATS

Aquafact (2011) noted that Annex IV species Daubenton's bat and Soprano Pipistrelle are known to be common along the River Fergus. Please refer to Section 3.1 for details of potential bat roosts and foraging areas within the zone of influence of the works area.

PLANTS

The proposed Project traverses the 10km grid square R37. No rare or protected plant species including those known to occur within this hectad were recorded during the site survey within the proposed works area (see Appendix B). Nationally scarce and localised plant species Great Water Dock (*Rumex hydrolapathum*) and Frogbit (*Hydrocharis morsus-ranae*) were recorded at the swallow-hole on Ballybeg Stream. Reed Sweet-grass (*Glyceria maxima*) and Greater Pond Sedge (*Carex riparia*) were also recorded within the marginal vegetation of the backdrain between Sluice Gates No. 3 and 4 (see Appendix B).

MAMMALS

Badger (*Meles meles*) tracks were also noted near Section C of the proposed flood defence earthen embankment works close to the ruins of Clareabbey. No signs of Badger activity such as snuffle holes were identified during surveys within the proposed works area. It is unlikely that Badgers would dig setts in the embankment as the embankment would not provide suitable burrowing substrata because of wet ground conditions and tidal inundation. No Badger setts were recorded during the site surveys.

No signs of Badger activity were recorded at Ballybeg and St. Flannans Stream.

6. PATHWAYS FOR POTENTIAL IMPACTS

As the proposed works on the flood defence earthen embankment run parallel, and within the boundary of the Lower River Shannon SAC, there is potential for direct impacts on the SAC via the loss of habitat within the works area.

Vectors or pathways for indirect impacts via water relate to the release of pollutants during in-stream works on the embankment, the backdrain and at the location of the three Sluice Gates and during works at Ballybeg Stream and St. Flannan's Stream, via overland flows of ponding surface water or percolation into groundwaters.

Vectors or pathways for indirect impacts by land or air relate to wind and the distribution of airborne pollutants and particulates such as dust between the proposed works and the SAC. Due to proximity of works on the backdrain and the embankment, impacts from noise, light and visual disturbance on the habitats and species within the SAC are also possible.

There is also potential for vibration related impacts as a result of piling and rock breaking activities.

Non-native invasive species can spread over land as a result of disturbance and transportation of soil and other means during construction activities.

The proposed works on the embankment and backdrain are located 0.25km upstream of the River Shannon and River Fergus Estuaries SPA and there is connectivity between the proposed works and the River Fergus via the sluices on the connecting channel to the backdrain. Vectors or pathways for indirect impacts by water relate to the release of pollutants into the River Fergus which may be carried downstream into the estuarine habitats of the SPA.

Light pollution caused by site works may also impact on the commuting/foraging corridor of Lesser Horseshoe Bat.

7. LIKELY SIGNIFICANT EFFECTS

7.1 QUALIFYING INTERESTS

The existing flood defence embankment footprint overlaps with 3.1hA of the Lower River Shannon SAC. The proposed works to the embankment overlap with 2.9hA of the SAC only, due to the fact that it is proposed to undertake the majority of the proposed works on the landward side of the embankment, away from the SAC boundary.

The potential for adverse effects on the Lower River Shannon SAC have been identified with regard to direct impacts on Qualifying Interests i.e. Annex I habitats and indirect impacts on water quality affecting Qualifying Interests i.e. the Annex II species within the River Fergus in the vicinity of the works and the Annex I habitats of the SAC downstream of the Project (which could also have a knock on effect on the wetland habitat supporting the Special Conservation Interests of the SPA).

There is also potential for direct and indirect impacts on Annex II listed aquatic species which may inhabit the backdrain and the River Fergus as a result of the limited instream works required at 3 No. discrete sluice gate locations and at Ballybeg Stream and St. Flannan's Stream.

Annex I habitats could also potentially be affected by non-native invasive plant species. Non-native invasive species could also be introduced into the study area and spread downstream into the SAC area in the absence of mitigation measures.

There is also potential for indirect impacts from noise, light, dust and visual disturbance on Annex II species or the habitat of these species during the construction phase.

7.1.1 Annex I Habitats

There are no Annex I habitats located within the footprint of the works. While the Annex I habitats listed as Qualifying Interests for the Lower Shannon SAC 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitricho-Batrachion* vegetation 3260' and 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, *Ano-padion*, *Alnion incanae*, *Salicion albae*) 91E0' are known to be present along the River Fergus upstream of the works area (Aquafact, 2011), these habitats were not recorded from the River Fergus during site surveys. Therefore, direct impacts to Annex I habitats of Qualifying Interest are not anticipated.

Indirect impacts to 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitricho-Batrachion* vegetation 3260' may occur if tidal incursions carried silt laden waters to upstream stands of *Ranunculus* vegetation. However, as *Ranunculus* vegetation floats on top of the water, impacts arising from a reduction in photosynthesis as a result of silt laden waters are unlikely. Impacts arising from the accidental spillage or release of hydrocarbons could result in a slight to moderate negative impact on the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitricho-Batrachion* vegetation 3260'.

A pathway exists for indirect impacts on the Annex I habitat 'Estuaries 1130' downstream in the Lower River Shannon SAC via a reduction in water quality arising from the construction phase of the Project. In the absence of avoidance and mitigation measures, a significant and/or continual pollution event, during the construction phase, could result in a deterioration of the water quality within the River Fergus with knock on impacts on the Annex II species and Annex I species utilising the estuarine habitats of the lower River Fergus estuary within the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.

7.1.2 Annex II Species

ATLANTIC SALMON

Construction Phase - General

There is potential for temporary moderate indirect negative impacts on the water dependant Annex II species Atlantic Salmon with regard to reduced water quality affecting the instream habitats supporting these species. A chronic or large scale pollution event has the potential to result in a more severe impact.

The release of silts could impact directly on water dependant Annex II species by blocking the respiratory organs (i.e. gills) of fish and the breathing apparatus of filter feeders such as Freshwater Pearl Mussel (*Margaritifera margaritifera*). Hydrocarbons and concrete fines could damage the respiratory organs and irritate and cause ulcerations on the skin of fish, amongst other impacts.

Construction Phase – Flood Overflow Culverts

Should works be constructed “in the wet” at the location of the swallow holes in St. Flannan’s and Ballybeg Streams, there is the potential for temporary indirect slight to moderate negative impacts on water quality in the event that silt laden surface water run-off from the excavation for the overflow weir enters the newly constructed culvert, or the existing swallow hole from where it would discharge to the backdrain and ultimately to the Lower River Shannon SAC. A similar risk will exist during the construction of the culverts themselves, should excavations fill with water.

Construction Phase – Embankment Works

During proposed works on the existing embankments, there is potential for temporary indirect slight to moderate negative impacts on water quality due to the proximity of the works to the River Fergus. Potential water quality impacts that may arise during the construction works to the existing embankment include:

- Pollution of the River Fergus as a result of silt laden runoff from exposed soil on the existing embankment during construction,
- Pollution of the River Fergus as a result of concrete or cement entering the river during construction of the flood wall,
- Pollution of the River Fergus as a result of the accidental release or spillage with other polluting substances such as fuels, lubricants from construction plant.

Construction Phase – Backdrain

During proposed works to fill in the existing backdrain and to excavate the new backdrain, there is potential for temporary indirect slight to moderate negative impacts on water quality as a result of:

- Pollution of the River Fergus as a result of silt laden runoff during excavation for the new backdrain,
- Pollution of the River Fergus as a result of the accidental release or spillage with other polluting substances such as fuels, lubricants from construction plant.

Construction Phase – Sluice Gates

During works on the sluices on the banks of the River Fergus at three discrete locations, there is potential for a more significant impact due to proximity of works to the River Fergus. Potential water quality impacts that may arise include:-

- Pollution of the River Fergus from suspended solids as a result of silt laden runoff from exposed soil during the excavation for the headwall formation,
- Pollution of the River Fergus due to disturbance of fine benthic substrates such as silts in the course of instream construction and excavation works,

- Pollution of the River Fergus with other polluting substances such as fuels, lubricants from construction plant.

In addition to the water quality impacts described above, there is also potential for the temporary loss of instream habitat i.e. 20m² in the River Fergus at the location of the 3 No. sluice gates due to localised instream works. It is anticipated that these works will result in the disturbance of the benthic river substrate and a localised indirect temporary slight to moderate negative impact on the diversity/abundances of macro-invertebrate communities and smaller fish species which form part of the food chain of Atlantic Salmon.

Construction Phase – Emergency Pumping Station

During works on the emergency pumping station in the Clare Abbey floodplain, there is potential for temporary indirect slight to moderate negative impacts on water quality as a result of:

- Pollution of the River Fergus from suspended solids as a result of silt laden runoff from the excavation for the pumping station,
- Pollution of the River Fergus as a result of concrete or cement entering the river during construction of the pumping station,
- Pollution of the River Fergus with other polluting substances such as fuels, lubricants from construction plant.

Operational Phase – all elements of works

As the proposed backdrain does not provided suitable habitat for Atlantic Salmon no impact on this species is anticipated as a result of the infilling of 350m long stretch of the backdrain habitat.

During maintenance work to unblock the backdrain there is potential for the release of suspended solids from the backdrain into the River Fergus via the sluice gates. Occasional routine maintenance will take place over an average period of 1 week every 2 to 3 years on the flood defence earthen embankment where minor works maybe required on localised sections of the embankment as a result of minor settlement, flood damage or removal of vegetation which can cause instability. Temporary indirect slight negative impacts could therefore arise as a result of maintenance activities and are similar to those of the construction phase. However, as maintenance works taken place previously on the existing flood defence earthen embankment, maintenance works are considered an existing impact and are not considered additional impacts as a result of the proposed Ennis South Flood Relief Scheme. It should also be noted that the use of the geogrid in the design of the flood defence earthen embankment will, however, improve the stability of the embankment thus reducing the extent of temporary disturbance that would otherwise be associated with maintenance works in the future.

SEA, RIVER (AND BROOK) LAMPREY

Construction Phase

In addition to the potential water quality impacts described above in relation to Atlantic Salmon, there is a risk of potential impact to River and Brook Lamprey as a result of the in-stream works proposed to the existing backdrain and at Ballybeg and St. Flannan's Streams as follows:

- Permanent loss of 350m of instream habitat and connectivity within the backdrain and temporary loss of the remaining backdrain habitat which is to be diverted and realigned to facilitate the upgrade of the flood defence earthen embankment,
- Loss of instream habitat within Ballybeg and St. Flannan's Streams due to the construction of the flood overflow culverts.

The backdrain habitat is an anthropogenic channel constructed in the 1950's as part of the flood defence earthen embankment. Since this time Lamprey (if present within the backdrain) have had access to the backdrain only as a result of the malfunctioning sluice gates. It should be noted that Lamprey, if translocated, to the new channel will have only limited access to the backdrain from the River Fergus and vice versa as repairs will have been made to the malfunctioning sluice gates.

Operational Phase

There is potential for permanent loss of lamprey habitat as a result of the infilling of 350m long stretch of the backdrain habitat. This will result in a permanent slight negative impact on lamprey in the context of the extent of Drainage ditch (FW4) habitat present within the Clare Abbey floodplains.

The realigned backdrain will provide habitat for lamprey during the operational phase of the project. However, limited access will be available to lamprey via the sluice gates as described above.

In addition to the potential water quality impacts described above for Atlantic Salmon, it is expected that periodic maintenance works to maintain the capacity of the backdrain during the operation of the scheme, would also maintain fish passage and connectivity to habitat for lamprey if the species were to gain access to the realigned backdrain. This will result in a neutral (provision of the realigned backdrain) to slight positive (maintenance of the backdrain channel) impact on River and Brook Lamprey.

OTTER

Construction Phase

While Otter activity was recorded during site visits, however, no Otter holts were identified within the works area.

Otter may also be disturbed whilst feeding/commuting, as a result of noise, vibration and visual disturbance from proposed works on the embankment, backdrain, sluice gates and pumping station. It should be considered that Otters are generally crepuscular animals. Given that the works are generally undertaken during full daylight hours this would suggest that disturbance of foraging would not be a factor during these hours. While the surrounding land-uses i.e. Ennis town accord a high level of acceptance of noise by existing wildlife, Otters are likely to avoid works by leaving resting in holts and lay-ups during the day due to noise and visual disturbance from proposed works. If Otter holts were present, disturbance of an Otter resting in a holt would result in a temporary indirect slight negative impact. The significance would potentially be higher, however, while females are rearing cubs as it would be more difficult for a female to move cubs than say a male to move resting locations (Envirocentre, 2006).

The potential for water quality impacts resulting from any elements of the works arising from the Project on the River Fergus is not considered to be on a scale which may result in indirect impacts on Otter within the Lower River Shannon cSAC. Slight to moderate indirect negative impacts affecting Otter may potentially arise as a result of:

- Reduced food supply i.e. where impacts affecting water quality may result in reduced macro-invertebrate community and fisheries production. The Otter is dependent on fish stocks, which are ultimately dependent on water quality,
- Loss of vegetation cover in relation to the proposed embankment works,
- Noise, light and visual disturbance during the construction phase due to the presence of plant machinery and humans,
- Vibration and noise related impacts from rock breaking and piling activities.

Operational Phase

While no Otter holts or Badgers setts were recorded along the 2.7km long section of embankment which is the focus of this study, one Otter holt and two Badger setts have been recorded along the existing embankment outside of the study area (Aquafact, 2011). The use of a geogrid membrane in the construction of the upgraded embankment will reduce opportunities for Otters and Badgers to dig out holts/setts in the embankment. It is not considered that the use of the geogrid poses an impact to Otters given that Otter have not constructed holts in this section of embankment to date. Furthermore, the function of the geogrid in the design is to reduce the extent of future temporary disturbance that would otherwise be associated with maintenance works to address instability issues in the absence of the geogrid. It should be noted, however, that in addressing long-term instability issues (including a reduction in extent of disturbance associated with routine maintenance activities) the use of the membrane will create a barrier to the re-growth of trees and shrubs along the upgraded flood defence earthen embankment. This will permanently prevent the natural recolonisation of Scrub (WS1) vegetation and scattered trees overtime which provided woody vegetation cover along sections of the embankment. The membrane will however allow the recolonisation of Reed and large sedge swamp (FS1) vegetation on the toe of the embankment and tall ruderal and pioneer herbaceous species which will provide cover for mammals.

ANNEX IV SPECIES

Construction Phase

The Tree-line (WL2) at St. Flannan's Stream contains mature trees with potential for bat roosts. However, these trees are located outside and adjacent to the proposed works area. Potential impacts to bats may arise as a result of accidental damage to these trees during works on the flood overflow culvert at St. Flannans Stream.

The use of temporary site lighting during the construction phase may disrupt the foraging areas/commuting route of bat species. Based on the extent of light pollution in the surrounding environment i.e. Ennis town, associated road infrastructure, the use of temporary site lighting could have a slight to moderate negative impact on the foraging route of the bat species.

The planned removal of Scrub (WS1) vegetation along different sections of the embankment is unlikely to result in reduced foraging areas for Lesser Horseshoe Bats, Daubenton's Bat and Soprano Pipistrelle bats given the extent of area involved. For details relating to impacts of planned vegetation removal relative to commuting corridors refer to Operational Phase.

Operational Phase

No permanent site lighting is proposed as part of the design.

As described above the use of the geogrid membrane on the embankment will create a barrier to the re-growth of trees and shrubs and will permanently prevent the natural recolonisation of Scrub (WS1) vegetation and scattered trees overtime which provided cover along sections of the embankment. Bats generally use corridors of tall vegetation, such as Hedgerow (WL1) and Tree-lines (WL2) to commute between their foraging areas and roosts. Lesser Horseshoe Bats are known to be very dependant on the existence of such corridors for their commuting routes. It should be noted that the Scrub (WS1) vegetation along the embankment and backdrain is not continuous and is absent along the majority of the embankment, and backdrain therefore it is unlikely that it is the Scrub (WS1) vegetation along the embankment which currently provides a corridor for bats within the landscape. It is considered likely that it is the 4.0m high embankment structure which is colonised by tall ruderal and pioneer herbaceous species which provides the corridor. The membrane will, however, permit the natural recolonisation of these species post-construction.

7.2 SPECIAL CONSERVATION INTERESTS

Construction Phase

As above for Qualifying Interests with the exception of potential direct impacts on (1) foraging areas and wintering nesting sites of Special Conservation Interests within the works area, and indirect impacts as a result of (2) noise and (3) visual disturbance to birds whilst feeding on the adjacent wetland and grasslands during the overwintering period as a result of the presence of plant machinery and humans.

It is likely that Special Conservation Interests species will utilise the Improved agricultural grassland (GA1), Wet Grassland (GS4) and Reed and large sedge swamp (FS1) vegetation adjacent to the backdrain for nesting and feeding during the winter period. There is potential for temporary significant impacts on Species Conservation Interests as a result of the temporary loss of Reed and large sedge swamp (FS1) within the works area and as a result of noise, vibration and visual related impacts if works were to take place during the winter months. However, it should be noted that the Reed and large sedge swamp (FS1) on the River Fergus side of the embankment will not be disturbed within the exception of the localised works on the 3 No. sluice sates which will retain habitat for overwintering species. Also species such as Black-tailed Godwit and Wigeon are more likely to utilise the adjacent improved agricultural grassland habitats as opposed to the habitats within the proposed works area along the embankment, backdrain and haul road for feeding during the winter months.

Cormorants which have a resident population may also be disturbed if works take place during the summer months, however, it should be noted that it is the overwintering population of this species which is listed as a Special Conservation Interest for the River Shannon and River Fergus Estuaries SPA.

A temporary slight to moderate negative impacts on water quality (as discussed above in relation to Atlantic Salmon) may also result in a reduction in the numbers of bird species of Special Conservation Interest within the River Fergus and in downstream estuarine habitats due to impacts on habitat quality, and associated feeding opportunities as a result of a reduced food supply i.e. where impacts affecting water quality may result in reduced macro-invertebrate, macrophyte and algal communities and fisheries production.

Operational Phase

As above for Otter, Atlantic Salmon and Lesser Horsehoe Bat.

As described above the use of the membrane on the embankment will create a barrier to the re-growth of trees and shrubs and will permanently prevent the natural recolonisation of Scrub (WS1) vegetation and scattered trees overtime which provided cover for birds along sections of the embankment. The membrane will however allow the recolonisation of Reed and large sedge swamp (FS1) and tall ruderal and pioneer herbaceous species which will provide cover for bird species. Furthermore, Reed and large sedge swamp (FS1) on the River Fergus side of the embankment will not be disturbed during construction within the exception of the localised works on the 3 No. sluice gates which will retain habitat for overwintering species. Also as previously outlined Black-tailed Godwit and Wigeon are more likely to utilise the adjacent improved agricultural grassland habitats as opposed to the Scrub (WS1) habitats within the proposed works area along the embankment, backdrain and haul road for feeding and roosting during the winter months.

7.3 OTHER HABITATS AND PROTECTED SPECIES

Construction Phase

HABITATS

Of the habitats recorded within and adjacent to the works area on the backdrain, the embankment and on the River Fergus at the locations of the sluice gates, the Wet Grassland (GS4) and Reed and tall sedge swamp (FS1) while not considered species rich, provide habitat for Common Frog (*Rana temporaria*), dragon- and damselflies and the local and overwintering bird populations, amongst other species. The backdrain between Sluice Gate No. 3 and 4 was found to contain species rich marginal vegetation, while a diverse instream macrophyte assemblage was recorded at Sluice Gate No. 4. The marginal vegetation at the swallow-hole on Ballybeg Stream was also found to be relatively species rich. The River Fergus, backdrain, and Ballybeg and St. Flannans Stream within the works are also known or have the potential to support Annex II species and other protected aquatic species. Scrub (WS1) and a number of semi and mature Hawthorn (*Crataegus monogyna*), Willow (*Salix* sp.) and Blackthorn (*Prunus spinosa*) trees were also recorded between Sluice Gates No. 5 and 6. A temporary to short-term slight to moderate negative impact on these habitats is anticipated as a result of disturbance of habitat as it is considered that the reuse of soil containing the seedbank of these habitats will assist in the recolonisation of these habitats within the proposed works area over time. In relation to woody habitats the use of the geogrid membrane will create a barrier to the re-growth of trees and shrubs along the upgraded flood defence earthen embankment. A temporary haul road is proposed through the Reed and large sedge swamp (FS1) where present parallel to the backdrain and between Sluice Gate No. 1 and 2. This will result in a temporary to short-term slight to moderate negative impact on this habitat type as the material utilised in the haul road will be removed post-construction. The sub-base utilised in the haul road will also permit movement of any surface waters present.

INVERTEBRATES

Molluscs

Temporary disturbance related impacts on the habitats supporting the Moss Bladder Snail (*Aplexa hypnorum*) are not anticipated as a result of the proposed works as the supporting habitat is located outside of the proposed works area. Impacts on molluscs potentially inhabiting Ballybeg Stream downstream of works on the flood overflow culvert may occur as a result of reduced water quality arising from instream works if works were undertaken in the wet.

Butterflies

No impacts on Marsh Fritillary Butterfly are anticipated as a result of the proposed works as suitable habitat (host plants) were not recorded during site surveys.

Dragon- and Damselflies and Beetles

As dragon- and damselfly larva were not recorded from the aquatic habitat of the backdrain species during surveys, impacts on this taxa are not anticipated as a result of the proposed works given the extent of other suitable habitat for these species in the Clare Abbey floodplain.

Water Beetles

No impacts to water beetles are anticipated as a result of the proposed works based on the findings of the surveys i.e. the presence of two common beetle species within the backdrain habitat.

FISH

Impacts on European Eels in the backdrain, Ballybeg Stream and St. Flannan's Streams will reflect those of Lamprey as discussed above. There is also potential for the disturbance of Wet Grassland (GS4) habitat which supports Common Frog as a result of the construction of the haul road and embankment works.

Impacts on Brown Trout, Twaité Shad, Pollan and Smelt will reflect those of Atlantic Salmon and lamprey.

AMPHIBIANS AND REPTILES

Impacts on Common Frog in the backdrain, Ballybeg Stream and St. Flannan's Stream and Smooth Newt in Ballybeg Stream will reflect those of Lamprey as discussed above. There is also potential for the disturbance of Wet Grassland (GS4) habitat which supports Common Frog as a result of the construction of the haul road and embankment works.

Impacts on potential Common Lizard habitat at Ballybeg Stream are not anticipated as the habitat is outside the proposed works area, however, the area of Recolonising bare ground (ED3) at the N85 bridge is proposed as the site compound for the duration of the Project. It is anticipated that disturbance of this habitat is unlikely as the Contractor is likely to utilise the existing hard standing area. Therefore a temporary slight negative impact on Common Lizard at this location is anticipated as a result of noise and visual disturbance which may result in Common Lizard avoiding the habitats. It is likely that Common Lizard will recolonise the area post-construction.

BIRDS

During the summer months several protected waterbird species use the River Fergus but they will most likely avoid the proposed works area during the works as they have other large foraging areas to exploit along the River Fergus. There is potential for impacts on nesting resident birds which may be disturbed during vegetation clearance and a result of the temporary loss of nesting sites/vegetation cover during and post-the construction of the embankment, haul road and realignment of the backdrain. However, it should be noted that the Reed and large sedge swamp (FS1) on the River Fergus side of the embankment will not be disturbed within the exception of the localised works on the 3 No. sluice gates which will retain cover for bird species. There is also potential for impacts on feeding opportunities for species such as Grey Heron and Mallard as a result of water quality related impacts (see Section 7.2)

The main threats/pressures to Kingfisher populations are disturbance (humans, pathways, road traffic etc.), water pollution, lowered fisheries production (due to water pollution or in-stream vegetation removal) and removal of overhanging vegetation/scrub (Cummins et al., 2010). Kingfishers are visual foragers; their foraging may therefore be affected temporarily where proposed works alter water quality and/ or clarity. Studies have also shown that Kingfishers will often not return to nest in an area if there is ongoing disturbance nearby (Boag, 1982). However, a study by Cummins & Crowe (2009) found that the impact of drainage maintenance activities on exclusively riverine-nesting bird species [such as Kingfisher], is localised and usually short-lived.. No impact on overhanging vegetation/scrub on the riverside of the embankment which may form perching sites for Kingfisher whilst feeding on the River Fergus is anticipated, as works are to be undertaken on the landward side of the embankment. Suitable habitat for nesting Kingfisher was not recorded during surveys of the embankment within the proposed works area. Therefore it is unlikely that the proposed works will result in a long-term negative impact on Kingfisher

BATS

Aquafact (2011) noted that Daubenton's Bat and Soprano Pipistrelle are known to be common along the River Fergus. Temporary slight to moderate negative impacts on the commuting/foraging route of these bat species are also expected as a result of temporary site lighting. The Tree-line (WL2) at St. Flannan's Stream may also provide suitable habitat for these bat species. As described above potential impacts to bats may arise as a result of accidental damage to these trees during works on the storm overflow culvert at St. Flannan's Stream. Refer to section 7.1.3 for further details regarding impacts to bats.

PLANTS

Potential impacts to Great Water Dock (*Rumex hydrolapathum*) and Frogbit (*Hydrocharis morsus-ranae*) recorded at the swallow-hole on Ballybeg Stream are not anticipated as they are located outside of the proposed works area. While the excavation and realignment of the backdrain will result in the removal of Reed Sweet-grass (*Glyceria maxima*) and Greater Pond Sedge (*Carex riparia*). These impacts are

considered to be temporary slight negative as it is proposed to salvage soils from the backdrain supporting these species reutilise the soils in the realigned backdrain to re-establish the former vegetation type.

MAMMALS

Impacts to Badgers will reflect those of Otter with the exception of water quality impacts.

Operational Phase

As above for Otter, Atlantic Salmon and Lesser Horseshoe Bat.

Impacts on the hydrogeology of the adjacent habitat supporting the Moss Bladder Snail (*Aplexa hypnorum*) or on the Wet Grassland and Reed and large sedge swamp (FS1) habitats present within the Clare Abbey flood plain are not anticipated post-construction based on the hydraulic and hydrological regime of the floodplain (see Sections 3.2.2 to 3.2.5).

As described above the use of the membrane on the embankment will create a barrier to the re-growth of trees and shrubs and will permanently prevent the natural recolonisation of Scrub (WS1) vegetation and scattered trees overtime which provided cover for birds along sections of the embankment. The membrane will however allow the recolonisation of Reed and large sedge swamp (FS1) and tall ruderal and pioneer herbaceous plant species which will provide cover for wildlife including birds such as Grey Heron and Mallard.

7.4 CUMULATIVE IMPACTS WITH OTHER PLANS/PROJECTS

Appropriate Assessment requires consideration of the proposed Project in combination with other plans or projects, which may give rise to cumulative impacts affecting a Natura 2000 site. There are a number of plans and projects which have taken place in the vicinity of the Project in the recent past and a number planned for the future. These include other flood relief schemes, road projects and wastewater projects.

The Clare County Development Plan 2011-2011, the Ennis Town Development Plan 2008-2014 and associated Appropriate Assessments and Strategic Environmental Assessments were consulted as part of this report to determine whether any of the policies or plans in combination with the Ennis South Flood Relief Scheme have the potential to result in a cumulative impact. It is noted that the area in which the proposed embankment works are proposed is located land zoned for "Open Space". Furthermore it is noted from the Ennis Town Development Plan Infrastructure/Flood Protection Map that the Project is located within the "Lower Fergus Floodplain Storage Area – Development Exclusion Zone", meaning that development will not be permitted in the vicinity of the embankment works. This area is adjacent to the "Lower Fergus Floodplain Storage Area – 100 year flood risk". The risk of future in-combination effects is therefore low, as development on the lands in the vicinity of the proposed embankment works will not normally be permitted. See extract from Map EE04 below.

It is noted that the Shannon Catchment Flood Risk Assessment and Management Study (CFRAMS) plan is underway since 2011 and is due to be completed in 2015 in accordance with the EU Floods Directive. The study focuses on areas known to have experienced flooding in the past and areas that may be subject to flooding in the future either due to development pressures or climate change. The plans will define the current and future flood risk in the Shannon River Basin District and set out how this risk can be managed. As part of the ongoing CFRAMS, Ennis has been identified as an AFA (Area for Further Assessment) which is an area of land where the degree of existing or potential risk is more significant than others in the study area. AFAs include existing towns and villages for which significant development is anticipated and other areas or structures where existing or future flood risk is deemed significant.

Other relevant plans consulted include the Shannon International River Basin District Management Plan and the Fergus Management Unit Action Plan. The Programme of Measures for the Fergus identifies the control of urban wastewater discharges (7 treatment plants requiring capital works, 2 treatment plants requiring

further investigation, 4 treatment plants requiring improvements in operational performance, 1 urban agglomeration requiring investigation of CSO's, 2 No. agglomerations requiring management of development), on-site wastewater treatment plants, 12 IPPC licenses requiring review and 25 licences under the Water Pollution Act requiring review. A Habitats Directive Assessment has been undertaken in relation to the programme of measures for the Shannon River Basin District Management Plan which states that *"Where potential impacts from the Draft RBMP/POMs were identified, alternatives have been proposed, and the decision process detailed in assessment/summary tables. These alternatives have been incorporated in to the Draft RBMP. The implementation of the POMs are highly desirable in order to protect, improve or maintain the current favourable conservation status of many of Ireland and Northern Ireland's Natura 2000 and Ramsar sites, however, in their implementation, there is potential for impacts, either directly or indirectly to Natura 2000/Ramsar sites as for e.g. they may involve the construction of new infrastructure in order to reduce waste water loadings to receiving waters. While there are potential effects which could accrue from the implementation of such measures as specified in the Required, Other Required and Additional Measures under the POMs, and also from other policies, plans and programmes in isolation, or in combination with each other, these cannot be assessed at present as the extent of their implementation is as yet unknown at the water body level. As these other policies, plans and programmes are implemented at a local level, and the water body specific measures under the Draft RBMP/POMs are identified at this scale, it is advisable to map these out spatially to gain a fuller understanding of their relationship with Natura 2000/Ramsar sites, and a screening exercise under the habitats assessment for potential impacts carried out. If the assessment shows the potential for impacts, an Appropriate Assessment should be carried out."*

Of the Plans reviewed in the course of preparation of this Natura Impact Statement, namely the Ennis Town Development Plan, Clare County Development Plan, the Shannon CFRAMS, and the Shannon International River Basin District Management Plan and in the absence of likely immitigable significant effects arising from the Ennis South Flood Relief Scheme, it is not considered that there is potential for further cumulative impacts arising in combination with the Plans which could result in significant in-combination effects on the Conservation Objectives or the *integrity* of the Lower River Shannon cSAC, River Shannon and River Fergus Estuaries SPA, Newhall and Edenvale Complex cSAC or Pouladatig Cave cSAC

Projects recently completed, currently underway or currently being planned in the vicinity of the proposed embankment upgrades works include the Upgrade of the Clonroadmore Wastewater Treatment Plant, the N85 road scheme and the OPW River Fergus Certified Drainage Scheme.

An upgrade to the existing Clonroadmore WWTP, which is located approximately 500m upstream of the Ennis South Flood Relief Scheme received a Grant of Permission on the 8th November 2011 for the upgrade of Clonroadmore Wastewater Treatment Plant by An Bord Pleanála subject to conditions." It is unknown exactly when construction of these upgrade works will commence, however, the construction works may coincide with the construction of the proposed embankment works element of the Ennis South Flood Relief Scheme. The Appropriate Assessment relating to the proposed upgrade works concluded that *"Taking into account all the matters discussed, and provided that the abovementioned mitigation measures and recommendations are adopted, it can be concluded that the proposed project will not adversely affect the integrity and conservation status of any Natura 2000 site or annexed species. As the proposed scheme will result in a net positive impact, the scheme will contribute to achieving the conservation objectives for the Lower River Shannon candidate Special Area of Conservation"*. Therefore, in the absence of likely significant effects on water quality arising from the Ennis South Flood Relief Scheme, it is not considered that there is potential for further cumulative impacts arising in combination with the upgrade works at the wastewater treatment plant which could result in significant in-combination effects on the Conservation Objectives or the *integrity* of the

Lower River Shannon cSAC, River Shannon and River Fergus Estuaries SPA, Newhall and Edenvale Complex cSAC or Pouladatig Cave cSAC

The N85 road development which involved a new road crossing of the Lower River Fergus (and the Lower Shannon cSAC) within the footprint of the Ennis South Flood Relief Scheme was opened to traffic at the end of December 2007. This project included the construction of a pipe bridge across the Lower River Fergus and the infilling of a section of riparian habitat. It is considered that any cumulative impacts arising from the N85 road development have been integrated into the baseline habitat and impact assessment carried out as part of the Appropriate Assessment for the Ennis South Flood Relief Scheme (see Appendix B – River Habitat Corridor Survey).

A number of flood relief schemes have taken place in Ennis town and environs in recent years as part of the OPW River Fergus Drainage Scheme. Phase 1 of this flood relief scheme involved upgrading of existing flood defences between Mill Road Bridge and Bank Place Bridge. These works were completed in 2009.

The River Fergus Lower Ennis Certified Drainage Scheme which represents Phase 2 of the River Fergus Drainage Scheme, is currently at tender stage and will involve the construction of new embankments and walls as well as minor channel modifications. This phase of the OPW Drainage Scheme will encompass a stretch of approximately 3.5km of the River Fergus, located both upstream and downstream of the Ennis South Flood Relief Scheme.

The project is designed to convey a 100 year return period flood safely through the town of Ennis and represents the culmination of the OPW Drainage Scheme project. The development constitutes an area along the River Fergus from Bank Place Bridge, within the town of Ennis to tidal reaches of the river below Clarecastle Bridge.

The design flood level at Clonroadmore and Cappahard is 3.2mOD and the design high tide level at Clarecastle is 4.25mOD. A freeboard of 0.5m is being provided above the design flood level and an additional allowance (varies based on location) is provided to allow for settlement. The final crest level (following settlement) will be 3.7mOD upstream of Doora Bridge and 4.75mOD downstream of the barrage. This scheme is currently at the tender stage and it is expected that construction on the Certified Drainage Scheme will be completed prior to this Project commencing construction.

Details of the works proposed along the River Fergus channel as part of the River Fergus (Lower) Ennis Certified Drainage Scheme are summarised below (taken from Aquafact Appropriate Assessment, 2011):

- Modification of the existing fish pass at the Mill Weir upstream of Mill Bridge Road which will involve instream works;
- Construction of a flood protection embankment and cut-off from Bank Place Bridge to Abbey Hostel (left bank).
- Replacement of stone wall at Abbey Street car park with stone-faced reinforced concrete wall.
- Water proofing of solicitor's building downstream of Abbey Street car park and construction of shallow footing flood defence wall in solicitor's car park.
- Removal of vegetation and repointing of walls at Newbridge Road wall and the Garda Station wall. This work will be carried out sympathetically and will try to maintain the original character of the walls. This work will require a very limited amount of instream works. Instream works will also be required to construct a drainage outfall structure.

- Removal of a door from the FBD insurance building and replacement with a flood proof door.
- Installation of a low reinforced concrete wall with stone cladding to visible faces, founded on a wide, shallow footing along the line of the existing hedge/ kerblineline to the rear of the CBS school. The proposed top of wall level will be 3.95mOD, 650mm above existing ground level. This part of the development will require work close to the river but will not involve any instream works.
- An existing embankment behind Fergus Park is to be modified and improved to a crest level of 3.75mOD. The works in this area will be close to the river and are not anticipated to involve any instream works.
- Construction of a wall upstream of Cusack Park GAA grounds towards the Aldi site, approximately 60m in length and 1.5m in height. This wall will join in with the rear wall behind the garda station yard. The embankment will be ramped within the GAA grounds to facilitate vehicle movement. Instream works will be required at the upstream end of the works adjacent to the garda station. The remainder of the works will be performed close to the river but are not anticipated to be instream.
- Downstream of Cusack Park GAA grounds towards the Aldi site, it is proposed to construct a wall of approximately 35m in length and 1.3m in height which will key in to the corner of Cusack Park terrace, extending to the boundary of the adjacent Aldi site. This portion of the project will not involve any instream works except for the installation of outfall pipes.
- Raising of stepped access from Aldi to the river and construction of rising main and drainage outfall headwall structure. This will involve instream works.
- It is proposed to install a deep footing flood defence wall in the river/riverbank immediately downstream of the Aldi site on the right bank. Further downstream a mixture of low embankments and shallow footing walls are proposed following a deep footing wall extending along the river bank at the existing amenity area down to Knox's bridge. A slipway will be constructed adjacent to Knox's Bank to allow emergency access to the river for boats. This section of the works will require the removal of trees and vegetation in the area and instream works.
- It is proposed to rehabilitate the existing embankment and replace the footpath with a new shallow footing reinforced concrete wall from Knox's Bridge to the Railway Bridge. The existing slipway has a top level of 3.30mOD but this will be modified to 3.50m. Downstream from the slipway the existing embankment which has a top level varying from 2.95m OD to 2.8m OD will be replaced by an embankment with a top level of 3.50m OD and shall tie in with the existing railway embankment. Some instream works will be required.
- The embankment from Tulla Road to Whitepark will be rehabilitated through a combination of partial removal of the existing embankment, installation of vinyl sheet piles and filling with imported/re-used material to final design levels. Drainage outfalls will be constructed through the embankment. It is also proposed to construct a new embankment on the east side of the river downstream of Whitepark, traversing an immature ash plantation. Instream works will be required at the southern end of the Whitepark housing estate to facilitate a sluice gate for the existing stream/ back drain at this location.
- It is proposed that the right bank of the Clonroad More embankment be rehabilitated so that it reaches 3.70mOD in height which will allow for a 500mm freeboard to the embankment. Instream works on the right bank of the river will be needed for the upper and lower reaches of this section to facilitate the installation of sluice gates.
- A combination of rehabilitation and replacement of the Clarecastle embankments is proposed extending from the barrage to Clarecastle road on both sides of the river.

- A new embankment and wall defence are proposed along the river edge from Clarecastle Bridge to Clarecastle Quay. A ramp and a new outfall structure are also planned for installation at the quay.
- 3 No. Surface Water Pumping Stations (and associated collection system and delivery pipework) are proposed to be constructed at New Road (In De Valera park in front of the court house), Adjacent to the railway at Cusack Lawn (Left bank, downstream of Knox's Bridge) and at the existing Francis Street Pumping Station Site Compound. Limited instream works will be needed during construction of the outfalls for each of these locations.

The Appropriate Assessment for the River Fergus (Lower) Drainage Scheme relating to these works states *"There are not expected to be any cumulative impacts on the Lower River Shannon cSAC to this section of the River Fergus (Lower) Drainage Scheme during the construction or operational phase. However, if the impacts predicted from this section of the scheme are taken in unison with the impacts felt from the first part of the scheme which is already complete, then there is potential for some negative effects to be felt by lamprey and Atlantic salmon species. It is now the intention to implement restoration measures for both schemes as a follow-on contract.*

The Appropriate Assessment for the River Fergus (Lower) Drainage Scheme concludes in relation to the Lower River Shannon cSAC:

"The area of the proposed development is very large in size and occurs within the Lower River Shannon cSAC. As such, due diligence must be exercised during any construction activities to ensure that minimal effect is felt on the Natura 2000 sites environment and mitigation measures are installed to alleviate any possible effects these activities might have.

During this study several possible effects on the Lower River Shannon cSAC were identified. A number of Annex I listed habitats (i.e. floating river vegetation and alluvial wet woodland) were identified and determined to be under possible threat due to the proposed works. However, mitigation measures have been proposed which will help preserve these designated habitats. Where loss of habitat was expected, measures were investigated to ensure that the affected habitat would be able to re-establish itself after construction activities have ceased. Several Annex II fish species could be affected by the proposed development. These include sea lamprey, river lamprey, brook lamprey, twaite shad and Atlantic salmon. There is expected to be removal/destruction of several redds belonging to some of these species due to instream works which needed to be carried out at points along the river. However, as long as mitigation measures are followed and steps are taken to ensure that these fish have sufficient spawning areas provided and that the weir located at the Mill Road Bridge is modified to enhance its effectiveness, there should be no significant negative effect on these species. The weir will also aid the upstream migrations of these and this is seen as a significant positive impact. The proposed development has the potential to impact badger and otter; however, the mitigation measures suggested will require the replanting of affected areas or planting of alternative areas which are connected with the plantation so that there is no net loss of habitat and that the area is not fragmented. The removal of these animals from active setts or holts, should they be identified will need to be done under permits acquired from the NPWS. Bird species such as the kingfisher may experience some habitat loss due to vegetation being removed; again, as long as mitigation measures are followed and areas of vegetation are either replanted in the original position or in an alternative position connected to the original plantation, there should be no significant effect on these species."

The Appropriate Assessment concludes in relation to the River Shannon and River Fergus Estuary SPA *"that the species of birds present within the River Shannon and River Fergus cSPA will not be negatively affected by the proposed development. As most of the species of birds which this site is designated occur in the estuary and lower reaches of the river and beyond, the development within Ennis will not impact upon them."*

Significant sections of existing river embankment downstream of the town centre are the responsibility of Clare Co Council (CCC) and CCC has consistently maintained these embankments over the years. The embankment to be improved in association with the River Fergus Lower Ennis Certified Drainage Scheme is pertinent here and accordingly, the OPW takes the view that this is a matter for CCC to deal with. Also the OPW contends that the issues to be dealt with under the scheme are more about surface water management than flood alleviation. For these reasons, the OPW never included the areas on the South side of Ennis which are prone to flooding as part of their "Ennis Scheme". The OPW has, however, agreed to consider applications for funding to deal with such situations under its Inland Small Scheme Programme. It is in this context that the Ennis South Flood Relief Scheme (the subject of this Natura Impact Statement) is now a firm proposal - being driven by the Local Authority and to benefit from grant support from the OPW.

The location of the Ennis South Flood Relief Scheme (Clare County Council) in relation to the River Fergus (Lower) Ennis Certified Drainage Scheme is shown earlier in Figure 5.2 and is also provided below in Figure 7.1 for ease of reference.

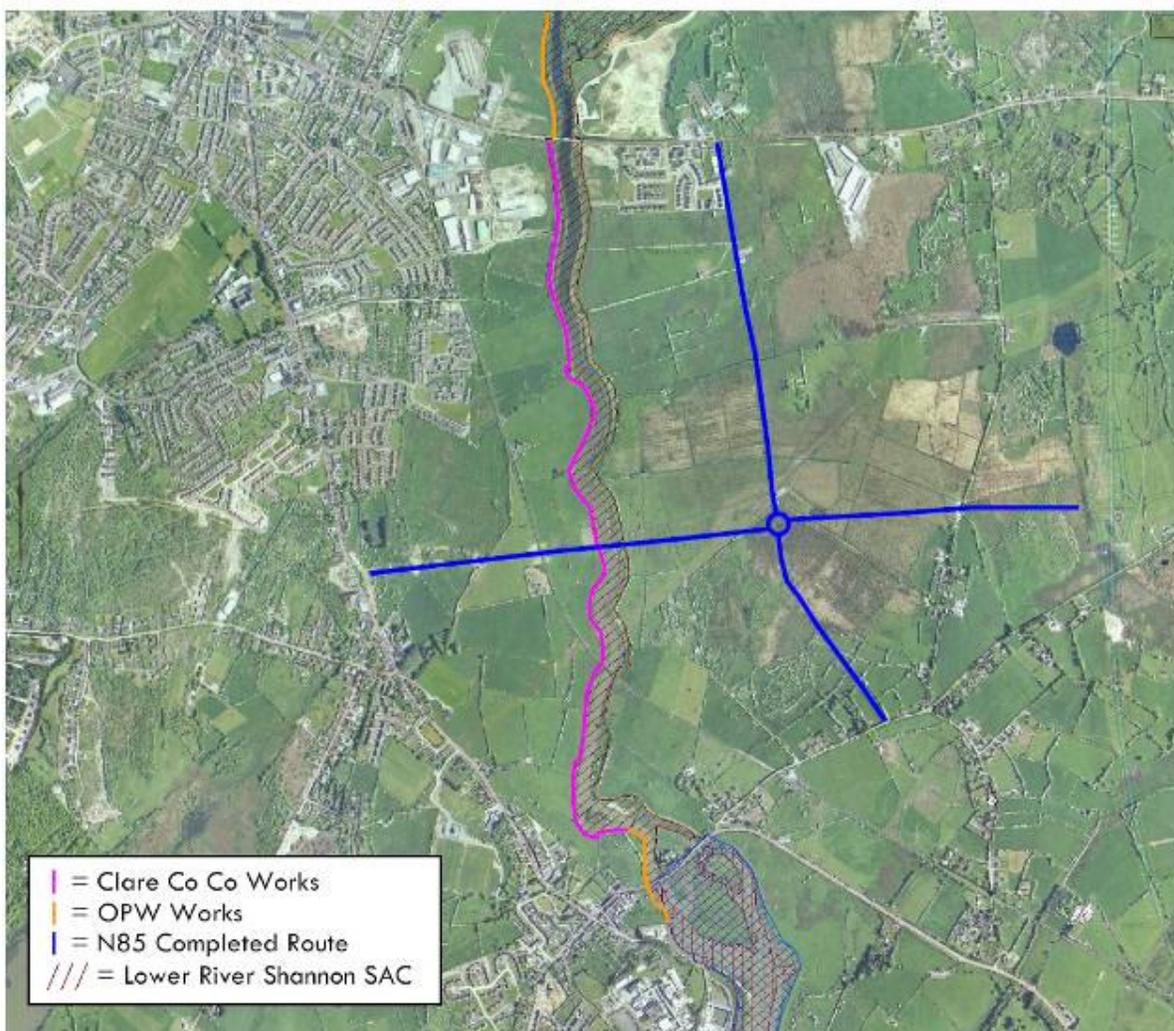


Figure 7.1 Location of Proposed Works relative to Natura 2000 sites

The River Fergus (Lower) Ennis Certified Drainage Scheme to be undertaken by the OPW is the only proposed development identified as potentially resulting in in-combination effects with this Project. There is no spatial overlap between the current Project and the River Fergus (Lower) Ennis Certified Drainage Scheme

or at the 'tie-in' to the Schemes at the Regional Road (R469). Both schemes are designed to convey the 100 year flood event.

It is expected that the River Fergus (Lower) Ennis Certified Drainage Scheme will be completed prior to the commencement of the Project which is the subject of this report. Therefore, no temporal overlap exists between the construction phases of the two schemes. With regard to the current Project, it is considered that the scale and nature of the works and the absence of direct impacts on Annex I habitats allows for the implementation of effective mitigations to avoid impacts affecting the Qualifying Interests and Special Conservation Interests of the Natura 2000 sites. Therefore, in the absence of likely immitigable significant impacts arising as a result of the Ennis South Flood Relief Scheme, it is not considered that there is potential for further cumulative impacts arising in combination with the River Fergus (Low) Ennis Certified Drainage Scheme which could result in significant in-combination effects on the Conservation Objectives or *integrity* of the Lower River Shannon cSAC, River Shannon and River Fergus Estuaries SPA, Newhall and Edenvale Complex cSAC or Pouladatig Cave cSAC.

8. AVOIDANCE AND MITIGATION MEASURES

Due to the presence of the works within the Lower River Shannon SAC and given the nature and proximity of the proposed works on the existing flood defence earthen embankment, backdrain and sluice gates to the River Fergus all construction works associated with the flood defence earthen embankment will be supervised by a Site Ecologist with appropriate qualifications and experience. The Site Ecologist will also supervise works on Ballybeg Stream and St. Flannan's Stream. The avoidance and mitigation measures described in the sections that follow will be written into the Works Requirements for the construction contract, to which the Contractor must adhere. A Resident Engineer, representing Clare County Council, will also be present on site during construction works to supervise the Contractor and to ensure that the Works Requirements are adhered to.

Prior to commencement of construction works, an Environmental Operating Plan (EOP) for the construction phase of the project will be prepared by the Main Contractor. The EOP will describe the Environmental Management System of the project, and will be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems. As this project is linear in nature, similar to a national road scheme, the EOP should be prepared in accordance with the NRA Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (NRA, 2008).

The EOP will assist the Contractor in minimising environmental impacts which may arise during the construction phase. The EOP will cover all aspects of site clearance and construction through the preparation of 'Environmental Control Measure Sheets'. These 'Environmental Control Measure Sheets' will list discrete actions or procedures that will assist in identifying any potential impacts on the natural environment and will provide a checklist for preventing, managing and/or minimising environmental impacts which could arise as a result of construction works.

The EOP will also outline all actions and the procedures for the delivery of the recommended avoidance and standard mitigation measures and for addressing general day-to-day environmental issues that can arise during site clearance and construction activities. The EOP will include a Spillage Response Plan and a Dust Minimisation Plan.

In order to avoid and minimise impacts from site clearance, a site specific method statement for site clearance works and a Environmental Control Measure Sheet will be prepared as part of the EOP. The site clearance method statement will detail the requirement for a Site Ecologist to undertake a walkover of the sites prior to commencement of site clearance in order to note any changes to the ecology of the site since the preparation of this document which may influence construction related avoidance and mitigation measures, methodologies and approaches e.g. the presence of Otter holts or Badger Setts, Common Frog and Smooth Newt.

The proposed works area will be fenced on both sides of the flood defence earthen embankment and at the locations of the 3 No. sluice gates to prevent damage and disturbance of native vegetation outside of the proposed works area. Where possible the Scrub (WS1) and semi- and mature Hawthorn, Willow and Blackthorn trees identified between Sluice Gate No. 5 and 6, should be retained where practically feasible. The root protection area of the mature trees in the Tree-line at St. Flannan's Stream will also be protected from damage and disturbance by the establishment of a root protection zone. The Reed and large sedge swamp (FS1) adjoining the temporary haul road parallel to the backdrain and between Sluice Gate No. 1 and 2 will also be protected from damage and disturbance.

All site clearance and construction activities are to be strictly confined to the works area for each of the proposed works elements. All construction traffic involved in the embankment upgrade, and associated works, will be confined to the haul road and the works area which will be fenced off from all other adjacent Scrub (WS1), Reed and tall sedge swamp (FS1), Wet grassland (GS4) and Improved agricultural grassland (GA1) habitats in the area. Only the minimal works area will be prepared or stripped of its topsoil which will minimise disturbance and exposure of soils to surface water runoff and avoid the potential for large surface water ponding areas. Surface water management plans for each element of the temporary works i.e. embankment upgrade, backdrain, pumping station, sluice gates and storm overflow culverts will be prepared and implemented by the Contractor throughout the construction phase with the specific aim of aiding surface water runoff and avoiding ponding.

The minimal interference with topsoils outside of the works areas will also avoid the spread of non-native species within the works area (see below).

The Contractor will be required to adhere to all relevant planning and environmental legislation in relation to the donor sites used for imported materials, the disposal sites used for material that cannot be re-used in the works and the transfer of materials between sites.

8.1 QUALIFYING INTERESTS

8.1.1 Annex I Habitats

There are no specific measures required for the protection of Annex I habitats of Qualifying Interest with the exception of avoidance and standard mitigation measures to reduce impacts on water quality and the management of non-native invasive species within the works area in order to avoid the spread of non-native invasive species to Annex I habitats of the Lower River Shannon SAC which are located outside of the proposed works area.

Avoidance and standard mitigation measures to reduce impacts on water quality are detailed below in relation to Annex II species. These measures will also serve to avoid or minimise potential impacts on the Annex I habitats upstream and downstream of the Ennis South Flood Relief Scheme (and on Annex I and II species which utilise these habitats for feeding and roosting opportunities).

Any non-native invasive species present within the works area should be managed in accordance with the NRA (2008) *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* prior to the commencement of construction, and throughout the construction phase where required, to eliminate these species where practically feasible from the development site.

Given the presence of non-native invasive aquatic species within the works area a method statement in relation to biosecurity measures for the site namely for works on the backdrain and on Ballybeg Stream will also be agreed in advance with NPWS and IFI.

Any plant or equipment that may have worked in environments where invasive species are present will be suitably cleaned within a defined washdown area by high pressure hose before being used elsewhere on the site to prevent the spread of invasive species. This activity shall always be carried out at the site compound/machinery depot and water used for this process will be intercepted and prevented from draining back into local watercourses. This activity will be reviewed by the Site Ecologist to ensure that it is adequate and that no contamination of clean waters occurs.

8.1.2 ANNEX II SPECIES

The River Fergus, the backdrain and St. Flannan's and Ballybeg Streams support and/or have the potential to support a number of Annex II species i.e. Atlantic Salmon, Otter, Sea and River Lamprey for which the Lower River Shannon cSAC is designated. Avoidance and standard mitigation in respect of potential impacts

on Annex II species in terms of both the construction and operational phase of the Project are provided below.

In order to minimise impacts on water quality, the Contractor will be required to prepare a detailed method statement on pollution prevention, in respect of the integrity of the cSAC in relation to the construction of all elements of the works i.e. the embankment works, the backdrain works, the pumping station, sluice gate works, vegetation clearance and flood overflow culvert works. The method statement will include avoidance and standard mitigation measures as outlined below which will be implemented to protect water quality and will include defining and minimising work areas, pollution prevention and management, working “in the dry” by damming the existing sluices between the backdrain and the river Fergus, working in low flow conditions, minimising the potential spread of invasive species and managing overspill from temporary site lighting and visual and noise disturbances associated with site clearance and construction works.

All temporary site facilities including the fuel tanks, stored lubricants and hydraulic fluids and refuelling areas will be bunded and will be kept at the maximum distance as practically feasible from the River Fergus, the backdrain, connecting Drainage ditches (FW4) and St. Flannan’s and Ballybeg Streams.

The site compound/machinery depot is to be located on the existing hard standing area upstream of the N85 river bridge. The bunded area within the site compound will accommodate 110% of the total capacity of the containers within it. Containers will be properly secured to prevent unauthorised access and misuse. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner. In addition:

- Spill kits will be made available close to watercourses and all staff will be properly trained on correct use.
- Disposal of raw or uncured waste concrete will be controlled to ensure that watercourses or other sensitive areas will not be impacted.
- The bunded area should also house the wash and toilet facilities for staff working on the project as well as a waste storage station. There should be no potential for introduction of wastes or hazardous substances from this area via Drainage ditches (FW4) connected to the River Fergus. Foul and sewage waste from temporary site offices and facilities should be appropriately managed and disposed of off-site.

Any soil heaps from site clearance and excavation will be stored at the maximum distance as practically feasible from the Lower River Shannon cSAC and on the landward side of the existing embankment which will provide a barrier to the release of suspended solids. Soil heaps will also be managed so as to contain silt laden surface water runoff and will not exceed 2m high to prevent the compaction of soils which are required for reuse on the embankment and for the restoration of native vegetation along the backdrain. There will be no temporary or permanent storage of soil outside of the proposed works area within the Lower River Shannon cSAC or wetland habitats within or outside the Clare Abbey floodplain.

The implementation of an EOP (and associated Spillage Response Plan and Dust Minimisation Plan) will assist in avoiding and minimising potential indirect impacts from pollution events during the construction phase. A Site Ecologist will be present on site to monitor any excavation activities required during the construction phase. Standard mitigation measures to manage ponding surface water and overland flows should follow best practice standards (e.g. DOMNR, 1998; Murphy, 2004; NRA, 2005; Kilfeather, 2007; NRA, 2010; and relevant CIRIA Guidelines) in order to minimise release of suspended solids from the proposed embankment, sluice gates, backdrain, pumping station and over flow culverts works.

All of the construction machinery operating in or near the watercourse will be systematically checked in order to reduce the risk of leaks of oils, hydraulic fluids and fuels.

There shall be no temporary crossings of Drainage ditches (FW4) by plant machinery within the adjacent improved agricultural landscape connected to the backdrain without prior notification to the Site Ecologist.

ATLANTIC SALMON

Construction Phase – Flood Overflow Culverts

The works required in the vicinity of each of the swallow-holes will be programmed for the summer months such that excavation works can be undertaken in the dry. The swallow-holes will be blocked temporarily with suitable material to ensure no discharge to groundwater takes place during excavation works.

Silt laden surface waters potentially arising from trench dewatering activities shall be treated using silt trays/settlement ponds and temporary interceptors prior to discharge.

Construction Phase – Embankment and Berm Works

Work in the Clare Abbey floodplain will avoid the winter months to minimise potential water quality related impacts during the salmonid spawning season and the times that early life stages of salmonid fish will be present as per Section 173 of the Fisheries (Consolidation) Act (1959). The timing of works will also serve to avoid disturbance to the overwintering Special Conservation Interest species.

In this regard, works will only be permitted in the Clare Abbey floodplain from April to September inclusive. In addition in consultation with the Site Ecologist, work will only be permitted on limited sections of the existing embankment at any one time in order to avoid continuous impacts along the 2.7 km length of existing embankment.

The 20m (average) wide riverbank between the existing flood defence embankment and the River Fergus provides valuable screening habitat and can provide a natural buffer against low levels of silt-laden surface water run off and therefore should not be disturbed during construction activities and specifically at the location of the 3 No. sluice gates. The presence of this natural buffer does not override the need to provide silt trays/settlement ponds and temporary interceptors for silt laden surface waters prior to discharge.

Access by heavy machinery is unlikely to be required in the immediate vicinity of the River Fergus which will minimise the risks of bank erosion and siltation. The presence of the existing embankment provides a natural barrier between the landside embankment works and the River Fergus. The existing embankment will be left in place on the riverside of the proposed flood wall to act as a barrier to the discharge of any silt laden runoff or concrete or cement discharge arising from the construction of the wall at the location of the N85 river bridge.

Where modifications to the existing flood defence earthen embankment and the construction the berm and haul road requires the excavation of unsuitable material, the removal of Scrub (WS1) and semi- and mature Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*) and Willow (*Salix* sp.) trees and wetland vegetation associated with the backdrain on the landward site of the flood defence embankment, the Site Ecologist will be present on site to highlight areas of greatest sensitivity. The Site Ecologist will provide direction on the location of buffer zones and high visibility fencing to minimise trampling and disturbance to native vegetation outside of the works area. The Site Ecologist will be present to ensure the minimal removal

or infilling of Scrub (WS1) and wetland vegetation and to identify soils suitable for the restoration of native vegetation along the backdrain.

Any soil heaps will be stored at the maximum distance as practically feasible from the Lower River Shannon cSAC and on the landward side of the existing embankment which will provide a barrier to the release of suspended solids. Soil heaps will also be managed so as to contain silt laden surface water runoff and to prevent compaction.

Construction Phase – Backdrains

Any instream works will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present as per Section 173 of the Fisheries (Consolidation) Act (1959) due to the potential for Brown Trout within the back drain. No instream works will be undertaken during the period October to April, unless a derogation is obtained in writing from the IFI.

Works on the backdrains will be carried out during low water conditions, where possible. Any silt release will be contained close to the source. A combination of silt traps, sedimats and straw bales may be utilised in the backdrain to contain silts during works. The relevant sluice connecting the backdrain to the River Fergus will be temporarily blocked during excavations works on the backdrains to reduce the risk of silt-laden water discharging to the River Fergus. All of the backdrain works will take place on the landward side of the existing embankment which will provide a barrier to silts entering the river.

Construction Phase – Sluice Gates

Any instream works will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present as per Section 173 of the Fisheries (Consolidation) Act (1959). No instream works will be undertaken during the period October to April, unless a derogation is obtained in writing from the IFI.

Localised damage to riverbank vegetation may occur in the area of the proposed works to the sluices. High visibility temporary protective fencing will be put in place to isolate the works area for the 3 No. sluices in order to protect the vegetated buffer zone.

During sluice gate works the removal of riverbank vegetation at the outfall to the River Fergus will be avoided where possible and where necessary the extent of vegetation removal will be limited; especially in areas where Tall Sedge and Reed Swamp (FS1) vegetation may be within, or in proximity to, the sluice gates works area. Where minor natural bankside vegetation is required to be removed to facilitate the works at the 3 No. sluices, machinery will operate from the landward side of the flood defence earthen embankment and draw vegetation away from the edge of the river. This will reduce potential impacts to sensitive aquatic and marginal wetland habitats on the riverside of the flood defence earthen embankment.

The upgrade works at the 2 No. existing sluices and on the installation of the new sluice will be undertaken during low water and low flow conditions. The works area at each of the three locations will require the damming of a 20m² area of instream habitat and work will be carried out in the dry to minimise the risk of silt entering the River Fergus. Prior to the commencement of construction an electrofishing survey of the dammed areas will be required to capture any salmonids (and lamprey or European Eel) present under licence from the IFI. Translocation to an appropriate recipient site shall be agreed with the IFI and shall be away from the zone of influence of the works.

All concrete components will be made of precast concrete and no concrete will be poured within this works area. Silt laden surface waters potentially arising from the sluice dewatering activities shall be treated using silt trays/settlement ponds and temporary interceptors prior to discharge.

As localised disturbance of the instream habitat will occur at the location of the sluice gates clean rounded gravels will be placed within the disturbed instream area in order to restore suitable spawning substrate for salmonids post-construction.

Inland Fisheries Ireland (IFI) and the NPWS will be consulted further to agree the provisions of a detailed method statement for instream works.

Instream works will adhere to:

- DOMNR (1998) Fishery guidelines for Local Authority works. Department of the Marine and Natural Resources, Dublin.
- Kilfeather, P.J., (2007) Maintenance and protection of the inland fisheries resource during road construction and improvement works. Southern Regional Fisheries Board, Clonmel, Co. Tipperary.
- Murphy, D.F. (2004) Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2005) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. Dublin: National Roads Authority.
- Control of water pollution from linear construction projects. Technical guidance (C648). CIRIA.
- Control of water pollution from linear construction projects. Site guide (C649). CIRIA.

Construction Phase – Emergency Pumping Station

Localised damage to riverbank vegetation may occur in the area of the proposed pumping station works. High visibility temporary protective fencing will be put in place to isolate the works area in order to protect the vegetated buffer zone. The existing embankment in the vicinity of the proposed pumping station will be retained and will provide a barrier between the pumping station works and the River Fergus. The existing sluice in the vicinity of the proposed pumping station works will be temporarily dammed during low flow conditions to ensure silt laden waters or discharges containing concrete or cement do not impact on the River Fergus.

Operational Phase

All of the avoidance and mitigation measures described above in relation to water quality will also be applicable during the operation (and maintenance) phase of the project.

SEA, RIVER (AND BROOK) LAMPREY

Construction Phase

The avoidance and mitigation measures described above in relation to potential water quality impacts to Atlantic Salmon will also serve to mitigate potential water quality impacts to lamprey.

At the location of the upgrade works at the 2 No. existing sluices and at the installation of the new sluice an advanced survey of the 20m² dammed areas will be required to determine the presence of lamprey or European Eel. Where found, these species will require capture under licence from the IFI and translocation to an appropriate recipient site agreed with the IFI and away from the zone of influence of the works. , the timing of works at these locations will take account of the sensitivity of these species within the river and no works will be undertaken until the end of the lamprey spawning season (see Table 8.1).

Furthermore, as the potential for lamprey spawning habitat has been identified within the backdrain a similar approach should also be taken in relation to advanced surveys, translocation and timing of works.

Table 8.1: Expected timing of lamprey and salmonid spawning/development on the River Fergus (Source: Ecofact, 2009)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salmonid season	close	■	■	■	■						■	■	■
Brook spawning	lamprey				■	■	■						
River spawning	lamprey				■	■	■						
Sea spawning	lamprey					■	■	■					
Lamprey drift/settlement	larvae					■	■	■	■				
Smelt spawning				■	■	■							

There is no proposed avoidance measure in respect of the loss of 350m of backdrain.

Operational Phase

The same avoidance and mitigation measures as for the construction phase will apply should periodic maintenance of the backdrains be required.

OTTER

Construction Phase

The main mitigation measure to limit potential impacts to Otter involves limiting works to discrete sections of the flood defence earthen embankment at any one time, in order to avoid continuous impacts along the entire works area of 2.7 km.

A pre-construction survey for Otter holts will be undertaken by the Site Ecologist prior to any clearance or construction works taking place at the existing embankments, sluices or backdrains. Should an Otter holt be located within the footprint of the proposed works, the NPWS will be consulted and a methodology for translocation under licence will be agreed.

Works will be carried out during daylight hours in order to reduce potential light or visual disturbance to Otter. In order to minimise noise and vibration disturbance associated with construction activities, the following measures will be put in place where practically feasible.

- No construction activities will take place during night time hours without prior consent of the local authority and consultation with the site ecologist,
- The methodology of British Standard WS 5228:1997 “Noise and Vibration Control on Construction and Open Sites” Part I, will be deployed during construction works where required to minimise emission of any noise to any residence,
- All construction plant and equipment for use within the site will comply with Statutory Instrument No 359 of 1996 “European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations 1996”,
- Silencers and engine covers should be kept in good and effective working order,

- The Contractor should select plant machinery that can be attenuated, to avoid any significant noise intrusion or disturbance where possible,
- Plant will also be chosen to avoid significant, low-frequency noise emissions which increases nuisance potential.
- Noisier plant will be positioned to optimise screening by other plant,
- Plant machinery should be turned off when not in use.

Operational Phase

As described earlier, the upgraded embankment will have a geogrid membrane to protect the embankment from the effects of erosion. The presence of the geogrid will greatly reduce the likelihood of Otter excavating holts in the future.

As the geogrid will also prevent the re-growth of trees and shrubs on the embankment it is recommended that planting of trees and shrubs is undertaken to the rear of the upgraded embankment to restore Scrub (WS1) habitat (see Section 8.3).

Noise, vibration and visual disturbance related avoidance mitigation measures require to minimise temporary impacts to commuting Otter during the operational phase will be as per the construction phase.

8.2 SPECIAL CONSERVATION INTERESTS

Construction Phase

The main measure required to protect Special Conservation Interest species outside of the River Shannon and River Fergus Estuaries SPA and adjacent to the River Fergus at the location of the proposed works is the timing of all works is to avoid the overwintering period from November to April (inclusive). This approach will serve to avoid (1) the temporary disturbance of any potential wintering nesting sites within the works area, (2) noise and vibration and (3) visual disturbance to birds feeding on the adjacent wetland and grasslands and (4) temporary water quality related impacts on the diversity/abundances of macro-invertebrate communities and smaller fish species which form the food resource for these species during the winter months.

As this period overlaps with the closed season for fisheries, this avoidance measure will also serve to protect the Qualifying Interests of the SAC including Annex II species Atlantic Salmon and other fish species which may utilise the River Fergus.

Standard mitigation measures are required to avoid and minimise impacts on water quality and from non-native invasive species in order to protect the wetland habitat supporting the Special Conservation Interest species downstream within the SPA are as above for Annex II Species.

Operational Phase

As described above the use of the membrane on the embankment will create a barrier to the re-growth of trees and shrubs and will permanently prevent the natural recolonisation of Scrub (WS1) vegetation and scattered trees overtime which provided cover for birds along sections of the embankment. The membrane will however allow the recolonisation of Reed and large sedge swamp (FS1) and tall ruderal and pioneer herbaceous plants which will provide cover for birds. As noted above, the Reed and large sedge swamp (FS1) on the River Fergus side of the embankment will not be disturbed within the exception of the localised works on the 3 No. Sluice Gates. Also Special Conservation Interest species such as Black-tailed Godwit and Wigeon are more likely to utilise the adjacent improved agricultural grassland habitats as opposed to the

Scrub (WS1) habitats within the proposed works area along the embankment, backdrain and haul road for feeding during the winter months.

8.3 ANNEX IV SPECIES

Construction and Operational Phase

In order to avoid impacts on Lesser Horseshoe Bat, temporary site lighting will not be permitted in the vicinity of the River Fergus, and all works will be carried out during daylight hours. Root protection zones will also be established to protect the mature trees at St. Flannans Stream.

8.4 OTHER HABITATS AND PROTECTED SPECIES

Construction Phase

HABITATS

During construction, the Contractor will be required to adhere to the following in order to avoid the spread and introduction of non-native invasive species and noxious weeds:

- No cohesive material (clay), subsoil, blinding or gravels will be brought on to the site without prior notification to and inspection by the Site Ecologist,
- Tyres and tracks of plant machinery and construction related vehicles will be checked for the presence of plant material e.g. leaves, roots and rhizomes from non-native invasive species,
- The donor site for the 'suitable cohesive material' required to be imported for the upgrade of the flood defence earthen embankment and the quarry site which is to act as the source of stone for the haul road will be subject to a Suitability Assessment and screening for non-native invasive species prior to the commencement of works.

It must be demonstrated by the Contractor, that the donor site and its material is not a source/vector for the introduction of non-native invasive species. In relation to noxious weeds, this will be achieved by causing localised disturbance to the soil in the donor site prior to transportation in order to identify flushes of any weed or non-native species.

It is not recommended that noxious weeds such as Ragwort (*Senecio jacobea*) which are already present within the site are managed. Given the extent of these species within the habitats on the site the use of herbicide would pose a risk to Annex II species in the River Fergus and inhabiting the backdrain.

The 'suitable cohesive material' or clay utilised in the upgrade of the embankment must be clean, inert and uncontaminated and would be ideally sub-soil, sourced in the local region. The use of sub-soils would support the establishment of semi-natural grassland as opposed to agricultural grassland species which are typically supported by nutrient rich topsoils. Unsuitable material from construction sites etc. would not be suitable for use within site.

Nutrient rich agricultural topsoils should not be utilised to 'finish' the Embankment. A layer of clean inert sub-soil from the backdrain excavation should be utilised. This subsoil should be revegetated as soon as possible after construction with an annual nurse grass seed crop and should be allowed to naturally recolonise with native vegetation with the objective of establishing a Dry calcareous grassland (GS1) on the crest and slopes of the embankment and marginal aquatic species along the toe of the embankment adjacent to the realigned backdrain. The excavated material from the backdrain which will also contain the seedbank of native vegetation present along the backdrain which will assist the process of natural recolonisation

The soils supporting wetland vegetation i.e. Reed and large sedge swamp (FS1), Wet Grassland (GS4) habitat and the species rich marginal plant communities of the backdrain [supporting Reed Sweet-grass (*Glyceria maxima*), and Greater Pond Sedge (*Carex riparia*) amongst other species] between Sluice Gate No. 3 and 4 should also be salvaged and utilised on the toe of the embankment and on the realigned backdrain where practically feasible.

A method statement for the management of soils containing the seedbank of native vegetation should be prepared by the Contractor in consultation with NPWS prior to the commencement of site clearance and soil movement.

INVERTEBRATES

Molluscs

The avoidance and mitigation measures described above in relation to potential water quality impacts to Atlantic Salmon will also serve to mitigate potential water quality impacts to molluscs.

Dragon- and Damselflies

The avoidance and mitigation measures described above in relation to Otter, lamprey and plants will also serve to mitigate potential impacts to dragon- and damselflies.

Butterflies

No avoidance and mitigation measures are proposed in respect of butterflies, however, avoidance and mitigation measures as outlined for plants will also serve to restore habitat for common butterfly species.

Water Beetles

No avoidance and mitigation measures are proposed in respect of water beetles, however, avoidance and mitigation measures as outlined for plants will also serve to restore habitat for beetles.

FISH

In relation to Brown Trout, Twaité Shad, Pollan and Smelt avoidance and standard mitigation measures are as above for Atlantic Salmon. An electrofishing survey of the backdrain and at the location of the 20m² area of instream habitat at the 3 No. sluice gate locations will be required to capture salmonids under licence from the IFI. Translocation to an appropriate recipient site shall be agreed with the IFI and shall be away from the zone of influence of the works. There is no proposed avoidance measure in relation to the loss of 350m of backdrain.

European Eel feed on insect larvae and crustaceans from April to September (as elvers and the adult yellow eel stage) in freshwater. Therefore, avoidance measures to protect European Eel whilst feeding will conflict with the timing of works to protect Atlantic Salmon and overwintering species. Therefore, no recommendations are made in relation to the timing of works to protect European Eel.

The avoidance and mitigation measures described above in relation to potential water quality impacts to Atlantic Salmon will also serve to mitigate potential water quality impacts to European Eel.

AMPHIBIANS AND REPTILES

Where Common Frog, Smooth Newt or European Eel are known to be present and/or are encountered during works, these species will also require capture under licence from the IFI and translocation to an appropriate recipient site agreed with the IFI and away from the zone of influence of the works. The avoidance and mitigation measures described above in relation to potential water quality impacts to Atlantic Salmon will also serve to mitigate potential water quality impacts to Common Frog and Smooth Newt.

There are no proposed avoidance and mitigation measures in respect of Common Lizard.

BIRDS AND MAMMALS

Noise and visual disturbance from construction activities may also disturb bird nesting potential during the summer months in the habitats adjacent to the site. The surrounding landuses including the N85 and the Quin Road Industrial Estate accord a higher level of acceptance of noise by existing wildlife. In order to minimise noise disturbance associated with construction activities, the measures outlined in above in relation to Otter will be put in place where practically feasible.

Measures to limit the impact of visual disturbance to wildlife would also involve limiting works to discrete sections of the flood defence earthen embankment at any one time, in order to avoid continuous impacts along the entire works area of 2.7 km

The removal of vegetation during the period 1st March to the 31st August is prohibited under the Wildlife Act (1976, amendment 2000) and any clearance works will require a derogation from the NPWS for any works carried out within this period. Any vegetation removal required will also be removed in accordance with the NRA (2006) *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub, Past, Prior and During the Construction of National Road Schemes* in order to avoid impacts on nesting birds.

Best practice dictates that impacts on bird species can be readily avoided during construction through timing of site clearance works and through ensuring that birds have left the vegetation prior to commencement of clearance or by timing of works prior to the breeding season.

Where felling within the bird nesting season is required, in order to accommodate site clearance, consultations should be undertaken with the NPWS in order to acquire permission to proceed with works. In any event the Site Ecologist will be present on site to check for nesting birds prior to removal of vegetation. Where nests are identified these should be notified to the NPWS and retained. Yellow hazard tape should be erected for 15m either side of the nest to retain the nest until the brood period has ended. This will be checked and determined by the Site Ecologist.

No vegetation clearance will take place after the 1st October and before end of hibernation period e.g. January/February depending on temperatures in order to avoid impacts on hibernating mammals where practically feasible. Where this is not feasible, a walk over survey to identify the presence of hibernating mammals will be undertaken by the Site Ecologist. Where identified, these will be notified to the NPWS and appropriate measures will be undertaken to relocate the mammals under licence.

The avoidance and mitigation measures described above in relation to potential water quality impacts to Atlantic Salmon will also serve to mitigate potential water quality impacts to Kingfisher, Grey Heron and Mallard.

Given that the use of the geogrid will create a barrier to the future growth of trees and shrubs along the Flood Defence Embankment, steps should be taken during the construction phase to highlight areas of Scrub (WS1) and scattered trees which should be retained. These 'vegetative areas to be retained' should be mapped and utilised to inform routine maintenance during the operational phase in order to maximise the retention of vegetative cover along the embankment overtime. These vegetative areas to be retained should overlap with the locations of the Scrub (WS1) vegetation and semi- and mature Hawthorn, Blackthorn and Willow trees identified between Sluice Gate No. 5 and 6, where practically feasible. Consideration should also be given to the strategic planting of trees and shrubs post-construction in particular between Sluice Gates No. 5 and No. 6.

BATS

Avoidance and standard mitigation measures for Lesser Horseshoe Bat, described above will also serve to protect Daubenton's Bat and Soprano Pipistrelle Bat.

The planting of new tree roost areas for bats should also be considered, as well as the installation of bat boxes.

PLANTS

The soils supporting the species rich marginal vegetation containing Reed Sweet-grass (*Glyceria maxima*) and Greater Pond Sedge (*Carex riparia*) between Sluice Gate No. 3 and 4 should be salvaged from the backdrain and reutilised along the banks of the realigned backdrain.

Operational Phase

Considering the sensitivity of the site, measures will be put in place to ensure that future maintenance works on the flood defence earthen embankment are subject to site specific standard mitigation measures. The same water quality, instream works and vegetation clearance avoidance and standard mitigation measures as described above for the construction phase will also be applicable to the operational phase. The use of the geogrid should reduce the extent of temporary disturbance that would otherwise be associated with maintenance works to address instability issues relating to the embankment in the future. Aside from required maintenance activities access to the flood defence earthen embankments, access to other areas of the Project should be limited to minimise potential for disturbance. This would not exclude the development of a sensitively managed 'nature walk'.

As the geogrid will create a barrier to growth of trees and shrubs along the flood defence earthen embankment, it is recommended that strategic planting of native trees and shrubs be undertaken adjacent to the flood defence earthen embankment (taking into account a maintenance access track) and that any areas of existing Scrub (WS1) and trees outside of the limit of the proposed embankment works should be protected from damage by plant machinery during routine maintenance activities. The 'vegetative areas to be retained' as per the construction phase should also be utilised to inform routine maintenance operations in order to maximise the retention of vegetative cover along the Project.

The planting of new tree roost areas for bats should also be considered, as well as the installation of bat boxes.

9. RESIDUAL IMPACTS

9.1 SPECIAL CONSERVATION INTERESTS

Post-implementation of avoidance and mitigation measures and upon final completion of the works a slight negative impact on Special Conservation Interest species of the River Shannon and River Fergus Estuaries SPA. The long term impact is expected to be negligible as vegetation will recolonise the embankment over time.

9.2 QUALIFYING INTERESTS

Post implementation of avoidance and mitigation measures and upon final completion of the works a permanent slight negative impact on lamprey species inhabiting the backdrain (if present) is anticipated as a result of the loss of 350m of habitat. As discussed the backdrain habitat is an anthropogenic channel constructed in the 1950's as part of the flood defence earthen embankment. Since this time Lamprey (if present within the backdrain) have had access to the backdrain only as a result of the malfunctioning sluice gates, therefore it is not considered that the loss of this habitat will impact on the lamprey population of the Lower River Shannon SAC.

9.3 OTHER HABITATS AND PROTECTED SPECIES

A short-term slight negative impact on resident bird populations and dragon and damselflies in and adjacent to the works is expected as a result of noise disturbance and loss of vegetation. The long term impact is expected to be negligible as vegetation will recolonise the embankment over time.

9.4 NATURA 2000 SITES IN THE WIDER LOCALITY

No residual impacts are expected on Natura 2000 sites in the wider locality.

10. CONCLUSION

Potential impacts during the construction and operational phase of the Ennis South Flood Relief Scheme have been considered in the context of the proposed Natura 2000 sites, their Qualifying Interests, Special Conservation Interests and their conservation objectives.

The extent of the proposed works area is linear in nature with potential edge effects over 2.7km of the Lower River Shannon cSAC. As such, works must be undertaken in discrete work sections and due diligence must be exercised during any construction activities to ensure pollution prevention.

Avoidance and standard mitigation measures for the protection of Qualifying Interests of the SAC and Special Conservation Interests of the SPA are provided. An Environmental Operating Plan will be prepared in advance of construction and where required, site specific method statements shall be prepared. A Site Ecologist will be present during construction works in the vicinity of the Lower Shannon SAC, Ballybeg Stream and St. Flannan's Stream to monitor the implementation of the avoidance and mitigation measures set out in this Natura Impact Statement.

Taking cognisance of the avoidance and standard mitigation measures proposed, it is not predicted that the favourable conservation status of the Qualifying Interests of the SAC and the Special Conservation Interests of the SPA or the *integrity* of the Lower River Shannon cSAC or the River Shannon and River Fergus SPA would be significantly effected by the proposed Ennis South Flood Relief Scheme. For the same reason, it is also not anticipated that the favourable conservation condition of the Annex IV species Lesser Horsehoe Bat will be significantly effected by the proposed Ennis South Flood Relief Scheme.

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Appendix A

Stage 1: Appropriate Assessment Screening Report

Lower River Shannon SAC (Site Code 002165) and River Shannon and River Fergus Estuaries SPA (Site Code 004077)

Project																
Location	Ennis, Co. Clare: Ballybeg Beg Stream, St. Flannan's Stream and an existing flood defence embankment on the Clare Abbey floodplain between Doora bridge on the Quin Road (R469) to the Clarecastle Tidal Barrage on the River Fergus, 220m upstream of the R471.															
Distance from designated site	Embankment upgrade works are located immediately adjacent to and within the Lower River Shannon SAC, and 0.25km upstream of the River Shannon and River Fergus Estuaries SPA.															
Brief description	<p>The aim of the Ennis South Flood Relief Scheme is to alleviate flooding experienced to the South of the town, affecting St. Flannans college along with a number of private dwellings and businesses.</p> <p>The Project consists of 2 No. 1,200mm diameter concrete flood overflow culverts (1,120m and 520m in length), construction of an emergency pumping station, realignment of an existing backdrain and the upgrade of 2.7km of existing flood defence embankment. This embankment upgrade will include the upgrade of associated backdrain, replacement of 2 No. sluice gates and installation of 1 additional sluice gates.</p> <p>The proposed flood defence embankment works are located within and adjacent to the Lower River Shannon SAC (Site Code: 002165) and upstream of the River Shannon and River Fergus Estuaries SPA (Site Code: 004077). The River Fergus at this location is a tidal river and supports internationally important wildfowl populations, Annex II species and nationally rare and localised plant species are known to occur in the adjoining terrestrial habitats such as nationally local Reed Sweet-grass, English Scurvy-grass, Greater Pond-sedge and Pink Water-speedwell, amongst others.</p> <p>The banks hold a 20m wide strip of marginal common reed, reed canary grass and localised greater pond sedge, enclosed by tall embankments. The immediate adjoining fields are generally improved agricultural grassland of low ecological value. Reed swamp and wet grassland are also present. There are patches of mature scrub and field boundaries featuring hedgerows which provide wildlife habitat.</p> <p>Table below summarises the above mentioned designated sites.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Name</th> <th style="width: 10%;">Site Code</th> <th style="width: 15%;">Designation</th> <th style="width: 10%;">Distance</th> <th style="width: 45%;">Notes</th> </tr> </thead> <tbody> <tr> <td>Lower Shannon River SAC</td> <td>002165</td> <td>SAC</td> <td>Adjoining</td> <td> <p>Annex I habitats: sandbanks, estuaries, mudflats and sand flats, large shallow inlets and bays, reefs, vegetation of stony banks, vegetated sea cliffs, Atlantic salt meadows, Mediterranean salt meadows, floating river vegetation</p> <p>Annex II species: sea lamprey, brook lamprey, river lamprey, bottlenose dolphin, otter and freshwater pearl mussel</p> </td> </tr> <tr> <td>River Shannon and River Fergus estuaries</td> <td>004077</td> <td>SPA</td> <td>0.25km</td> <td>The site is the most important coastal wetland site in the country and regularly supports in excess of 50,000 wintering waterfowl. This site also has vast expanses of</td> </tr> </tbody> </table>	Name	Site Code	Designation	Distance	Notes	Lower Shannon River SAC	002165	SAC	Adjoining	<p>Annex I habitats: sandbanks, estuaries, mudflats and sand flats, large shallow inlets and bays, reefs, vegetation of stony banks, vegetated sea cliffs, Atlantic salt meadows, Mediterranean salt meadows, floating river vegetation</p> <p>Annex II species: sea lamprey, brook lamprey, river lamprey, bottlenose dolphin, otter and freshwater pearl mussel</p>	River Shannon and River Fergus estuaries	004077	SPA	0.25km	The site is the most important coastal wetland site in the country and regularly supports in excess of 50,000 wintering waterfowl. This site also has vast expanses of
Name	Site Code	Designation	Distance	Notes												
Lower Shannon River SAC	002165	SAC	Adjoining	<p>Annex I habitats: sandbanks, estuaries, mudflats and sand flats, large shallow inlets and bays, reefs, vegetation of stony banks, vegetated sea cliffs, Atlantic salt meadows, Mediterranean salt meadows, floating river vegetation</p> <p>Annex II species: sea lamprey, brook lamprey, river lamprey, bottlenose dolphin, otter and freshwater pearl mussel</p>												
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				intertidal flats and Annex I habitat on EU habitats directive.		
Is the plan directly connected with or necessary to the Natura 2000 site management for nature conservation?	No					

Stage 1 - Screening

Describe the individual elements of the plan (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 sites.	<p>The proposed flood defence embankment upgrade is located within, and adjacent to the Lower River Shannon SAC, with the emergency pumping station adjacent to this SAC.</p> <p>The main channel of the River Fergus is a designated salmonid water under the European Communities (Quality of Salmonid Waters) Regulation of 1988 implementing the freshwater fish directive.</p> <p>Impacts within the lands encompassed by the SAC are mainly associated with potential direct impacts due to loss of reed and large sedge swamp, scrub, wet grassland and tree-line habitat through the upgrade of the embankment and realignment of the backdrain and the construction of upgrade/installation of 3 No. sluice gates. There is also potential for indirect impacts on Qualifying Interests as a result of temporary changes to water quality as a result of silt laden runoff during construction works on the embankment (and backdrain) and at S. Flannan's and Ballybeg Streams.</p>
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: Size and scale; Land-take; Distance from Natura 2000 site or key features of the site; Resource requirements; Emissions; Excavation requirements; Transportation requirements; Duration of construction, operation etc.; Others.	<p>Direct impacts of the proposed works would include habitat loss and potential indirect impacts to water quality as a result of silt laden runoff from work areas located beside the River Fergus and at Ballybeg and St. Flannan's Streams.</p> <p>Indirect impacts are defined as affects that are "caused by and result from the activity although they are later in time or further removed in distance, but still are reasonably foreseeable" (Bowers-Marriott, 1997). The main potential indirect impact of the current proposed Project would be pollution of downstream habitats within the River Fergus estuary. This could include suspended solids released as a result of runoff from disturbed areas. Accidental release or spillage of oils or fuels from site vehicles could also have an effect. Such potential impacts would be particularly severe if they were to occur during the salmonid or lamprey spawning seasons. Only the month of September is outside of salmonid and lamprey spawning seasons on the River Fergus.</p> <p>Impacts would be expected to mainly occur during the construction phase. Once operational the main potential impact would be from maintenance activities along the embankment.</p>
Describe any likely changes to the site arising as a result of: Reduction of habitat area; Disturbance of key species; Habitat or species fragmentation; Reduction in species density; Changes in key indicators of conservation value; Climate change.	<p>Existing habitats within the study area include the aquatic environment of the River Fergus (and backdrain), St. Flannan's and Ballybeg Streams, scrub, reed swamp, tree-lines and wet grassland habitats along the River Fergus corridor.</p> <p>The clearance of habitats for the proposed Project will require the removal of scrub, reed swamp and wet grassland vegetation in localised areas along 2.7km of the Fergus River. Loss of reed swamp will be primarily on the landward side of the embankment where the footprint of the embankment will be increased. This loss of</p>

	<p>habitat may affect Otter and overwintering birds.</p> <p>Lamprey may be present in the existing backdrain at the foot of the embankment which would be affected by the realignment of the existing embankment footprint due to loss of habitat.</p> <p>The proposed works will not directly affect the estuarine Annex I habitats of the SAC as these are located downstream of the Clarecastle tidal barrage.</p>
<p>Describe any likely impacts on the Natura site as a whole in terms of: Interference with the key relationships that define the structure of the site; Interference with key relationships that define the function of the site.</p>	<p>Only minor localised instream works will temporarily affect the flow regime or water quality, there will be no interference with the hydrogeology or hydrology of the Natura 2000 site as a whole.</p> <p>There is the potential for indirect impacts on water quality as a result of silt laden runoff from work being carried out along the embankment and at St. Flannan's and Ballybeg Streams, along with the potential for the spillage or accidental release of fuels and oils from machinery at the construction and maintenance (during operational) stage.</p>
<p>Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale of magnitude of impacts is not known.</p>	<p>The proposed embankment upgrade will result in the disturbance of vegetation along 2.7km of embankment and adjacent backdrain with potential loss of habitat and disturbance to Annex II species, including lamprey and Otters.</p> <p>The screening exercise concludes that further ecological assessment is required to ascertain the presence and location of Annex II species before the proposed works are to be carried out. A suite of mitigation measures is to be prepared aimed at protecting the water quality, species and habitats found in/along the River Fergus and at Ballybeg and St. Flannan's Streams. These mitigation measures are to be agreed with the NPWS prior to construction.</p>

Appendix B

River Habitat Corridor Survey



Comhairle Contae an Chláir
Clare County Council

ENNIS SOUTH FLOOD RELIEF SCHEME

RIVER HABITAT CORRIDOR SURVEY

AUGUST 2012



Sherwood House, Sherwood Avenue, Taylor's Hill, Galway
Suite D4, The Cubes Offices, Beacon South Quarter, Sandyford Dublin 18

1. Introduction

Ryan Hanley has been commissioned by Clare County Council to undertake a River Habitat Corridor Survey of Ballybeg Stream and St. Flannan's Stream, Ennis Co. Clare and the tidal backdrain and adjacent habitats connected to the River Fergus between Clarecastle and Ennis town, Co. Clare in light of the proposed Ennis South Flood Relief Scheme.

The Ennis South Flood Relief Scheme (referred to herein as the Project) includes the installation of 2 No. flood overflow culverts at the location of Ballybeg and St. Flannan's Streams and the upgrade of an existing flood defence earthen embankment adjacent to the River Fergus, among other ancillaries.

This River Habitat Corridor Survey was prepared to inform the Natura Impact Statement (NIS) for the proposed Project.

2. Methods

2.1 Study Area

A River Habitat Corridor Survey was undertaken in November 2011 and August 2012 on the following surface water bodies and adjoining habitats in order to acquire baseline information on the habitat quality and value of the surface water bodies and to ascertain whether any protected aquatic species or habitats were present:

- Ballybeg Stream
- St. Flannans Stream
- Backdrain, River Fergus and associated drainage network
- River Fergus

The survey results also provide a benchmark for future management to ensure that the existing habitat quality and species composition of the surface waterbodies in the footprint of the works area can be maintained during the construction and operational phases of the Ennis South Flood Relief Scheme.

2.2 River Corridor and Fisheries Assessment

In accordance with best practice the following guidance documents were used in the assessment:

- River Habitat Survey Methodology (EA, 2003)
- Fishery Assessment Methodology (O'Grady, 2006)
- Lamprey Spawning Habitat Assessment (Scottish Natural Heritage, 2004; 2007).
- Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes (NRA, 2008)
- Guidelines for Baseline Ecological Assessment (IEA, 1995)

The habitat mapping was undertaken in accordance with the 'Best Practice Guidelines for Habitat Mapping' (The Heritage Council, 2010) and the 'Guidelines for Baseline Ecological Assessment' (IEA, 1995).

Any habitats identified were categorised as per Fossitt (2000) 'A Guide to Habitats in Ireland' and where relevant they were also categorised according to EC (2007b) 'Interpretation Manual of European Union Habitats' where they were found to correspond to Annex I habitats

The DAFOR scale was utilised to measure frequency and percentage cover of in-stream macrophytes as follows:

- Dominant (D) - >75% cover
- Abundant (A) – 51-75% cover
- Frequent (F) – 26-50% cover
- Occasional (O) – 11-25% cover
- Rare (R) – 1-10% cover

Locally Frequent (LF) is also used where the frequency and distribution is patchy.

Available EPA water quality data was reviewed to obtain baseline water quality data from watercourses within and adjacent to the proposed Project.

2.2 Macro-invertebrate Assemblage

Based on the nature and scale of the proposed works on the backdrain a further detailed assessment of the water quality based on the macro-invertebrate assemblage was undertaken. While it was preferable to undertake such a detailed assessment on the River Fergus at the 3 No. sluice gate locations on the River Fergus, River Fergus is deep and slow flowing at these locations indicating unsuitability for sampling under the EPA Q-value system.

While the EPA Q-value system (Toner et al., 2005) was developed to broadly classify the biological water quality of rivers and streams in Ireland, it is not applicable to classifying the water quality of ponding water in drains, or that of ponds, or lakes. Therefore, no user friendly system currently exists in an Irish context to classify the water quality of ponding water in the backdrain using macro-invertebrates or macrophyte plant species.

Furthermore, there is no unified nationally accepted methodology for evaluating the ecological and fisheries value of ponding water in the backdrain habitat, small lakes or river habitats.

In light of the above, the following best practice guidance documents were used in the assessment:

- A guide to monitoring the ecological quality of ponds and canals using PSYM (Pond Action, 2002)

In the UK, Pond Action have developed a scoring system known as 'PSYM' to classify pond conservation value based on invertebrate composition using the BMWP¹ and other scoring indices. This is based on the number of meso-habitats in the aquatic system which in turn supports various invertebrate assemblages depending on water quality.

While this scoring system cannot be directly applied to assessing conservation value in Ireland, as it involves an index that looks at national rarity of species in the UK, it can be used in Ireland as a qualitative measure to infer the water quality and value of ponding water habitat, as invertebrate families common to both countries have similar tolerances to pollution and habitat degradation. Therefore the scores applied are still broadly relevant in an Irish context.

¹ Biological Monitoring Workers Party: scores are assigned to taxa as defined by Maitland (1977). Each family of benthic macro invertebrates is assigned a value between 1 and 10 depending on its known tolerance to organic pollution; higher scores indicate lower pollution tolerance.

Based on the experience of the surveyor, and on foot of a walkover, this system provided the best available measure of the habitat quality of the backdrain habitat.

In addition to the field surveying techniques of O Grady (2006) and EA (2003), to assess the ecology and fisheries value of the backdrain habitat the following field surveying techniques were utilised to inform the PSYM method.

A standard hand net (250 mm width, mesh size 500 micron) was used to sweep macrophytes and capture invertebrates from macrophytic vegetation and substrata along the backdrain. The net was moved up and down (Chael *et al.* 1993) along the bottom to collect epibenthic and epiphytic invertebrates from the substratum and from overlying floating macrophytes. In order to ensure appropriate habitat coverage, a 3-minute sampling period was divided amongst the range of meso-habitats present within each of the Sections (A-D) of the backdrain in order to acquire a representative sample for these sub-habitats. These data give an indication of the diversity within the backdrain and water quality through the adapted methodology outlined above.

2.4 Criteria for Identification of Ecological Constraints

In the absence of any nationally recognised standards or guidance for evaluating the ecological significance of potential impacts arising from developments, other than roads (see the NRA EACG), ecological features were evaluated by the criteria listed below to determine the significance of the features located in the study area on an importance scale of seven ranks: -

- International importance,
- National importance,
- County / Regional importance,
- High Local importance,
- Moderate Local importance,
- Low Local importance, and
- Negligible.

The reference area for “Local” importance for terrestrial habitats is a 10 × 10 km grid square.

For freshwater ecological features, the reference area for “Local” importance is the river catchment(s).

This system of geographical ranking of the importance of sites is in accordance with guidance contained in the Institute for Ecology and Environmental Management’s (IEEM) *Guidelines for Ecological Impact Assessment* (2006).

3. Description of the Existing Environment

Based on the findings of the River Habitat Corridor Survey, habitat mapping was prepared of the habitats within and adjacent to the proposed Project (see Drawing Nos. 2188 HAB/1 to 6.) These drawings should be read in conjunction with the description of the habitats outlined below.

3.1 Ballybeg Stream

Ballybeg Stream is a Depositing/lowland river (FW2) that is located in the town land of Ballybeg in the southern suburbs of Ennis town, Co. Clare.

It flows in a north easterly direction parallel to the Limerick Road just south of the N85 roundabout. It terminates as a large ponding water body classified as a small ponding waterbody (FL8) where it disappears underground via a karst swallow-hole (see Drawing No. 104/BP).

Ballybeg Stream is relatively small at approximately 1.5m wide and 0.3m deep. The benthic substrate was found to be composed primarily of silt and gravels. The channel exhibits a “U” shaped profile throughout and has been realigned and modified based on the presence of large boulders around the perimeter of the swallow-hole.

The channel was found to contain a low diversity but relatively high percentage cover of in-stream macrophytes. The macrophyte assemblage was found to be dominated by Duckweed (*Lemna minor*), Fool's Watercress (*Apium nodiflorum*) and Yellow Water Lily (*Nuphar lutea*), while the emergent/marginal zone was found to be dominated by Fine-leaved Hemlock Water dropwort (*Oenanthe aquatica*), Angelica (*Angelica sylvestris*), Meadowsweet (*Fillipendula ulmaria*), Yellow Flag (*Iris pseudacorus*) and Branched Bur-reed (*Sparganium erectum*).

At the terminus of the stream, the ponding waterbody at the entrance to the swallow-hole is approximately 10m in diameter with an unknown benthic substrate type and depth. The banks were found to be modified with large boulders. The adjacent sloping banksides contained fly-tipping from the adjacent gardens which backed onto the swallow-hole including arisings from grass cutting. A reinforced concrete wall has been constructed around the garden of one adjacent dwelling which was flooded in November 2009 which runs parallel to the stream and terminates south of swallow-hole.

The floating and emergent macrophyte assemblage of the ponding waterbody was found to be dominated by Frogbit (*Hydrocharis morsus-ranae*), Common Water Plantain (*Alisma plantago-aquatica*), the non-native invasive species Curly-leaf Pondweed (*Potamogeton crispus*) and Canadian Pondweed (*Elodea canadensis*), while the species rich marginal vegetation consisted of Water Mint (*Mentha aquatica*), Water Figwort (*Scrophularia auriculata*), Great Water Dock (*Rumex hydrolapathum*), Water Forget-me-not (*Myosotis scorpioides*), Hemlock Water dropwort (*Oenanthe aquatica*), Branched Bur-reed (*Sparganium erectum*), Meadowsweet (*Fillipendula ulmaria*), Reed Canary Grass (*Phalaris arundinacea*), Angelica (*Angelica sylvestris*), Yellow Flag (*Iris pseudacorus*) and Marsh Woundwort (*Stachys palustris*).

On the bankside, the habitat can be classified as Recolonising bare ground (ED3) dominated by Plantain (*Plantago lanceolata*), Nettle (*Urtica dioica*), Creeping Buttercup (*Ranunculus repens*), Rough Hawksbeard (*Crepis biennis*), Sorrel (*Rumex acetosella*), Tormentil (*Potentilla erecta*), Rosebay Willowherb (*Epilobium angustifolium*), Nightshade (*Solanum* sp.), Dock (*Rumex obtusifolius*), Yellow Flag (*Iris pseudacorus*), Ragwort (*Senecio jacobea*) and Dandelion (*Taraxacum* sp.).

The stream and the swallow-hole are bound by Buildings and artificial surfaces (BL3), Recolonising bare ground (ED3) and a Tree-line (WL2). The high canopy layer surrounding the stream and pond is dominated by Ash (*Fraxinus excelsior*), the non-native species *Leylandii*, the non-native invasive species Sycamore (*Acer pseudoplatanus*) and a low canopy of tall shrubs dominated by Willow (*Salix* spp.), Hawthorn (*Crataegus monogyna*) and the non-native invasive species Snowberry (*Symphoricarpos albus*) and trailing and climbing species consisting of Bramble (*Rubus fruticosus*) and Ivy (*Hedera helix*).

The ponding water body has potential for Common Frog (*Rana temporaria*) and Smooth Newt (*Triturus vulgaris*). Numerous structures were noted in the margins around the stream such as piles of stone from construction and demolition waste and branches of trees from tree cutting which would form suitable hibernacula or overwintering sites for Smooth Newt. European Eel (*Anguilla anguilla*) are also known to occur in the pond (based on information provided by a local landowner). It is likely that the stream and pond also supports Brook Lamprey (*Lampetra planeri*) and River Lamprey (*Lampetra fluviatilis*).

3.2 St. Flannans Stream

St. Flannan's Stream is a Depositing/lowland river (FW2) that is located in the grounds of St. Flannan's College just off the Limerick Road in Ennis town, Co. Clare.

It flows in a north easterly direction along the boundary of the college sportgrounds classified as Amenity grassland (GA2). It terminates as a ponding water body classified as a small ponding waterbody (FL8) where it disappears underground via a karst swallow-hole (see Drawing No. 102/BP).

St. Flannan's Stream is relatively small at approximately 1.5m wide and 0.5m deep. The benthic substrate was found to be composed primarily of silt and boulders. The channel exhibits a "U" shaped profile throughout and has been realigned and modified based on the presence of large boulders around the perimeter of the swallow-hole.

The channel was found to contain a low diversity and low cover of in-stream macrophytes. The macrophyte assemblage was found to be dominated by Fool's Watercress (*Apium nodiflorum*), Duckweed (*Lemna minor*) and localised Reed Canary Grass (*Phalaris arundinacea*), while the emergent/marginal zone was dominated by Water Mint (*Mentha aquatica*), Water Figwort (*Scrophularia auriculata*), Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*) and Marsh Woundwort (*Stachys palustris*).

At the terminus of the stream, the ponding waterbody at the entrance to the swallow-hole is approximately 7.0m in diameter with an unknown benthic substrate type and depth. The banks were found to be modified with large boulders. On the bankside, the habitat was dominated by Rosebay Willowherb (*Epilobium angustifolium*), Creeping Buttercup (*Ranunculus repens*), Dock (*Rumex obtusifolius*), Nettle (*Urtica dioica*), Silverweed (*Potentilla anserina*), Meadow Buttercup (*Ranunculus acris*), Greater Plantain (*Plantago major*), Herb Robert (*Geranium robertianum*), Ragwort (*Senecio jacobea*) and Hedge Bindweed (*Calystegia sepium*).

The stream and the swallow-hole are bound by a Tree-line (WL2). The high canopy layer surrounding the stream and pond is dominated by the non-native species Horse Chestnut (*Aesculus hippocastanum*), the non-native invasive species Sycamore (*Acer pseudoplatanus*) and a low canopy of tall shrubs dominated by Willow (*Salix* spp.) and trailing and climbing species consisting of Bramble (*Rubus fruticosus*) and Ivy (*Hedera helix*).

The ponding water body has good potential for Common Frog (*Rana temporaria*) and European Eel (*Anguilla anguilla*). It is likely that the stream and pond also supports Brook Lamprey (*Lampetra planeri*) and River Lamprey (*Lampetra fluviatilis*).

3.1.3 Backdrain, Flood Defence Embankment and adjacent habitats

The backdrain is located on the Clareabbey floodplain east of Ennis town, Co. Clare and runs parallel to an existing flood defence earthen embankment located along the banks of the River Fergus between Doora Bridge on the Quin Road (R469) and the Clarecastle Tidal Barrage, 220m upstream of the regional road R471. The backdrain is connected to the River Fergus via a series of existing sluice gates. It is also connected to a series of Drainage ditches (FW4) or field boundaries within the adjacent improved agricultural grassland of the Clare Abbey floodplain.

The backdrain can be categorised as a Tidal river (CW2);- 'lower reach of a river or artificial watercourse, that are tidal and where there are regular fluctuations in salinity and turbidity, and in the rate and direction of flow' as per Fossitt (2000) 'A Guide to Habitats in Ireland'.

Based on a walkover of the site the assessment of the backdrain has been divided into four Sections A-D as follows:

Section A: between Sluice Gate No. 1 & Sluice Gate No. 3

This is the furthest upstream (northern) section of the backdrain and associated habitats under assessment and is located downstream of Doora bridge near Ennis town (see Drawing No. 109/BP).

The adjacent habitats of the backdrain between Sluice Gate No. 1 and Sluice Gate No. 3 commence with an area of disturbed ground categorised as Recolonising bare ground (ED3) associated with the adjacent Business Park. The recolonising bareground was found to be dominated by a diverse array of ruderal and pioneer species and patches of Scrub (WS1) vegetation. Amongst the construction and demolition waste and fly-tipping, the ruderal and pioneer species recorded were Dandelion (*Taraxacum* sp.), Black Medic (*Medicago lupulina*), Ragwort (*Senecio jacobea*), Coltsfoot (*Tussilago farfara*), Creeping Buttercup (*Ranunculus repens*), Herb Robert (*Geranium robertianum*), Willow seedlings (*Salix* sp.), Creeping Thistle (*Cirsium arvense*), Red Clover (*Trifolium pratense*), Willowherb (*Epilobium* sp.), Ox-eye Daisy (*Leucanthemum vulgare*), Bramble (*Rubus fruticosus*), Water Figwort (*Scrophularia auriculata*), Sharp-flowered Rush (*Juncus acutiflorus*), Rosebay Willowherb (*Epilobium angustifolium*), St. Johnswort (*Hypericum hirsutum*), Ragwort (*Senecio jacobea*), Hedge Woundwort (*Stachys sylvatica*), Common Knapweed (*Centaurea nigra*), Bulrush (*Typha latifolia*), Kidney Vetch (*Anthyllis vulneraria*) Ribwort Plantain (*Plantago lanceolata*), Ivy-leaved Toadflax (*Cymbalaria muralis*), White Clover (*Trifolium repens*) and the non-native species (a likely garden escapee) Stonecrop (*Sedum* sp.). The scrub layer was found to be dominated by Willow Scrub (WS1) containing the non-native invasive species Butterfly Bush (*Buddleia davidii*), Gorse (*Ulex europaeus*) and Bramble (*Rubus fruticosus*).

The backdrain at this location has a riparian zone composed of Reed and large sedge swamp (FS1) with 100% cover of Common Reed (*Phragmites australis*) while the wetted channel itself consists of a two stage channel with a species poor macrophyte assemblage consisting mainly of localised patches of Fool's Watercress (*Apium nodiflorum*) where light can reach the margins of the drain. The channel is also heavily choked with Duckweed (*Lemna minor*) and the green algae (*Cladophora* sp.) indicating local enrichment and eutrophication pressures. The water flow in the backdrain at this location is very slow moving during the slack part of the tidal cycle at this location. The depth of water was very shallow (0.50m mean depth).

The adjacent flood defence earthen embankment was found to be dominated by tall dense vegetation consisting mainly of ruderal, pioneer and agricultural weedy species indicating that topsoil sourced from Improved agricultural grassland (GA1) was utilised in the construction of the embankment and possibly nutrient enrichment from alluvial deposits post flood events (see Plate 1). The weedy species are also indicative of the recent disturbance associated with the site investigation works undertaken in January 2012. Species recorded along the embankment include the annual Oil Seed Rape (*Brassica napus*), also Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*), Dock (*Rubus obtusifolius*), Angelica (*Angelica sylvestris*), Hogweed (*Heracleum sphondylium*), Rough Hawksbeard (*Crepis biennis*), False Oat Grass (*Arrhenatherum elatius*), Dandelion (*Taraxacum* sp), Sorrel (*Rumex acetosella*), Red Clover (*Trifolium pratense*), Rosebay Willowherb (*Epilobium angustifolium*), Ragwort (*Senecio jacobea*) and Hedge Bindweed (*Calystegia sepium*). The only woody species recorded along the entire length of the embankment in Section A was Bramble (*Rubus fruticosus*) (see Plate 1). A few scattered semi-mature trees predominantly Willow (*Salix* sp.) were also recorded. along with a short Tree-line (WL2) also dominated by Willow.



Plate 1: Typical vegetation of the flood defence earthen embankment.

Common Reed (*Phragmites australis*) was also recorded at the toe of the embankment along the margins of the backdrain.

Moving east from the Business Park, the adjacent habitats of the backdrain changes from Recolonising bareground (ED3) to a large area of Reed and large sedge swamp (FS1) dominated by a monoculture of Common Reed (*Phragmites australis*) and on to (wet semi-) Improved agricultural grassland (GA1) with localised patches of Common Rush (*Juncus effusus*) and dominated by Perennial Ryegrass (*Lolium perenne*),

Dock (*Rumex obtusifolius*), Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*), Creeping Buttercup (*Ranunculus repens*), Meadow Buttercup (*R. acris*) and Sorrel (*Rumex acetosella*).

Between the Business Park and the Reed swamp is a Tree-line (WL2) with a high canopy of Alder (*Alnus glutinosa*) and a low canopy of Hawthorn (*Crataegus monogyna*) and Willow (*Salix* sp.) which lines a small surface water body categorised as a Drainage ditch (FW4) running perpendicular to the embankment. A few semi- and mature Willow and Hawthorn trees were also recorded scattered along the riverside of the embankment within this Section.

The backdrain was found to contain a species poor macrophyte assemblage with a high percentage cover of submerged and emergent species including Duckweed (*Lemna minor*) and Fool's Watercress (*Apium nodiflorum*), while the emergent/marginal zone was more species rich and was found to be dominated by Common Water Plantain (*Alisma plantago-aquatica*), Marsh Bedstraw (*Galium palustre*), Brooklime (*Veronica beccabunga*), Fine-leaved Hemlock Water dropwort (*Oenanthe aquatica*), Meadowsweet (*Fillipendula ulmaria*), Yellow Flag (*Iris pseudacorus*), Sharp-flowered Rush (*Juncus acutiflorus*), Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Water Mint (*Mentha aquatica*), Horetail (*Equisetum* sp.), Reed Sweet Grass (*Glyceria maxima*) and Marsh Woundwort (*Stachys palustris*).

Moving further east the Improved agricultural grassland (GA1) becomes slightly drier in nature and consists of rough pasture categorise as (semi-) Improved agricultural grassland (GA1) dominated by Creeping Buttercup (*Ranunculus repens*), Meadow Buttercup (*Ranunculus acris*), Redshank (*Polugonum*), Silverweed (*Potentilla anserina*), Mouse-ear Chickweed (*Cerastium vulgatum*), Perennial Ryegrass (*Lolium perenne*) and Meadow grass (*Poa* sp.).

Section B: between Sluice Gate No. 3 & Sluice Gate No. 4

The adjacent habitats of the backdrain between Sluice Gate No. 3 and 4 are dominated by (wet) Improved agricultural grassland (GA1) with localised patches of Common Rush (*Juncus effusus*) with Perennial Ryegrass (*Lolium perenne*), Dock (*Rumex obtusifolius*), Dandelion (*Taraxacum* sp.), White Clover (*Trifolium repens*), Yorkshire Fog (*Holcus lanatus*), Meadow grass (*Poa* sp), Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*) and Sorrel (*Rumex acetosella*).

Further south, the area of wet Improved agricultural grassland (GA1) closest to Sluice Gate No. 4 contains localised patches of Yellow Flag (*Irish pseudacorus*) as opposed to Rushes (*Juncus* sp.) which are reduced to occasional across this field. Similar constituent species to the adjacent Rushes (*Juncus* sp.) dominated field occur with exception of Cocksfoot (*Dactylis glomerata*). Creeping Thistle (*Cirsium arvense*) and Nettle (*Urtica dioica*) are also now restricted to the margins of the field where it bounds the backdrain. Cats-Ear (*Hydrochaeris radicata*), Greater Plantain (*Plantago major*) and Horsetail (*Equisetum* sp.) were also recorded adjacent to a short Tree-line (WL2). The Tree-line (WL2) which consists of a double row of trees either side of an agricultural access point over the backdrain runs perpendicular to the backdrain between the *Juncus* and *Iris* dominated grasslands and contains a high canopy layer of *Leylandii*, 2 no. Lodgepole Pines (*Pinus contorta*), a young Ash (*Fraxinus excelsior*) tree and a ground flora with a low percentage cover of Cow Parsely (*Anthriscus sylvestris*), Nettle (*Urtica dioica*), Greater Plantain (*Plantago major*) and Ivy (*Hedera helix*). No potential for bat roosts in these trees was recorded during the site survey. The adjacent ruins of Clare Abbey church outside of the works area may have potential for bats (see Plate 2).



Plate 2: View from backdrain of the Leylandii dominated Tree-line (WL2) (to the right) and wet Improved agricultural grassland in the foreground and Clare Abbey ruins in the background.

The vegetation of the embankment in Section B was found to be similar in nature to Section A with Rosebay Willowherb (*Epilobium angustifolium*), Nettle (*Urtica dioica*), Hedge Bindweed (*Calystegia sepium*) and Oil Seed Rape (*Brassica napus*) dominating.

The section of the backdrain between Sluice Gate No. 3 and 4 was found to be fast flowing during the fill and ebb of the tide. The backdrain is very deep in places (>2.5m) and was found to contain a species poor macrophyte assemblage with a high percentage cover of Duckweed (*Lemna minor*), Starwort (*Callitriche stagnalis*), Spiked Water-milfoil (*Myriophyllum spicatum*) and Fool's Watercress (*Apium nodiflorum*), while the emergent/marginal zone was more species rich and was found to be dominated by Common Water Plantain (*Alisma plantago-aquatica*), Marsh Bedstraw (*Galium palustre*), Brooklime (*Veronica beccabunga*), Water Forget-me-not (*Myosotis scorpioides*), Fine-leaved Hemlock Water dropwort (*Oenanthe aquatica*), Angelica (*Angelica sylvestris*), Meadowsweet (*Filipendula ulmaria*), Fool's Watercress (*Apium nodiflorum*), Yellow Flag (*Iris pseudacorus*), Hard Rush (*Juncus inflexus*), Sharp-flowered Rush (*Juncus acutiflorus*), Common Reed (*Phragmites australis*), Reed Canary Grass (*Phalaris arundinacea*), Water Mint (*Mentha aquatica*), Horetail (*Equisetum* sp.), Reed Sweet Grass (*Glyceria maxima*), Spiked Water-milfoil (*Myriophyllum spicatum*), Marsh Woundwort (*Stachys palustris*) and localised patches of Common Clubrush (*Schoenoplectus lacustris*), Large Yellow Sedge (*Carex flava*) and Greater Pond Sedge (*Carex riparia*).

The backdrain is fringed by patches of Reed and large sedge swamp (FS1) vegetation dominated by Common Reed (*Phragmites australis*) and localised Reed Canary Grass (*Phalaris arundinacea*) at the toe of the embankment where it meets the backdrain.



Plate 3 – Location of Sluice Gate No. 3: backdrain and Drainage Ditch (FW4) with embankment to the rear

A surface waterbody categorised as a Drainage ditch (FW4) runs perpendicular to the backdrain at Sluice Gate No. 3 (see Plate 3). This backdrain was found to contain green algae *Cladophora*, Starwort (*Callitriche stagnalis*), Fools Watercress (*Apium nodiflorum*) and the non-native invasive species Curly-leaf Pondweed (*Potamogeton crispus*). Marginal vegetation was found to be dominated by Brooklime (*Veronica beccabunga*), Water Forget-me-not (*Myosotis scorpioides*), Fine-leaved Hemlock Water Dropwort (*Oenanthe aquatica*), Watermint (*Mentha aquatica*), Marsh Ragwort (*Senecio aquaticus*), Pendulous Sedge (*Carex pendula*), Angelica (*Angelica sylvestris*), Common Clubrush (*Schoenoplectus lacustris*), European Bur-reed (*Sparganium emersum*), St. Johnsworth (*Hypericum hirsutum*), Marsh Woundwort (*Stachys palustris*), Meadowsweet (*Filipendula ulmaria*), Marsh Marigold (*Caltha palustris*) and Horetail (*Equisetum* sp.). Sorrel (*Rumex acetosella*), Creeping Buttercup (*Ranunculus repens*), Redshank (*Polygonum persicaria*), Creeping Thistle (*Cirsium arvense*) and Nettle (*Urtica dioica*) were recorded along the field boundary, while a small patch of Common Reed (*Phragmites australis*) and Reed Canary Grass (*Phalaris arundinacea*) was found at the toe of the embankment where it meets the Drainage ditch (FW4).

A structurally poor hedgerow was recorded along the southern bank of the Drainage ditch (FW4) which was dominated by a small number of Willow (*Salix* sp.) and Hawthorn (*Crataegus monogyna*) trees. No high canopy or low shrub layer was found to be present within the lands made available to the Project. The climbing and trailing layer was found to contain Bramble (*Rubus fruticosus*) and Dog Rose (*Rosa canina*).

At the southern end of Section B at Sluice Gate No. 4, the adjacent habitat changes from Improved agricultural grassland to Recolonising bareground (ED3) associated with the construction of the N85 road bridge (see Plate 4). This area is the proposed location for the site compound. The habitat is dominated by pioneer and ruderal species including Ragwort (*Senecio jacobea*), Tufted Vetch (*Vicia cracca*), Greater Plantain (*Plantago major*), Silverweed (*Potentilla anserina*), Red Clover (*Trifolium pratense*), Common Knapweed (*Centaurea nigra*), Willowherb (*Epilobium* sp.), Creeping Thistle (*Cirsium arvense*), Groundsel (*Senecio vulgaris*), Dandelion (*Taraxacum* sp.), Ox-eye Daisy (*Leucanthemum vulgare*), Rough Hawksbeard (*Crepis biennis*), Scented Mayweed (*Matricaria recutita*), Mouse-ear Chickweed (*Cerastium vulgatum*), Hedge Woundwort (*Stachys sylvatica*), a Nightshade (*Solanum* sp.) (one individual) seedling, White Clover (*Trifolium repens*), Coltsfoot (*Tussilago farfara*), Scarlet Pimpernel (*Anagallis arvensis*), Black Medic (*Medicago lupulina*), the non-native species Teasel (*Dipsacus* sp.) and seedlings of the non-native invasive species Butterfly Bush (*Buddleia davidii*). Cats-ear (*Hypochaeris radicata*) and Birds-foot Trefoil (*Lotus corniculatus*) were also recorded present.

The backdrain at this location contains a high diversity of macrophyte species including Spiked-water Milfoil (*Myriophyllum spicatum*), Starwort (*Callitriche stagnalis*), Water Plantain (*Plantago aquatica*), Fools Watercress (*Apium nodiflorum*), Watercress (*Rorippa nasturtium-aquaticum*), Water Parsnip (*Berula erecta*), Reed Sweet Grass (*Glyceria maxima*), European Bur-reed (*Sparganium emersum*), a green algae *Cladophora* sp., Fennel Pondweed (*Potamogeton pectinatus*) and the non-native invasive species Curly-leaved Pondweed (*Potamogeton crispus*). A very small stand of Common Water Crowfoot (*Ranunculus aquatilis*) was recorded present.

European Eel (*Anguilla anguilla*) was confirmed present at Sluice Gate No. 4, where numerous small elvers were found during surveys.



Plate 4: Location of Sluice Gate No. 4 and the area of Recolonising bare ground at the N85 road bridge (location of proposed Pumping Station to the right of photograph)

Section C: between Sluice Gate No. 4 & Sluice Gate No. 5

The habitat under the N85 road bridge and adjacent to the River Fergus at the commencement of Section C is also categorised as Recolonising bare ground (ED3) and is dominated by Angelica (*Angelica sylvestris*), Cow Parsley (*Anthriscus sylvestris*), Ragwort (*Senecio jacobea*), Creeping Thistle (*Cirsium arvense*), Dandelion (*Taraxacum* sp.), Willowherb (*Epilobium* sp.), Horsetail (*Equisetum* sp.), Marsh Woundwort (*Stachys palustris*), Meadow Vetchling (*Lathyrus pratensis*), Greater Plantain (*Plantago major*), Rosebay Willowherb (*Epilobium angustifolium*), Cats-ear (*Hypochaeris radicata*), Tormentil (*Potentilla erecta*), Nettle (*Urtica dioica*), Bindweed (*Calystegia sepium*), Rough Hawksbeard (*Crepis biennis*), Bramble (*Rubus fruticosus*), Timothy (*Phleum pratense*), Creeping-bent Grass (*Agrostis stolonifera*), Sunspurge (*Euphorbia* sp.) and Mint (*Mentha* sp.). Common Reed (*Phragmites australis*) was also noted present in patches.

On the southern side of the N85 road bridge, the habitats adjacent to the backdrain can be categorised as disturbed Wet grassland (GS4) and Reed and large sedge swamp (FS1) (see Plate 5), while the roadside embankment of the N85 road bridge and the habitats to the east of the Reed swamp can be categorised as Dry meadows and grassy verges (GS2). These habitats were formerly stripped of vegetation and topsoil during the construction of the N85 road bridge.

The flood defence earthen embankment south of the N85 road bridge in Section C was found to be dominated by the same tall dense vegetation as described for Section A and B. However, Willow Scrub (WS1) was recorded in very small localised areas.

The disturbed Wet Grassland (GS4) habitat (see Plate 4) was found to be dominated by Common Rush (*Juncus effusus*), Willow (*Salix* sp.) seedlings, Yellow Flag (*Iris pseudacorus*), Horsetail (*Equisetum* sp.), Hard Rush (*Juncus inflexus*), Bulbous Rush (*Juncus bulbosus*) and Bulrush (*Typha latifolia*). On the fringes and drier disturbed areas Red Clover (*Trifolium pratense*), Self Heal (*Prunella vulgaris*), Mint (*Mentha* sp.), Cats-ear (*Hypochaeris radicata*), Creeping Buttercup (*Ranunculus repens*), Sorrel (*Rumex acetosella*), St. Johnswort (*Hypericum hirsutum*), Rosebay Willowherb (*Epilobium angustifolium*), Marsh Woundwort (*Stachys palustris*), Tormentil (*Potentilla erecta*), Ox-eye Daisy (*Leucanthemum vulgare*), Common Knapweed (*Centaurea nigra*), Mouse-ear Chickweed (*Cerastium vulgatum*), Silverweed (*Potentilla anserina*) and Greater Plantain (*Plantago major*) were recorded present. Small patches of Common Reed (*Phragmites australis*) and Reed Canary Grass (*Phalaris arundinacea*) were also found scattered within the Wet Grassland (GS4). Adult Common Frog (*Rana temporaria*) were also recorded present in the Wet Grassland (GS4) during the site survey.



Plate 5: Disturbed Wet Grassland (GS4) habitat adjacent to the N85 road bridge

Moving further south, the Wet Grassland (GS4) grades into a narrow band of Reed and large sedge swamp (FS1) dominated by a monoculture of Common Reed (*Phragmites australis*) with small patches of the same Wet Grassland (GS4) as described above. Dry meadow and grassy verges (GS2) was found to back on to the Reed and large sedge swamp (FS1) (see Plate 5). These habitats were also formerly stripped of vegetation and topsoil during the construction of the N85 road bridge.



Plate 5: View from the flood defence embankment of the Reed and large sedge swamp (FS1) (covering the backdrain) and the Dry Meadow Grass Verge habitat (GS2) in the middle ground.

At this location, the backdrain is initially characterised by a much slower moving channel choked with Common Reed (*Phragmites australis*) vegetation with a benthic substrate of silt (100%). It is the least diverse section of channel in terms of the riparian and macrophyte community and because of the stagnant and shallow water and absence of open areas for light penetration and is dominated by Duckweed (*Lemna minor*) (see Plate 5).

Section D: between Sluice Gate No. 5 & Sluice Gate No. 6

Otter (*Lutra lutra*) tracks were recorded under the railway bridge at the commencement of Section D.

Further downstream beyond the railway bridge crossing the profile of the backdrain changes to almost riffle habitat in sections with a benthic substrate comprising of gravels (55%) and silts (45%). There is potential for salmonids in this section of the backdrain. Instream macrophyte assemblage was found to be almost absent, with the exception of localised patches of Fools Watercross (*Apium nodiflorum*) and Starwort (*Callitriche stagnalis*). Marginal species were also absent with exception of a narrow band of Common Reed (*Phragmites australis*) in localised areas where woody vegetation cover overhanging the backdrain was found to be absent.

A linear strip of Willow dominated Scrub (WS1) also containing Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*) is present on the landward side of the embankment and along the top of the embankment. However, some scrub vegetation had been removed to accommodate the site investigation.

The embankment opens out into ruderal and pioneer species for a stretch until the vegetation cover changes to Scrub/transitional woodland (WS1)_where a group of 15 No. immature Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*) trees were recorded on the landward side of the embankment and on the north side of a field gate entrance.

On the southern and opposite side of the field gate entrance a group of 5 No. Willow trees, 1 No. mature Hawthorn tree and 3 no. immature Hawthorn trees with a ground flora of Bracken (*Pteridium aquilinum*), Bramble (*Rubus fruticosus*), Blackthorn (*Prunus spinosa*) and Ivy (*Hedera helix*) were recorded, For the most part Bramble dominates this Scrub (WS1) habitat. 1 No. mature Willow and 2 No. mature Hawthorn trees were also recorded scattered along the riverside of the embankment within this Section.

Otter (*Lutra lutra*) tracks was also recorded on the embankment just south of this location.

The adjacent habitat changes back to Improved agricultural grassland (GA1) dominated by Perennial Ryegrass (*Lolium perenne*) behind the embankment in Section D. Creeping Buttercup (*Ranunculus repens*) and Mouse-ear Chickweed (*Cerastium vulgatum*) were also recorded present within the fields, while Nettle (*Urtica dioica*), Creeping Thistle (*Cirsium arvense*) and Bramble (*Rubus fruticosus*) were found along the fringes of the fields where they border the backdrain.

3.3 River Fergus

The River Fergus rises in Loughnagowan which is located west of Corofin and flows into the Shannon Estuary. At the location of the Project it is approximately 20m wide and supports on average a 20m wide strip of marginal Common Reed (*Phragmites australis*), with localised areas of Reed Canary Grass (*Phalaris arundinacea*) and Greater Pond Sedge (*Carex riparia*) categorised as Reed and large sedge swamp (FS1) located between the existing flood defence earthen embankment and the river (see Plate 6). The vegetation of the flood defence embankment grades into the Reed and large sedge swamp (FS1) vegetation along the River Fergus.

The River Fergus is connected with the backdrain via the sluice gates.

Downstream of the works at the tidal barrage the River Fergus begins to form an estuarine complex (with mudflats, reed beds, swamps and marsh). The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). The lower River Fergus supports internationally important wildfowl populations.

The instream macrophyte assemblage of the River Fergus was found to be dominated by Marestalk (*Hippuris vulgaris*), Starwort (*Callitriche stagnalis*) and the non-native invasive species Curly-leaf Pondweed (*Potamogeton crispus*). Floating river vegetation i.e. Water Crowfoots (*Ranunculus* sp.) were not recorded in the river during the site surveys.

See Section 3.4 for further details on the ecology of the River Fergus.



Plate 6: Typical stretch of the River Fergus within the zone of influence of the Project.

Table 1 – Summary of the River Habitat Corridor Survey

Site No.	Habitats	In-stream macrophyte plant diversity and abundance using DAFOR scale	Fisheries Potential	Photographs
Ballybeg Stream	<p>Instream Habitat: 100% glide habitat</p> <p>Substrate: Silt and gravel, boulders on margins</p> <p>Riparian zone: ED3 & WL2</p> <p>U- Shaped.</p> <p>Water Depth:- 0.3-0.5m</p> <p>Water Width:- 1.5m</p> <p>Depth of swallow-hole unknown</p>	<p><i>Elodea Canadensis</i> (F)</p> <p><i>Lemna minor</i> (D)</p> <p><i>Apium nodiflorum</i>(O)</p> <p><i>Hydrocharis morsus-ranae</i> (O)</p> <p><i>Potamogeton crispus</i> (F)</p>	<p>Good potential for European Eel.</p> <p>Low to moderate potential for Brook and River Lamprey.</p> <p>Potential for Common Frog and Smooth Newt.</p>	

Site No.	Habitats	In-stream macrophyte plant diversity and abundance using DAFOR scale	Fisheries Potential	Photographs
<p>St. Flannan's Stream</p>	<p>Instream Habitat: slow moving</p> <p>Substrate: Silt and gravel, boulders on margins</p> <p>Riparian zone: W12, GA2</p> <p>U- Shaped</p> <p>Water Depth:- 0.5-0.7m</p> <p>Water Width:- 1.5m</p>	<p><i>Lemna minor</i> (D)</p> <p><i>Apium nodiflorum</i>(O)</p>	<p>Good potential for European Eel.</p> <p>Low to moderate potential for Brook and River Lamprey.</p> <p>Potential for Common Frog.</p>	
<p>Section A: Sluice Gate No. 1</p>	<p>Instream Habitat: 100% slow moving glide habitat, tidal.</p> <p>Substrate:- Deep silt substrate with high organic matter content</p> <p>Riparian zone: ED3 & FS1</p> <p>U- Shaped, 2 stage</p>	<p><i>Elodea Canadensis</i> (O)</p> <p><i>Lemna minor</i> (D)</p> <p><i>Apium nodiflorum</i>(F)</p> <p><i>Cladophora sp.</i> (D)</p>	<p>Good potential for European Eel and Brown Trout in this section.</p> <p>Low to moderate potential for River Lamprey.</p>	

Site No.	Habitats	In-stream macrophyte plant diversity and abundance using DAFOR scale	Fisheries Potential	Photographs
	<p>channel.</p> <p>Water Depth:- 0.5-0.7m</p> <p>Water Width:- 4m</p>			
<p>Section B: Sluice Gate No. 2</p>	<p>Instream Habitat: 100% slow moving glide habitat, tidal.</p> <p>Substrate:-Hard Clay substrata with some boulders.</p> <p>Riparian zone: FS1</p> <p>U- Shaped, 2 stage channel.</p> <p>Water Depth:- 0.5-0.7m</p> <p>Water Width:- 4m</p>	<p><i>Myriophyllum spicatum</i> (F)</p> <p><i>Callitriche stagnalis</i>(A)</p> <p><i>Rorippa nasturtium-aquaticum</i>(O)</p> <p><i>Apium nodiflorum</i>(O)</p>	<p>Good potential for European Eel, adult Brown Trout. Moderate potential for River and Brook Lamprey.</p>	

Site No.	Habitats	In-stream macrophyte plant diversity and abundance using DAFOR scale	Fisheries Potential	Photographs
<p>Backdrain: Sluice Gate No.3</p>	<p>Instream Habitat: 100% slow moving pool habitat, tidal.</p> <p>Substrate:-Hard clay and cobble matrix with lesser amounts of boulders.</p> <p>Riparian zone: FS1</p> <p>U- Shaped channel.</p> <p>Water Depth:- 2.5-3m</p> <p>Water Width:- 3m</p>	<p><i>Myriophyllum spicatum</i> (F)</p> <p><i>Callitriche stagnalis</i>(F)</p> <p><i>Plantago aquatica</i>(R)</p> <p><i>Apium nodiflorum</i>(O)</p> <p><i>Hippuris vulgaris</i> (A)</p>	<p>Good potential for European Eel, adult Brown Trout. Moderate potential for River and Brook Lamprey.</p>	
<p>Backdrain: Sluice Gate No. 4</p>	<p>Instream Habitat: 100% slow moving pool habitat, tidal.</p> <p>Substrate:-Hard clay and coarse gravel</p> <p>Riparian zone: FS1</p> <p>U- Shaped channel.</p> <p>Water Depth:-</p>	<p><i>Myriophyllum spicatum</i>(O)</p> <p><i>Callitriche stagnalis</i> (F)</p> <p><i>Plantago aquatica</i>(O)</p> <p><i>Apium nodiflorum</i>(F)</p> <p><i>Rorippa nasturtium-aquaticum</i>(O)</p> <p><i>Berula erecta</i> (O)</p> <p><i>Potamogeton pectinatus</i> (O)</p> <p><i>Potamogeton crispus</i> (O)</p> <p><i>Cladophora sp.</i>(O)</p> <p><i>Ranunculus aquatilis</i> (R)</p>	<p>European Eel elvers present in good numbers.</p> <p>Good potential for Brown Trout. Low to moderate potential for River and Brook Lamprey. No Brown Trout or Lamprey recorded during surveying.</p> <p>Fifteen Spined Stickleback present.</p>	

Site No.	Habitats	In-stream macrophyte plant diversity and abundance using DAFOR scale	Fisheries Potential	Photographs
	<p>1.2m Water Width:- 3-4m</p>			
<p>Backdrain: Sluice Gate No. 5</p>	<p>Instream Habitat: 100% slow moving pool habitat, tidal. Choked with. FS1 Substrate:-100% soft silt. Riparian zone: 100% reed swamp. U- Shaped channel. Water Depth:- 1.2m Water Width:- 3-4m</p>	<p><i>Lemna minor (D)</i></p>	<p>Some potential for European Eels and Stickleback. None found during surveying.</p>	

3.4 Rare and Protected Habitats and Species

Habitats

The habitats recorded within the works area include Wet Grassland (GS4), Reed and tall sedge swamp (FS1), Recolonising Bare ground (ED3), Dry meadows and grassy verges (GS2), Improved agricultural grassland (GA1), Drainage ditches (FW4), Tidal Rivers (CW2), Depositing/lowland rivers (FW2), ponding waterbodies (FL8), Tree-lines (WL2) and Scrub (WS1). While the Wet Grassland (GS4) and Reed and tall sedge swamp (FS1) are not considered species rich habitats they do provide habitat for Common Frog (*Rana temporaria*), Dragon- and Damselflies and the local and overwintering bird populations, amongst other species. The backdrain between Sluice Gate No. 3 and 4 was found to contain species rich marginal vegetation, while a diverse instream macrophyte assemblage was recorded at Sluice Gate No. 4, where European eel (*Anguilla anguilla*) were also recorded present.

The marginal vegetation at the swallow-hole on Ballybeg Stream was also found to be relatively species rich where European Eel are also known to be present.

The Annex I habitats listed as Qualifying Interests for the Lower Shannon SAC 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 3260' and 'Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, *Ano-padion*, *Alnion incanae*, *Salicion albae* 91E0' were not recorded during site surveys, however, these habitats are known to be present along the River Fergus upstream of the works area (Aquafact, 2011). A very small stand of Common Water Crowfoot (*Ranunculus aquatilis*) was recorded present in the backdrain at Sluice Gate No. 4.

The Annex I habitat 'Estuaries 1130' occurs downstream of the proposed works at the tidal barrage at Clarecastle.

Plants

The proposed Project traverses the Osi 10km grid square R37. Within this grid square the following rare and protected plant species are known to occur on the lower River Shannon including Triangular Club-rush (*Scirpus triquetrus*), Meadow Barley (*Hordeum secalinum*), Hairy Violet (*Viola hirta*), Summer Snowflake (*Leucojum aestivum*), Deadly Nightshade (*Atropa belladonna*) and Golden Dock (*Rumex maritimus*) were not recorded present during the site surveys. Penny Royal (*Mentha pulegium*) was recorded in the vicinity of Ennis town in 1892.

Opposite leaved pondweed (*Groenlandia densa*) is an Irish Red Data Book aquatic plant which is found in the River Shannon at Limerick. The species is an herbaceous, aquatic perennial that occurs in ditches, streams, ponds and canals and on marginal muds in estuaries (Curtis & McGough, 1988). Opposite Leaved Pondweed was not recorded present within the backdrain, St. Flannan's Stream and Ballybeg within the proposed lands made available during site surveys and there are no records for the species in the River Fergus on the National Biodiversity Data Centre web mapper.

The nationally scarce plant species Flowering rush (*Butomus umbellatus*) was previously recorded on the lower River Shannon as well as the nationally local Reed Sweet-grass (*Glyceria maxima*), English Scurvy-grass (*Cochlearia anglica*), Great Water Dock (*Rumex hydrolapathum*) Greater Pond Sedge (*Carex riparia*) and Pink Water-Speedwell (*Veronica catenata*). Of these species, Reed Sweet Grass and Greater Pond Sedge were recorded present during the site survey of the backdrain (see Appendix B).

Of the remaining plant species identified during site surveys, Frogbit (*Hydrocharis morsus-ranae*) recorded at the swallow-hole on Ballybeg Stream also has a restricted range in Ireland, being confined to central and east Ireland. There are two other records for Frogbit in Co. Clare and these are located in Ennis town and

southwest of Ennis town at Ballybeg Lough (National Biodiversity Data Centre, 2012) which is the source of Ballybeg Stream.

No protected, rare or threatened terrestrial or aquatic plant species were recorded during site surveys.

Mammals

Otter (*Lutra lutra*) tracks and scat were identified under the railway bridge at Clare Abbey in Section C and at a crossing on the flood defence earthen embankment in Section D at the following grid coordinates (ITM 535002, 675007; Lat/Long 52° 49' 0.82" N, -8° 57' 53.58" W, respectively). Otter would certainly use the River Fergus as a migration corridor and for foraging. Otters are considered 'near threatened' by Marnell *et al.* (2009), are listed on Annexes II and IV of the EU Habitats Directive, and are protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

It is unlikely that Otter (*Lutra lutra*) utilise Ballybeg and St. Flannan's Stream due to the size of stream and the absence/abundance of suitable prey items/food resource.

Badger tracks were also noted near Section C of the proposed flood defence earthen embankment works close to the ruins of Clareabbey. No signs of badger activity such as snuffle holes were identified during surveys within the proposed works area. It is unlikely that badgers would dig setts in the embankment as the embankment would not provide suitable burrowing substrata because of wet ground conditions and tidal inundation. No badger setts were recorded during the site surveys.

Badgers are considered a species of 'least concern' for conservation by Marnell *et al.* (2009), but are protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

No signs of Badger activity were recorded at Ballybeg and St. Flannans Streams.

The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) utilise the River Fergus corridor as a commuting/foraging route. While there are a number of mature Hawthorn and Willow trees located along the southern end of embankment, these are not considered suitable for bat roosts. The railway bridge and the N85 road bridge are also considered unsuitable for bats due to the absence of suitable roosting sites. No bat boxes were visible on the N85 road bridge during site surveys.

A Tree-line (WL2) of mature Sycamore (*Acer pseudoplatanus*), Ash (*Fraxinus excelsior*) and Horse Chestnut (*Aesculus hippocastanum*) trees runs parallel to St. Flannan's Stream on the grounds of St. Flannan's College outside of the proposed works area. There is potential for bats to utilise these trees as tree roosts.

Birds

The adjacent Improved agricultural grassland was found to contain a typical assemblage of common Irish farmland and hedgerow birds. Some additional species also occur as a result of the various semi-natural habitats in the general vicinity. The open Improved agricultural grassland (GA1) hold few birds, mainly Meadow Pipits (*Anthus pratensis*) and Skylarks (*Alauda arvensis*). The wetter fields feature good numbers of Snipe (*Gallinago gallinago*) but probably dry out too much in summer to be suitable for breeding Snipe. The Hedgerows (WL1) and Scrub (WS1) provide habitat for Woodpigeon (*Columba palumbus*), Robin (*Erithacus rubecula*), Blackbird (*Turdus merula*), Wren (*Troglodytes troglodytes*), Stonechat (*Saxicola rubicola*), Bullfinch (*Pyrrhula pyrrhula*), Song Thrush (*Turdus philomelos*), House Sparrow (*Passer domesticus*), Linnet (*Carduelis cannabina*), Blue Tit (*Parus caeruleus*), Great Tit (*Parus major*), Coal Tit (*Periparus ater*), Goldcrest (*Regulus regulus*) and Reed Bunting (*Emberiza schoeniclus*), amongst others. Whitethroat (*Sylvia communis*) and Cuckoo (*Cuculus canorus*) also occur commonly; these species are common in this region but scarce in other parts of Ireland.

The River Fergus itself provides habitat for Mute Swan (*Cygnus olor*), Cormorant (*Phalacrocorax carbo*), Grey Heron (*Ardea cinerea*) and Mallard (*Anas platyrhynchos*). Two Grey Herons were recorded in Section A during the site surveys in August 2012 feeding in the backdrain, while approximately 20 no. Mallard were noted within the River Fergus. A Kingfisher (*Alcedo atthis*) was also recorded in flight over the Improved agricultural grasslands (GA1) and took shelter in the Tree-line (WL2) in Section B as it was being chased by a number of House Sparrows (*Passer domesticus*). A Reed Bunting (*Emberiza schoeniclus*) was also recorded in Section C. Due to the absence/abundance of suitable prey items/food resources the backdrain habitat is not considered suitable for Kingfisher. Suitable habitat for nesting Kingfisher was not recorded during surveys of the embankment within the proposed works area. Kingfisher are likely to utilise the River Fergus for nesting and as a commuting/foraging route.

Amphibians and Reptiles

It is likely that the Drainage ditch (FW4) or field boundary network in the Improved agricultural fields (GA1) behind the backdrain support Common Frog (*Rana temporaria*) as they contain shallow sloping banks, abundant aquatic plants and vegetation and low flow rates. Common Frog is most likely restricted to these Drainage ditches (FW4) which are subject to a lower tidal range and are not influenced by saline waters.

This habitat contrasts with the saline conditions and flow rates of the backdrain where the velocities can increase significantly as water draws out of the channel network on the ebb of the tide.

Frogs most likely breed in patches of wet flush and shallow depressions adjacent to the Drainage ditches (FW4)s, and in the slow moving shallower sections of channel, where water temperatures can increase to ambient levels. Adult Common Frog (*Rana temporaria*) were confirmed present in the Wet Grassland (GS4) habitat in Section C.

Common Frog and Smooth Newt are likely to utilise Ballybeg Stream, while Common Frog are likely to utilise St. Flannan's Stream.

Common Frog and Smooth Newt and their breeding places are protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

The Recolonising bare ground (ED3) and Ballybeg Stream also contain suitable habitat to support Common Lizard (*Lacerta vivipara*); however, this species was not found during the course of the site surveys. Common Lizard is protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

Invertebrates

Butterflies

The rare Marsh Fritillary (*Euphydryas aurinia*) butterfly, an Annex II species, occurs 0.75km east of the site in a large area of Wet Grassland (GS4) at Skehanagh (National Biodiversity Data Centre, 2011). However the absence of Devil's Bit Scabious (*Succisa pratensis*) (its larval food plant) in the habitats adjacent to the backdrain would indicate the habitat is sub-optimal for this species.

Dragon- and Damselflies

The Banded Jewelwing (*Calopteryx splendens*) dragonfly is known to occur in the Clare Abbey area of the River Fergus. The species is found on streams with slower to moderate flow and can be found in canal habitats also (Nelson and Thompson 2004). The species favours areas with stands of Yellow Flag (*Iris pseudacorus*),

sedges and bur reeds on which it perches. This species was recorded present during site surveys on the backdrain at Sluice Gate No. 3.

A number of other dragonflies and damselflies were recorded during site surveys including a Moorland Hawker (*Aeshna juncea*), Amberwinged Hawker (*Aeshna grandis*), Common Blue Damselfly (*Enallagma cyathigerum*), Four-spotted Chaser (*Libellula quadrimaculata*) and a Ruddy Darter (*Sympetrum sanguineum*).

A Four-spotted Chaser (*Libellula quadrimaculata*) was also recorded during site surveys at the swallow-hole on Ballybeg Stream.

Molluscs

Both *Mercuria similis* and Desmoulins Whorl snail (*Vertigo moulinsiana*) were previously recorded in the earlier part of the last century at Ballybeg Lough 1.5km south west of the proposed flood defence embankment and the source of Ballybeg Stream R.A. Phillips in 1936 (Dr. E. Moorkens, pers. comm.). At Sluice Gate No. 3 there is direct connectivity with Ballybeg Lough via a Drainage ditch (FW4) channel, indicating that there may be potential for both species to exist in the Reed and Large Sedge Swamp (FS1) vegetation that is found adjacent to the backdrain. Both species are Irish Red Data List species (Moorkens, 2006).



Mercuria similis
(Source: E. Moorkens)

In total there are eight species of the tiny whorl snails in Ireland of which three species afforded protection under Annex II of the Habitats Directive (92/43/EEC); *Vertigo geyeri*, *V. angustior* and *V. moulinsiana*. Desmoulins Whorl Snail (*V. moulinsiana*) favours tall monocotyledon vegetation stands such as Reed and large sedge swamp (FS1) and Tall Herb Swamp (FS2) (Kileen, 2003) while *Mercuria similis* favours brackish water and Reed and tall sedge swamp (FS1) vegetation which is a characteristic habitat within the study area. It should be noted that these species were not recorded during surveys of the River Fergus by Ecofact (2009) and Aquafact (2011) for the River Fergus, Lower Ennis Certified Drainage Scheme.

Fisheries and other taxa

Salmonids

The River Fergus catchment is classified as an important system for Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*); the former is a species listed on Annex II of the EU Habitats Directive.

'The Quantification of the Freshwater Salmon Habitat Asset in Ireland' (McGinnity *et al.*, 2003) details the Fergus River as one of 173 national Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*) migratory systems and accounts for 1.12% of the national accessible spawning habitat for the species.

It is unlikely that salmonids would spawn in the habitat of the backdrain, Ballybeg Stream or St. Flannans Stream because of the limited gravels, therefore it is unlikely that juveniles are present. However, Brown Trout (*Salmo trutta*) are likely to utilise the habitat present in the backdrain.

Lamprey

Three lamprey species recorded in Ireland are listed on Annex II of the EU Habitats Directive and all three of the species have been confirmed present in the River Fergus in the footprint of the works according to the River Fergus, Lower Ennis Certified Drainage Scheme Supplementary Ecological Assessment (Aquafact, 2011).

Lamprey larval burrows are characteristically found at eddies or backwaters, on the inside of bends or behind obstructions, where current velocity is below that of the main stream and where organic material tends to accumulate (Kelly & King, 2001). They favour partially shaded areas, and the presence of aquatic plants.

While Sea Lamprey (*Petromyzon marinus*) would not use the backdrain because of limited coarse substrata for spawning, the smaller River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*) would most likely use the channel because of the presence of fine silt and sand in the channel.

River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*) may also utilise Ballybeg Stream and St. Flannans Stream.

European Eel

The critically endangered European Eel (*Anguilla anguilla*) (Kottelat, 2010) are considered to be the most 'at threat' fish species in Ireland in a recent Irish Red Data List publication (King *et al.* 2011). This species was confirmed present at Sluice Gate No. 4, where numerous small elvers were found (see Plate 6).

European Eel are also known to be present in the swallow-hole at Ballybeg Stream and are also likely to be found in St. Flannans Stream.

The European Eel has protective status under the European Eel Regulation EC No. 1100/2007 to facilitate the recovery of the eel stocks since the large decline in the 1980's.

White Clawed Crayfish

The White Clawed Crayfish (*Austropotamobius pallipes*) is an Annex II species and is known to occur in the Hollymount River 6km north-west of Crusheen village according to the National Biodiversity web mapper. The Hollymount River is a tributary of the upper River Fergus. However no crayfish are likely to occur in the River Fergus near Ennis where the river remains within the tidal reaches. There are no records of crayfish in the 10km grid squares in the vicinity of the works area (National Biodiversity Data Centre, 2012).



Plate 6: European Eel (*Anguilla anguilla*) found present in the Backdrain

3.5 Water Quality

There are no EPA water quality stations between Clarecastle, Clareabbey and Doora Bridge as the River Fergus is deep and slow flowing in these sections indicating unsuitability for Q sampling.

However further north in Ennis there are two EPA stations, No. 590 and No. 700 that are located on the north and south channels of the River Fergus where the River is crossed by the regional road R352. The water quality was found to be achieving 'Poor Status' (Q3) at both sites or an equivalent Ecological Quality Rating of 0.6 indicating that the River is not meeting the objectives of the Water Framework Directive (2000/60/EC) in that all rivers must achieve Good Status by 2015.

The River Fergus estuary downstream of the study area is considered 'unpolluted' according to the most recent water census collected between 2007 and 2009 (EPA web mapper) indicating an improvement from data collected between 2006 and 2008 when the water quality was considered 'intermediate'.

3.6 PSYM Assessment of Backdrain

Benthic Macro Invertebrate Fauna and water quality

The findings of the PSYM system (Pond Action, 2002) for the backdrain including the macro-invertebrate survey of the backdrain found n=22 species of macro-invertebrate species, one species of zooplankton (ca

alcareous shelled ostracod) and one fish species the Sea or Fifteen Spined Stickleback (*Spinachia spinachia*) indicative of brackish conditions in the backdrain.

The overall diversity was highest at Sluice Gate No. 1 with n=15 species recorded resulting in a very high BMWP score of 61. However the overall community composition across the sites was dominated by Lymnaeid, Physid and Planorbid snails indicating nutrient enriched and low oxygen conditions. This is further verified by the absence of plecopeteran, ephemeropteran and odonate taxa (i.e. stonefly, mayfly & dragonfly species) that are typical of cleaner water.

This is also evident in the low average score per taxon (ASPT) across the sites where the absence of these cleaner water taxa leads to a score range being between 2.8 & 3.7.

Overall the water quality can be considered as 'moderate'. Thus the water quality cannot be considered as achieving 'good status' and is therefore, not meeting the requirements of the Water Framework Directive (2000/60/EC).

Dragonflies, Damselflies and Beetles

No red databook listed beetles were found in the macro-invertebrate samples.

A Red Data Listed beetle species, the Reed Beetle (*Donacia marginata*) has been recorded in two locations in Co. Clare and is closely associated with Unbranched Bur Reed (*Sparganium erectum* L.) and stagnant water (Foster et al., 2009). However no specimens have been recorded to date in the River Fergus.

Only two common beetles were recorded in the backdrain, *Dytiscus marginalis* and *Platambus* sp. (see Table 2).

Table 2:- Macro-invertebrate composition in the backdrain adjacent to the River Fergus at Clareabbey (continued overleaf).

Species	Common name	Sluice 1	PSYM	Sluice 2	PSYM	Sluice 3	PSYM	Sluice 4	PSYM	Sluice 5	PSYM
<i>Gammarus duebeni</i>	Freshwater Shrimp	8	6	3	6	16	6	3	6		
<i>Lymnaea peregra</i>	Wandering Snail	13	3	37	3	57	3	41	3	8	3
<i>Bythnia tentaculata</i>	Common Bythnia			1	3	51	3				
<i>Potamopyrgus jenkinsi</i>	Jenkins Spire Shell			2	3	21	3	3	3		
<i>Lymnea stagnalis</i>	Great Pond Snail	9	3	15	3	4	3	11	3		
<i>Planorbis planorbis</i>	Ramshorn Snail			5	3			7	3	3	3
<i>Planorbis laevis</i>	Smooth Ramshorn Snail	1	3							1	3
<i>Physa fontanalis</i>	Bladder Snail	6	3								
<i>Pisidium amnicum</i>	Orb Mussel	1	3								
<i>Dytiscus marginalis</i>	Great Diving Beetle	11	5					1	5		
<i>Platambus sp.</i>	Platambus Beetle	1	5								
<i>Asellus aquaticus</i>	Freshwater Hog Louse	8	3	7	3	4	3	5	3	21	3
<i>Chironomus riparius</i>	Bloodworm	19	2							3	2
<i>Piersigia sp.</i>	Water Mite	83	n/a								
<i>Limnochares aquatica</i>	Water Mite	1	n/a								
<i>Limnephilus flavicornis</i>	Cased Caddis	5	3								
<i>Turbellaria sp.</i>	Flatworm	1	5								

Table 2:- Macro-invertebrate composition in the backdrain adjacent to the River Fergus at Clareabbey (continued).

Species	Common name	Sluice 1	PSYM	Sluice 22	PSYM	Sluice 3	PSYM	Sluice 4	PSYM	Sluice 5	PSYM
<i>Ostracod sp.</i>	Ostracod		n/a					1	n/a	1	n/a
<i>Tubifex sp.</i>	Freshwater Worm		1	11	1						
<i>Haemopsis sanguisuga</i>	Leech		3			1	3				
<i>Glossiphonia complanata</i>	Leech	3	3								
<i>Hesperocorixa sahlbergi</i>	Water Boatman		5			1	5				
<i>Hesperocorixa moesta</i>	Water Boatman		5							1	
<i>Spinachia spinachia</i>	Fifteen Spined Stickleback		n/a	1	n/a			2	n/a		
PSYM Score			61		25		29		26		14
ASPT			3.6		3.1		3.6		3.7		2.8

4. Evaluation

Summary evaluations of the ecological features identified within the study area are presented in Table 3.

The composition of dominant and characteristic species, habitat structure, and important features of ecosystem function were recorded. Thus, an accurate evaluation of the conservation value of the habitats and other ecological features present within the lands made available to the Project and adjacent habitats is presented below.

Table 3 – Summary evaluations of the aquatic ecological features present on site.

Ecological feature	Evaluation
Birds	Moderate to High Value Local Importance (River Fergus and adjacent habitats)
Mammals	Moderate Value to High Value Local Importance (River Fergus)
Reptiles	Low Value Local Importance (Adjacent habitats of the backdrain and Ballybeg Stream)
Amphibians	Low Value to Moderate Value Local Importance (All sites)
Terrestrial Invertebrates	Moderate Value Local Importance ² (All sites)
Benthic Macro Invertebrates	Low Value Local Importance (Backdrain)
Molluscs	Moderate Value Local Importance (Backdrain and adjacent habitats)
Fish	Low Value Local Importance (St. Flannans Stream), Moderate Value (Ballybeg Stream), National Importance (Backdrain and River Fergus)
Aquatic plants	High Value Local Importance (Backdrain and Ballybeg Stream)
Tidal River (CW2)/Backdrain and River Fergus	High Value Local Importance to National Importance
Depositing Lowland Rivers (FW2)	Low Value Local Importance (St. Flannan's Stream), National Importance (Ballybeg Stream)
Drainage Ditches (FW2)	High Value Local Importance

Ballybeg and St. Flannans Stream

Ballybeg Stream was found to support a high diversity of marginal plant species. Overall the plant community in the backdrain is considered to be of High Value Local Importance, while St. Flannans Stream was found to be species poor and of Low Value Local Importance.

Ballybeg Stream also contained good numbers of European Eel. It also had a high potential to support River and Brook L; thus the stream is considered to be of National Importance. St. Flannans Stream is considered to be of Low Value Local Importance.

Backdrain and Embankment

The backdrain was found to support a high diversity of aquatic plant species (n=14) plant species. Overall the plant community in the backdrain is considered to be High Value Local Importance. The embankment was found to be species poor therefore it is considered to be of Low Value Local Importance.

The backdrain also contained good numbers of European Eel elvers, an Irish Red Data Listed and critically endangered species. It also had a high potential to support lamprey an Annex II listed species; thus the backdrain is considered to be of National Importance for fish species

The riparian zone of the backdrain may support populations of Desmoulin's Whorl Snail (*Vertigo moulinsiana*) (an Annex II species) and *Mercuria similis* (Irish Red Data Listed species) based on a 1936 record for Lough Beg, located 1.5km from the site. It is recommended that a targeted molluscan survey is undertaken within the lands made available to the Project.

The overall evaluation of the backdrain is considered to be High Value Local Importance to National Importance.

However, as the backdrain and embankment are located (in parts) within the Lower River Shannon SAC, these habitats based on their presence within a Natura 2000 Site are considered to be of International Importance.

River Fergus

The the overall evaluation of the River Fergus based on available desktop infomraiton and site surveys is considered to be National Importance and based on its presence within the Lower River Shannon SAC, it is considered to be of International Importance.

5. REFERENCES

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Appendix C

Molluscan Survey

A MOLLUSCAN SURVEY OF THE ENNIS SOUTH FLOOD RELIEF SCHEME, COUNTY CLARE

April 2012

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1.0 Introduction

A molluscan survey was undertaken along the Fergus River and associated ditches and wetlands at Ennis South, County Clare, in association with proposed works for the Ennis South flood relief scheme.

The survey was carried out on 2nd and 3rd April 2012. The survey was undertaken to establish whether rare or threatened species of mollusc may occur in areas that could be potentially negatively affected by the civil works development proposed close to the Fergus River. Key species that were surveyed for were *Vertigo moulinsiana*, *Mercuria confusa*, and *Vertigo angustior*. Both aquatic and terrestrial species in potential habitats were surveyed.

2.0 Methodology

At each site the main habitats of molluscan interest were investigated: aquatic habitats with potential to support *Mercuria*, marginal water fringe habitats, ditch and marsh with any potential to support *Vertigo*. Habitats were sampled by hand, e.g. stones and the underside of timber. Fringe vegetation was sampled by banging leaves onto a white tray.

2.1 Aquatic sampling

Aquatic habitats were sampled using an extendable robust, aluminium-framed pond net (handle and frame 2.4m in length, equipped with a 0.5mm nylon mesh bag). Both the bivalves (which mainly live in the sediment) and the gastropods (which mainly live on the weeds) were collected. At each sampling point the net contents were amalgamated into a bucket. The sample was agitated in water to release snails from the weed, allowed to settle, and then snail-free vegetation was removed.

The samples were examined in the field by tipping the molluscs into a white tray, and the large bivalve and gastropod species present were recorded. The remainder of each sample was placed in labelled self-seal bags and examined microscopically in the laboratory, while still alive, the following day.

2.2 Terrestrial Sampling

As well as observing snails in the field, terrestrial molluscs were sampled by collecting litter samples. Approximately 2-3 litres of wetland litter were taken from each sampling site, air dried in the laboratory and then sieved through two mesh sizes, 3mm and 0.5mm. The contents of each sieve were examined for snails. An Olympus 40X binocular microscope was used to examine the smaller species.

3.0 Results

The sites chosen to sample are described in Table 1. Photographs of the sites are shown in Appendix 1 and the species found in the survey are shown in Appendix 2. Figure 1 shows the location of the sites surveyed.

Table 1. Sites with potential habitat for molluscs sampled during survey.

Site/Section	Grid Reference	Description	Comments
1	R34955 75443	Engineered ditch with <i>Lemna</i> and <i>Scirpus</i>	Potential for <i>Vertigo moulinsiana</i> , but rather anoxic.
2	R34978 75465	Backdrain - flowing ditch, very weedy and silted	Surveyed from Sluice 4 to W/E ditch c. 200m to west. Poor potential for rare species.
3	R35001 75423	River Fergus side of bund, <i>Phragmites</i> on muddy tidal slope	Some potential for <i>Mercuria</i> , but generally too steep.
4	See map	Backdrain - between motorway and railway (sluice 4 to sluice 5), Ditch on west side of bund	Potential for <i>Vertigo moulinsiana</i> . Mostly dense <i>Phragmites</i> and rather steep banks.
5	See map	River Fergus side of bund, <i>Phragmites</i> on muddy tidal slope	Some potential for <i>Mercuria</i> . Generally steep with very little suitable habitat
6	See map	Backdrain - south of railway (sluice 5 to sluice 6), Ditch on west side of bund	Potential for <i>Vertigo moulinsiana</i> . Mostly dense <i>Phragmites</i> in steep banked ditch.
7	See map	River Fergus side of bund, <i>Phragmites</i> on muddy tidal slope	Poor potential for <i>Mercuria</i> . Generally steep with very little suitable <i>Mercuria</i> habitat
8	R34949 75263	Weedy W/E ditch with stands of sedge	Potential <i>Vertigo moulinsiana</i> habitat
9	R34934 75172 to R34939 75117	Very shallow pools with <i>Typha</i> and <i>Glyceria fluitans</i>	Potential <i>Vertigo moulinsiana</i> fringes
10	R34943 75093	Bed of sedge <i>Carex riparia</i>	Potential but found to be too dry for <i>Vertigo moulinsiana</i> .
11	R34998 75034	<i>Iris</i> patch	Potential for <i>Vertigo angustior</i> .
12	R35005 75023	Bed of sedge <i>Carex riparia</i>	Potential but found to be too dry for <i>Vertigo moulinsiana</i>
13	See map	Backdrain - flowing ditch, very weedy and silty	Surveyed from W/E ditch to sluice 3
14	See map	River Fergus side of bund, <i>Phragmites</i> on muddy tidal slope	Generally steep with very little suitable <i>Mercuria</i> habitat. Shelf on west side of bund with sedge and <i>Phragmites</i> but too dry for <i>Vertigo</i>
15	R34797 75919	Stream flowing west to east stream	Swift flowing, weedy with steep sides, some marginal sedge but too dry for <i>V. moulinsiana</i> .
16	See map	Backdrain - flowing ditch, very weedy and silted.	Surveyed from sluice 3 to north of sluice 2.
17	See map	River Fergus side of bund, <i>Phragmites</i> on muddy tidal slope	Generally steep with very little suitable <i>Mercuria</i> habitat. Shelf on west side of bund with sedge and <i>Phragmites</i> but too dry for <i>Vertigo</i> .
18	R34884 76055	Very muddy West/east ditch	Poor potential.
19	R43750 76014	North/south ditch	Some sedge habitat but too dry for <i>Vertigo</i> .
20	R34607 76147	Stream flowing west/east, weedy and silted.	Poor potential.
21	R34842 76227	Backdrain at junction with stream, very weedy and silted.	Shelf on west side of bund with sedge and <i>Phragmites</i> but too dry for <i>Vertigo</i> .
22	See map	North of section 16/17	Shelf on west side of bund with sedge and <i>Phragmites</i> but too dry for <i>Vertigo</i> .
23	See map	Field unit to north with rough <i>Juncus</i> pasture and ditches with <i>Phragmites</i>	Too dry for <i>Vertigo moulinsiana</i> .
24	R34549 75424	Ditch with dense <i>Carex riparia</i>	Potential <i>Vertigo moulinsiana</i> habitat.
25	R34548 75456	<i>Iris</i> dominated marsh	Potential for <i>Vertigo angustior</i> .

4.0 Discussion

A total of 21 species of molluscs were found within the potential habitats sampled during the survey, 14 aquatic and 7 terrestrial.

While there was some potential for *Mercuria confusa*, *Vertigo moulinsiana* and *Vertigo angustior*, none of these three species were found to be present.

Mercuria confusa is associated with reedbed edges in very slightly brackish water, and thus had some potential to occur in the backdrain and the Fergus River close to the backdrain. The snail was searched for in the best areas of potential habitat but not found. In general, the vast majority of the area was too steep in slope to support this species would be unlikely to survive in the very small and fragmented areas of potential.

Vertigo moulinsiana is a species of fen or riparian habitats that include tall, strongly structured vegetation, especially the larger *Carex* species, *Phragmites* or *Glyceria*. There was some potential for this species in the sites surveyed, and considering the direct connectivity with its known site at Ballybeg Lough via a well-flowing stream / drainage channel, the species was thoroughly searched for in all potential habitat areas. The snail was not found, and it can be concluded that the riparian areas directly associated with the backdrain and associated drains are too steep sided, thus the vegetation that the *V. moulinsiana* could utilise would be too dry in the summer to support the snail, which needs the high humidity that is associated with saturated vegetation (Moorkens & Killeen, 2011).

Vertigo angustior is a species of marsh either freshwater or with a saline transition zone. The marsh habitats in the vicinity of Clare Abbey had some potential for this species, but when sampled, these marshy habitats had a very poor molluscan fauna typical of new or very disturbed habitats, and thus are not of high conservation interest.

The most important habitat found in the survey was area with very shallow pools with *Typha* and *Glyceria fluitans* at Site 9, part of the field area adjacent to the backdrain between Sluice No. 4 and Sluice No. 5. This field had the most natural habitat of the sites surveyed, and the quality was reflected in the presence of the moss bladder snail *Aplexa hypnorum* in the pools. This species was once widespread but is now strongly declining due to loss of habitat, such as infilling of farm ponds and ditches (Kerney, 1999), and land drainage in general. The species likes late successional habitats, with a network of ditches and ephemeral ponds and pools. The species is listed as “vulnerable” in the Irish molluscan red data list (Byrne *et al.*, 2009). Care should be taken not to cause undue disturbance to this field during any works, and that the hydrogeology of the field will not be significantly affected by the works.

Other than the *Aplexa* ponds, all the other habitats, including the backdrain and the Fergus River itself, supported very common and widespread molluscan species and are not of high conservation value for molluscs.

5.0 References

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Appendix 1. Photographs

	
<p>Photo1: general view west from motorway crossing towards sluice 3</p>	<p>Photo 2: site 1</p>
	
<p>Photo 3: Section 2 ditch</p>	<p>Photo 4: Section 3 Fergus side of bund</p>
	
<p>Photo 5: Habitat on Fergus side of bund</p>	<p>Photo 6: field unit to south of motorway</p>
	
<p>Photo 7: site 8</p>	<p>Photo 8: site 9</p>



Photo 9: site 10



Photo 10: section 4 habitat



Photo 11: site 15



Photo 12: sluice 3



Photo 13: Section 16



Photo 14: site 18



Photo 15: site 19



Photo 16: site/section 21



Photo 17: view down into marsh on west side of railway



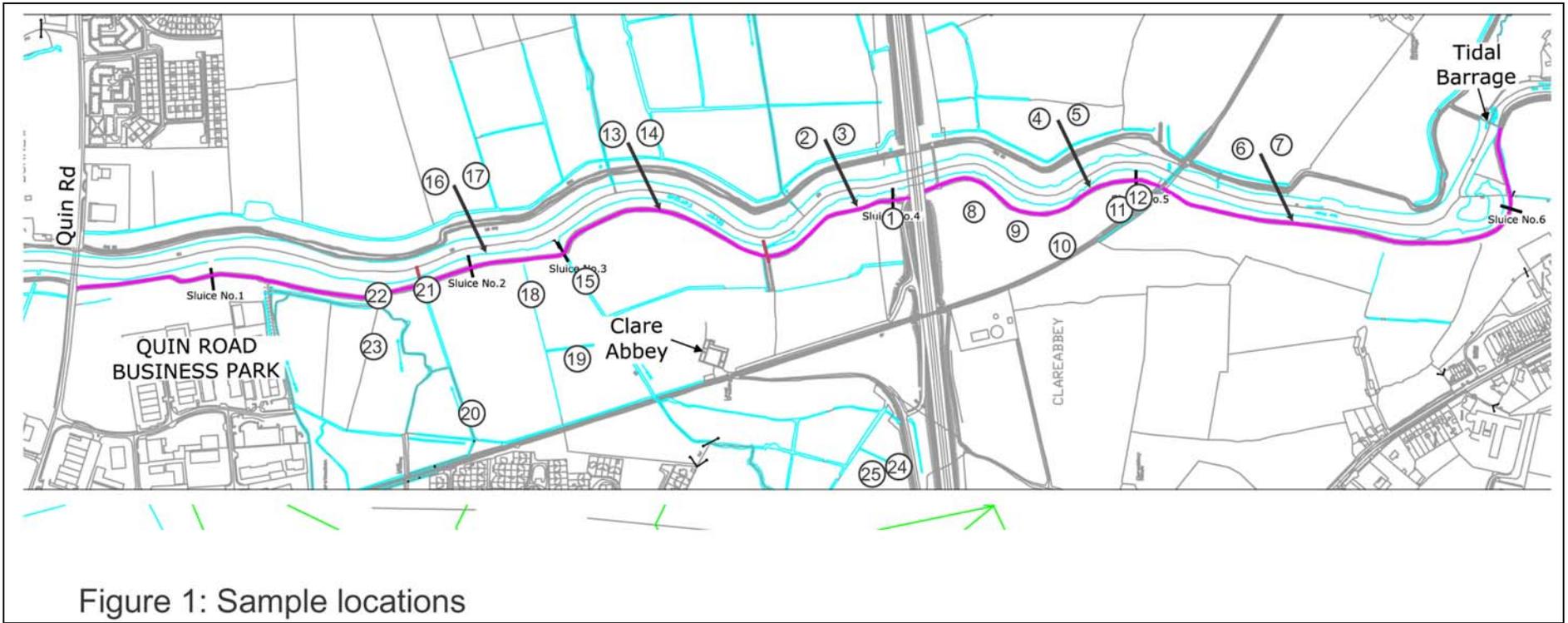
Photo 18: site 24



Photo 19: site 25

Appendix 2. Table of results

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Freshwater species																									
<i>Bithynia tentaculata</i>		X	X					X					X		X						X				
<i>Potamopyrgus antipodarum</i>		X	X	X	X		X	X					X	X	X		X	X	X	X	X	X	X		
<i>Galba truncatula</i>			X		X	X	X							X			X				X	X			
<i>Radix balthica</i>	X	X	X	X		X	X	X	X				X	X	X	X					X	X			
<i>Stagnicola fuscus</i>		X	X	X		X	X	X	X				X		X						X	X			X
<i>Aplexa hypnorum</i>									X																
<i>Physa fontinalis</i>		X							X				X								X				
<i>Physella acuta</i>	X	X																							
<i>Anisus leucostoma</i>																									X
<i>Planorbis planorbis</i>	X	X	X				X	X	X				X								X	X			
<i>Musculium lacustre</i>		X											X									X			
<i>Pisidium nitidum</i>															X						X	X			
<i>Pisidium subtruncatum</i>															X						X				
<i>Pisidium personatum</i>																									X
Terrestrial species																									
<i>Arion subfuscus</i>			X					X			X		X										X	X	
<i>Deroceras reticulatum</i>								X															X		
<i>Carychium minimum</i>																									X
<i>Oxyloma elegans</i>			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Succinea putris</i>			X																				X		
<i>Zonitoides nitidus</i>																							X		X
<i>Cepaea nemoralis</i>											X														



Appendix D

Site Synopsis

SITE SYNOPSIS

SITE NAME : LOWER RIVER SHANNON

SITE CODE : 002165

This very large site stretches along the Shannon valley from Killaloe to Loop Head/ Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus Estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus flow through Carboniferous limestone as far as Foynes, but west of Foynes Namurian shales and flagstones predominate (except at Kerry Head, which is formed from Old Red Sandstone). The eastern sections of the Feale catchment flow through Namurian Rocks and the western stretches through Carboniferous Limestone. The Mulkear flows through Lower Palaeozoic Rocks in the upper reaches before passing through Namurian Rocks, followed by Lower Carboniferous Shales and Carboniferous Limestone. The Mulkear River itself, immediately north of Pallas Green, passes through an area of Rhyolites, Tuffs and Agglomerates. Rivers within the subcatchment of the Feale include the Galey, Smearlagh, Oolagh, Allaughaun, Owveg, Clydagh, Caher, Breanagh and Glenacarney. Rivers within the sub-catchment of the Mulkear include the Killeenagarrieff, Annagh, Newport, the Dead River, the Bilboa, Glashacloonaraveela, Gortnageragh and Cahernahallia.

The site is a candidate SAC selected for lagoons and alluvial wet woodlands, both habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for floating river vegetation, *Molinia* meadows, estuaries, tidal mudflats, Atlantic salt meadows, Mediterranean salt meadows, *Salicornia* mudflats, sand banks, perennial vegetation of stony banks, sea cliffs, reefs and large shallow inlets and bays all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Bottle-nosed Dolphin, Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Atlantic Salmon and Otter.

The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon estuary (considered to be a line across the narrow strait between Kilcredaun Point and Kilconly Point). Within this main unit there are several tributaries with their own 'sub-estuaries' e.g. the Deel River, Mulkear River, and Maigue River. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulnasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River Estuary.

Both the Fergus and inner Shannon estuaries feature vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats, but have their own unique characteristics, e.g. Poulnasherry Bay is stony and unusually rich in species and biotopes. Plant species are typically scarce on the mudflats, although there are some Eel-grass beds (*Zostera* spp.) and patches of green algae (e.g. *Ulva* sp. and *Enteromorpha* sp.). The main macro-invertebrate community, which has been noted from the inner Shannon and Fergus estuaries, is a *Macoma-Scrobicularia-Nereis* community.

In the transition zone between mudflats and saltmarsh, specialised colonisers of mud predominate: swards of Common Cord-grass (*Spartina anglica*) frequently occur in the upper parts of the estuaries. Less common are swards of Glasswort (*Salicornia europaea* agg.). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and Clubrushes (*Scirpus maritimus*, *S. tabernaemontani* and *S. triquetrus*). In addition to the nationally rare Triangular Club-rush (*Scirpus triquetrus*), two scarce species are found in some of these creeks (e.g. Ballinacurra Creek): Lesser Bulrush (*Typha angustifolia*) and Summer Snowflake (*Leucojum aestivum*).

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus Estuary and at Ringmoylan Quay. The dominant type of saltmarsh present is Atlantic salt meadow occurring over mud. Characteristic species occurring include Common Saltmarsh Grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*), Creeping Bent (*Agrostis stolonifera*), Saltmarsh Rush (*Juncus gerardi*), Long-bracted Sedge (*Carex extensa*), Lesser Seaspurrey (*Spergularia marina*) and Sea Arrowgrass (*Triglochin maritima*). Areas of Mediterranean salt meadows, characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus Estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the compass of Common Saltmarsh-grass (*Puccinellia maritima*) and Hard-grass (*Parapholis strigosa*).

Saltmarsh vegetation also occurs around a number of lagoons within the site. The two which have been surveyed as part of a National Inventory of Lagoons are Shannon Airport Lagoon and Clooncneen Pool. Clooncneen Pool (4-5 ha) is a natural sedimentary lagoon impounded by a low cobble barrier. Seawater enters by percolation through the barrier and by overwash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. The adjacent shore features one of the best examples of a drowned forest in Ireland. Aquatic vegetation in the lagoon includes typical species such as Beaked Tasselweed (*Ruppia maritima*) and green algae (*Cladophora* sp.). The fauna is not diverse, but is typical of a high salinity lagoon and includes six lagoon specialists (*Hydrobia ventrosa*, *Cerastoderma glaucum*, *Lekanesphaera hookeri*, *Palaemonetes varians*, *Sigara stagnalis* and *Enochrus bicolor*). In contrast, Shannon Airport Lagoon (2 ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Listed species of Stonewort (*Chara canescens* and *Chara cf. connivens*).

Most of the site west of Kilcredaun Point/Kilconly Point is bounded by high rocky sea cliffs. The cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris*), Sea Campion (*Silene maritima*), Thrift and Plantains (*Plantago* spp.). A rare endemic Sea Lavender (*Limonium recurvum* subsp. *pseudotranswallinum*) occurs on cliffs near Loop Head. Cliff-top vegetation usually consists of either grassland or maritime heath. The boulder clay cliffs further up the estuary tend to be more densely vegetated, with swards of Red Fescue and species such as Kidney Vetch (*Anthyllis vulneraria*) and Bird's-foot Trefoil (*Lotus corniculatus*).

The site supports an excellent example of a large shallow inlet and bay. Littoral sediment communities in the mouth of the Shannon Estuary occur in areas that are exposed to wave action and also in areas extremely sheltered from wave action. Characteristically, exposed sediment communities are composed of coarse sand and have a sparse fauna. Species richness increases as conditions become more sheltered. All shores in the site have a zone of sand hoppers at the top and below this each of the shores has different characteristic species giving a range of different shore types in the pcSAC.

The intertidal reefs in the Shannon Estuary are exposed or moderately exposed to wave action and subject to moderate tidal streams. Known sites are steeply sloping and show a good zonation down the shore. Well developed lichen zones and littoral reef communities offering a high species richness in the sublittoral fringe and strong populations of *Paracentrotus lividus* are found. The communities found are tolerant to sand scour and tidal streams. The infralittoral reefs range from sloping platforms with some vertical steps to ridged bedrock with gullies of sand between the ridges to ridged bedrock with boulders or a mixture of cobbles, gravel and sand. Kelp is very common to about 18m. Below this it becomes rare and the community is characterised by coralline crusts and red foliose algae.

Other coastal habitats that occur within the site include the following:

- stony beaches and bedrock shores - these shores support a typical zonation of seaweeds (*Fucus* spp., *Ascophyllum nodosum* and kelps).
- shingle beaches - the more stable areas of shingle support characteristic species such as Sea Beet, Sea Mayweed (*Matricaria maritima*), Sea Campion and Curled Dock (*Rumex crispus*).
- Sandbanks which are slightly covered by sea water at all times – there is a known occurrence of sand/gravel beds in the area from Kerry Head to Beal Head.
- sand dunes - a small area of sand dunes occurs at Beal Point. The dominant species is Marram Grass (*Ammophila arenaria*).

Flowing into the estuaries are a number of tidal rivers.

Freshwater rivers have been included in the site, most notably the Feale and Mulkear catchments, the Shannon from Killaloe to Limerick (along with some of its tributaries, including a short stretch of the Kilmastulla River), the Fergus up as far as Ennis, and the Cloon River. These systems are very different in character: the Shannon being broad, generally slow-flowing and naturally eutrophic; the Fergus being smaller and alkaline; while the narrow, fast-flowing Cloon is acid in nature. The Feale and Mulkear catchments exhibit all the aspects of a river from source to mouth. Semi-natural habitats, such as wet grassland, wet woodland and marsh occur by the rivers, however, improved grassland is most common. One grassland type of particular conservation significance, *Molinia* meadows, occurs in several parts of the site and the examples at Worldsend on the River Shannon are especially noteworthy. Here are found areas of wet meadow dominated by rushes and sedges and supporting a diverse and species-rich vegetation, including such uncommon species as Blue-eyed Grass (*Sisyrinchium bermudiana*) and Pale Sedge (*Carex pallescens*).

Floating river vegetation characterised by species of Water-crowfoot (*Ranunculus* spp.), Pondweeds (*Potamogeton* spp.) and the moss *Fontinalis antipyretica* are present throughout the major river systems within the site. The rivers contain an interesting bryoflora with *Schistidium alpicola* var. *alpicola* recorded from in-stream boulders on the Bilboa, new to county Limerick.

Alluvial woodland occurs on the banks of the Shannon and on islands in the vicinity of the University of Limerick. The woodland is up to 50m wide on the banks and somewhat wider on the largest island. The most prominent woodland type is gallery woodland where White Willow (*Salix alba*) dominates the tree layer with occasional Alder (*Alnus glutinosa*). The shrub layer consists of various willow species with sally (*Salix cinerea* ssp. *oleifolia*) and what appear to be hybrids of *S. alba* x *S. viminalis*. The herbaceous layer consists of tall perennial herbs. A fringe of Bulrush (*Typha* sp.) occurs on the riverside of the woodland. On slightly higher ground above the wet woodland and on the raised embankment remnants of mixed oak-ash-alder woodland occur. These are poorly developed and contain numerous exotic species but locally there are signs that it is invading open grassland. Alder is the principal tree species with occasional Oak (*Quercus robur*), Elm (*Ulmus glabra*, *U. procera*), Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and the shrubs Guelder-rose (*Viburnum opulus*) and willows. The ground flora is species-rich.

Woodland is infrequent within the site, however Cahiracon Wood contains a strip of old Oak woodland. Sessile Oak (*Quercus petraea*) forms the canopy, with an understorey of Hazel and Holly (*Ilex aquifolium*). Great Wood-rush (*Luzula sylvatica*) dominates the ground flora. Less common species present include Great Horsetail (*Equisetum telmateia*) and Pendulous Sedge (*Carex pendula*).

In the low hills to the south of the Slievefelim mountains, the Cahernahallia River cuts a valley through the Upper Silurian rocks. For approximately 2km south of Cappagh Bridge at Knockanavar, the valley sides

are wooded. The woodland consists of Birch (*Betula* spp.), Hazel, Oak, Rowan (*Sorbus aucuparia*), some Ash (*Fraxinus excelsior*) and Willow (*Salix* spp.). Most of the valley is not grazed by stock, and as a result the trees are regenerating well. The ground flora feature prominent Greater wood-rush and Bilberry (*Vaccinium myrtillus*) with a typical range of woodland herbs. Where there is more light available, Bracken (*Pteridium aquilinum*) features.

The valley sides of the Bilboa and Gortnageragh Rivers, on higher ground north east of Cappamore, support patches of semi-natural broadleaf woodland dominated by Ash, Hazel, Oak and Birch. There is a good scrub layer with Hawthorn, Willow, Holly and Blackthorn (*Prunus spinosa*) common. The herb layer in these woodlands is often open with a typically rich mixture of woodland herbs and ferns. Moss species diversity is high. The woodlands are ungrazed. The hazel is actively coppiced in places.

There is a small area of actively regenerating cut away raised bog at Ballyrorheen. It is situated approx. 5km north west of Cappamore Co. Limerick. The bog contains some wet areas with good moss (*Sphagnum*) cover. Species of particular interest include the Cranberry (*Vaccinium oxycoccos*) and the White Sedge (*Carex curta*) along with two other regionally rare mosses including *S. fimbriatum*. The site is being invaded by Birch (*Betula pubescens*) scrub woodland. Both commercial forestry and the spread of rhododendron has greatly reduced the overall value of the site.

A number of plant species that are Irish Red Data Listed species occur within the site - several are protected under the Flora (Protection) Order, 1999:

- Triangular Club-rush (*Scirpus triquetrus*) - in Ireland this protected species is only found in the Shannon Estuary, where it borders creeks in the inner estuary.
- Opposite-leaved Pondweed (*Groenlandia densa*) - this protected pondweed is found in the Shannon where it passes through Limerick City.
- Meadow Barley (*Hordeum secalinum*) - this protected species is abundant in saltmarshes at Ringmoylan and Mantlehill.
- Hairy Violet (*Viola hirta*) - this protected violet occurs in the Askeaton/Foynes area.
- Golden Dock (*Rumex maritimus*) - noted as occurring in the River Fergus Estuary.
- Bearded Stonewort (*Chara canescens*) - a brackish water specialist found in Shannon Airport lagoon.
- Convergent Stonewort (*Chara connivens*) - presence in Shannon Airport Lagoon to be confirmed.

Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. The highest count in 1995-96 was 51,423 while in 1994-95 it was 62,701. Species listed on Annex I of the E.U. Birds Directive which contributed to these totals include: Great Northern Diver (3; 1994/95), Whooper Swan (201; 1995/96), Pale-bellied Brent Goose (246; 1995/96), Golden Plover (11,067; 1994/95) and Bar-tailed Godwit (476; 1995/96). In the past, three separate flocks of Greenland White-fronted Goose were regularly found but none were seen in 1993/94.

Other wintering waders and wildfowl present include Greylag Goose (216; 1995/96), Shelduck (1,060; 1995/96), Wigeon (5,976; 1995/96); Teal (2,319; 1995-96); Mallard (528; 1995/96), Pintail (45; 1995/96), Shoveler (84; 1995/96), Tufted Duck (272; 1995/96), Scaup (121; 1995/96), Ringed Plover (240; 1995/96), Grey Plover (750; 1995/96), Lapwing (24,581; 1995/96), Knot (800; 1995/96), Dunlin (20,100; 1995/96), Snipe (719, 1995/96), Black-tailed Godwit (1062; 1995/96), Curlew (1504; 1995/96), Redshank (3228; 1995/96), Greenshank (36; 1995/96) and Turnstone (107; 1995/96). A number of wintering gulls are also present, including Black-headed Gull (2,216; 1995/96), Common Gull (366; 1995/96) and Lesser Black-backed Gull (100; 1994/95). This is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank.

A number of species listed on Annex I of the E.U. Birds Directive breed within the site. These include Peregrine Falcon (2-3 pairs), Sandwich Tern (34 pairs on Rat Island, 1995), Common Tern (15 pairs: 2 on Sturamus Island and 13 on Rat Island, 1995), Chough (14-41 pairs, 1992) and Kingfisher. Other breeding birds of note include Kittiwake (690 pairs at Loop Head, 1987) and Guillemot (4010 individuals at Loop Head, 1987)

There is a resident population of Bottle-nosed Dolphin in the Shannon Estuary consisting of at least 56-68 animals (1996). This is the only known resident population of this E.U. Habitats Directive Annex II species in Ireland. Otter, a species also listed on Annex II of this directive, is commonly found on the site.

Five species of fish listed on Annex II of the E.U. Habitats Directive are found within the site. These are Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Twaité Shad (*Allosa fallax fallax*) and Salmon (*Salmo salar*). The three lampreys and Salmon have all been observed spawning in the lower Shannon or its tributaries. The Fergus is important in its lower reaches for spring salmon while the Mulkear catchment excels as a grilse fishery though spring fish are caught on the actual Mulkear River. The Feale is important for both types. Twaité Shad is not thought to spawn within the site. There are few other river systems in Ireland which contain all three species of Lamprey.

Two additional fish of note, listed in the Irish Red Data List, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). Only the former has been observed spawning in the Shannon.

Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs abundantly in parts of the Cloon River.

There is a wide range of landuses within the site. The most common use of the terrestrial parts is grazing by cattle and some areas have been damaged through overgrazing and poaching. Much of the land adjacent to the rivers and estuaries has been improved or reclaimed and is protected by embankments (especially along the Fergus Estuary). Further, reclamation continues to pose a threat as do flood relief works (e.g. dredging of rivers). Gravel extraction poses a major threat on the Feale.

In the past, Cord-grass (*Spartina* sp.) was planted to assist in land reclamation. This has spread widely, and may out less vigorous colonisers of mud and may also reduce the area of mudflat available to feeding birds.

Domestic and industrial wastes are discharged into the Shannon, but water quality is generally satisfactory - except in the upper estuary, reflecting the sewage load from Limerick City. Analyses for trace metals suggest a relatively clean estuary with no influences by industrial discharges apparent. Further industrial development along the Shannon and water polluting operations are potential threats.

Fishing is a main tourist attraction on the Shannon and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other uses of the site include commercial angling, oyster farming, boating (including dolphin-watching trips) and shooting. Some of these may pose threats to the birds and dolphins through disturbance. Specific threats to the dolphins include underwater acoustic disturbance, entanglement in fishing gear and collisions with fast moving craft.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitat lagoon, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Listed species are also present, perhaps most notably the thriving populations of Triangular

Club-rush. A number of species listed on Annex I of the E.U. Birds Directive are also present, either wintering or breeding. Indeed, the Shannon and Fergus Estuaries form the largest estuarine complex in Ireland and support more wintering wildfowl and waders than any other site in the country. Most of the estuarine part of the site has been designated a Special Protection Area (SPA), under the E.U. Birds Directive, primarily to protect the large numbers of migratory birds present in winter.

6.10.2006

SITE SYNOPSIS

SITE NAME: RIVER SHANNON AND RIVER FERGUS ESTUARIES SPA

SITE CODE: 004077

The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises all of the estuarine habitat west from Limerick City and south from Ennis, extending west as far as Killadysert and Foynes on the north and south shores respectively of the River Shannon (a distance of some 25 km from east to west). Also included are several areas in the outer Shannon estuary, notably Clonderalaw Bay and Poulnasherry Bay, as well as the intertidal areas on the south shore of the Shannon between Tarbert and Beal Point.

The site has vast expanses of intertidal flats. The main macro-invertebrate community present is a *Macoma-Scrobicularia-Nereis* community which provides a rich food resource for the wintering birds. Other species occurring include Common Cockle (*Cerastoderma edule*), Lugworm (*Arenicola marina*), the polychaete *Nephtys hombergii*, the gastropod *Hydrobia ulvae* and the crustacean *Corophium volutator*. Eelgrass (*Zostera* spp.) is present in places, along with green algae (e.g. *Ulva* spp. and *Enteromorpha* spp.). Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds. Characteristic species occurring include Common Saltmarsh-grass (*Puccinellia maritima*), Sea Aster (*Aster tripolium*), Thrift (*Armeria maritima*), Sea-milkwort (*Glaux maritima*), Sea Plantain (*Plantago maritima*), Red Fescue (*Festuca rubra*) and Saltmarsh Rush (*Juncus gerardi*). In the innermost parts of the estuaries, the tidal channels or creeks are fringed with species such as Common Reed (*Phragmites australis*) and club-rushes (*Scirpus maritimus*, *S. lacustris* subsp. *tabernaemontani*). Also found is the nationally rare Triangular Club-rush (*Scirpus triquetter*). Elsewhere in the site the shoreline comprises stony or shingle beaches.

The site is the most important coastal wetland site in the country and regularly supports in excess of 50,000 wintering waterfowl (mean of 59,183 for the 4 seasons 1996-97 to 1999/00), a concentration easily of international importance. The site has internationally important populations of Dunlin (14,987), Black-tailed Godwit (706) and Redshank (1,983) - all figures are average peaks for 3 of the 5 seasons in the 1995/96-1999/00 period. A further 16 species have populations of national importance, i.e. Cormorant (148), Whooper Swan (141), Greylag Goose (88), Shelduck (895), Wigeon (3,025), Teal (1,558), Pintail (40), Shoveler (56), Scaup (76), Golden Plover (4,073), Grey Plover (564), Lapwing (13,007), Knot (686), Bar-tailed Godwit (481), Curlew (1,231) and Greenshank (33). The site is among the most important in the country for several of these species, notably Dunlin (11% of national total), Grey Plover (7.5% of total), Lapwing (6.5% of total), Redshank (6% of total) and Shelduck (6.0% of total). The site is also used by Oystercatcher (363), Ringed Plover (70), Brent Goose (135), Great Crested Grebe (47), Red-breasted Merganser (14), Mallard (247), Turnstone (71), Mute Swan (54), Grey Heron (25), Black-headed Gull (1,233) and Common Gull (194).

The Shannon / Fergus system was formerly frequented by a Greenland Whitefronted Goose population but this declined during the 1980s and 1990s and the birds now appear appear to have abandoned

the area. The site provides both feeding and roosting areas for the wintering birds. Habitat quality for most of the estuarine habitats is good. Some species, particularly Whooper Swan and Greylag Goose, utilise areas outside of the site for feeding.

Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn. Regular species include Blacktailed Godwit, Whimbrel and Greenshank.

Much of the land adjacent to the rivers and estuaries has been reclaimed and improved for agriculture and is protected by embankments (especially along the River Fergus estuary). Further reclamation, especially near to the urbanised and industrial areas continues to pose a threat. The site receives pollution from several sources, including industry and agriculture, but it is not known if this has any significant impacts on the wintering birds. Aquaculture occurs in some areas of the site – future increases in this activity could cause disturbance to the habitats and the associated birds. Common Cord-grass (*Spartina anglica*) is well-established and may threaten some of the estuarine habitats. Some disturbance occurs from boating activities.

This site is of great ornithological interest, being of international importance on account of the numbers of wintering birds it supports. It also supports internationally important numbers of three species, i.e. Dunlin, Black-tailed Godwit and Redshank. In addition, there are 16 species that have populations of national importance. For several of the bird species, it is the top site in the country. Also of note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit. The site is most effectively censused from the air and this is carried out in most winters.

1.4.2005

SITE SYNOPSIS**SITE NAME: NEWHALL AND EDENVALE COMPLEX****SITE CODE: 002091**

This site is situated approximately 4 km south of Ennis. It consists of three distinct locations which are used, at various times throughout the year, by the Lesser Horseshoe Bat (*Rhinolophus hipposideros*), a species listed on Annex II of the EU Habitats Directive.

Newhall and Edenvale Caves are natural fossil limestone caves. Newhall is a narrow, dry passage formed along an inclined joint. The main passage of Edenvale Cave runs into a cliff for 15 m and is crossed by a number of other passages. The side passages run in two directions at acute angles to each other, forming many intersections, hence the local name, "The Catacombs". The two caves are used as winter hibernation sites by the bats while a two-storey farm outbuilding is used as a breeding site. Two of the locations, Newhall Cave and the farm building, are in the grounds of Newhall House, and the second cave, Edenvale Cave, is in the grounds of Edenvale House, within 1 km of Newhall House. The bats have uninterrupted access to all sites. In 1983 grilles were fitted to both caves.

The surrounding areas of mature mixed woodland, parkland and lakes provide ideal foraging habitat and shelter for the bats throughout the year and are included within the site.

Bats have been recorded at this site since 1983 and the population is estimated at more than 500 individuals. The site is of international importance for Lesser Horseshoe Bat, and ranks as one of the most important sites in Europe for the species.

22.05.2003

SITE SYNOPSIS**SITE NAME: POULADATIG CAVE****SITE CODE: 000037**

Pouladatig cave is a natural limestone cave situated near Inch bridge, west of Ennis, County Clare. It is used as a hibernating site for the Lesser Horseshoe Bat (*Rhinolophus hipposideros*), a species listed on Annex II of the EU Habitats Directive.

The site comprises a relatively short, active stream cave with some rock falls and small chambers. The cave entrance is small and is sheltered by Hawthorn (*Crataegus monogyna*) trees. After the entrance there is a low bedding crawl but the cave then opens out into roomier passageways. Cave habitats include flowing water, mud banks, boulders, rock roof and walls.

The bats hang from the roof and along the walls of the main passageway. The surrounding scrub vegetation and hedgerows is included in the site as it provides suitable foraging habitat areas and shelter for the bats.

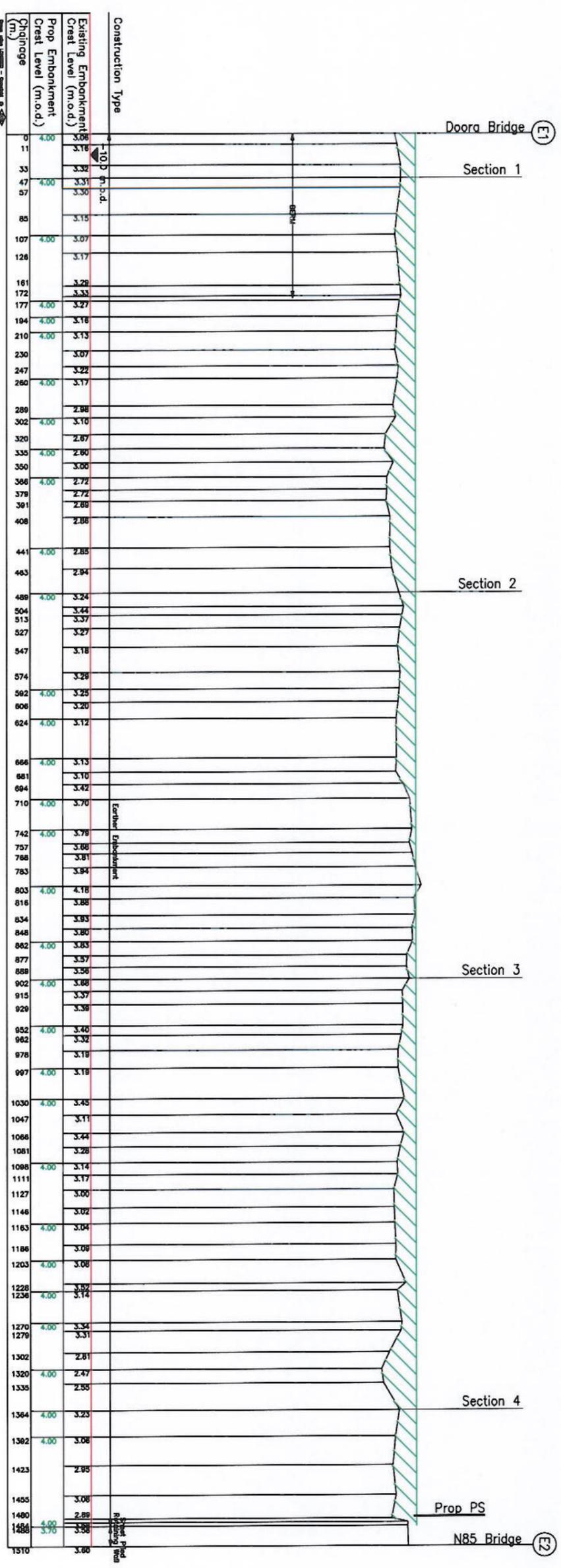
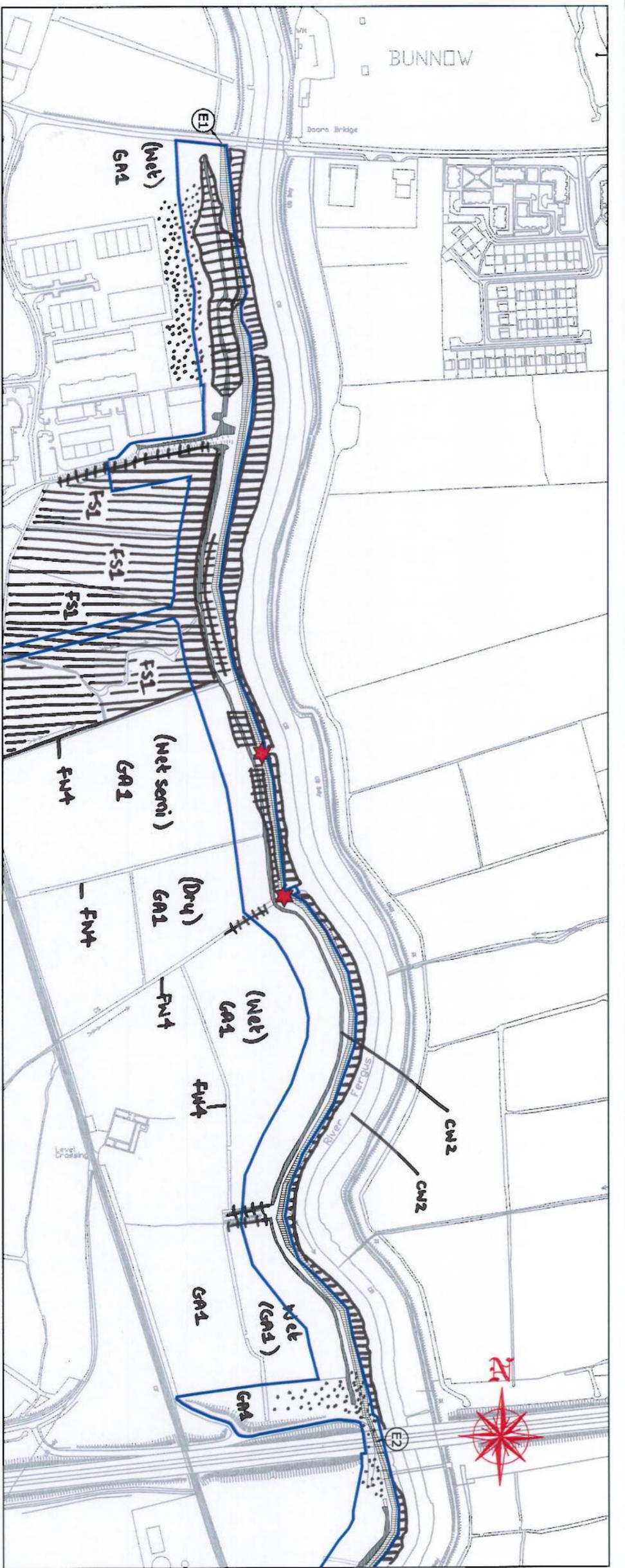
Lesser Horseshoe bats have been using this cave for many years and approximately 100 bats have been recorded at this site each winter since 1986. The site is therefore of international importance.

Although there is an active stream in the cave, this does not pose any threat of flooding to the bats. This site is not subject to visitor disturbance and is considered to be a safe hibernating site for the Lesser Horseshoe Bat.

03.09.2001

Appendix E

Habitat Mapping



- LEGEND**
- Existing Embankment (GA1)
 - Existing Backdrain (CW2)
 - Sluice Works Location
 - Works Area
 - Recolonising bare ground (ED3)
 - Reed and large sedge swamp (FWS1)
 - Improved agricultural grassland (GA1)
 - Tree-line (W12)/H11
 - Scrub (WS1)
 - Damage ditch (FW1)

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PROJECT: ENNIS SOUTH FLOOD RELIEF SCHEME

TITLE: HABITAT MAPPING (Sheet 1 of 6)

SCALE: As Shown

DATE: AUG 2012

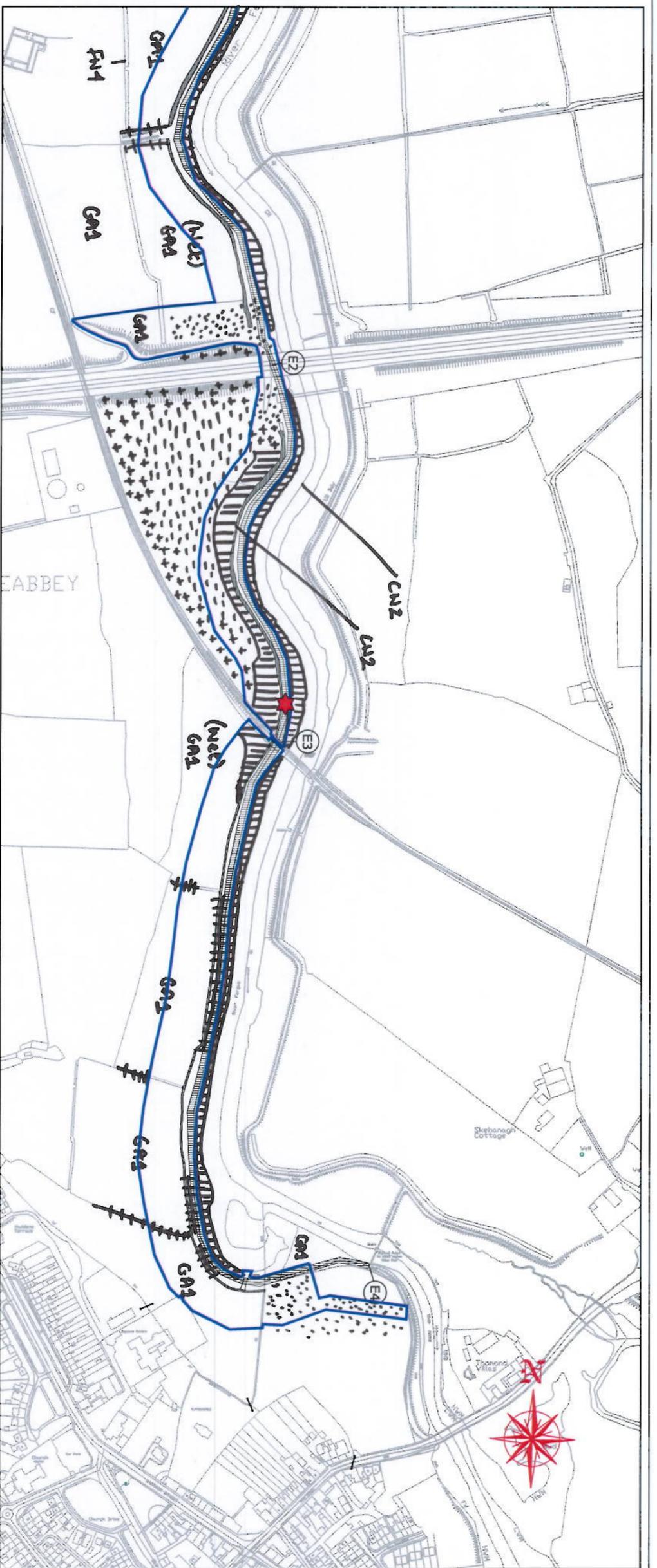
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JOB No: 2188

DRAWING No: HAB/1



Chainage (m)	Existing Embankment Crest Level (m.o.d.)	Invert Level (m.o.d.)	Construction Type
1510			N85 Bridge (E2)
1543	3.76	3.76	Sheet Pile Reinforcing Wall -10.0 m.o.d.
1563	2.84	2.84	
1572	2.86	2.86	
1591	2.81	2.81	
1606	2.79	2.79	
1617	3.03	3.03	
1642	2.90	2.90	
1656	2.98	2.98	
1689	2.81	2.81	
1711	2.40	2.40	
1731	2.90	2.90	
1746	2.90	2.90	
1770	2.63	2.63	
1784	2.91	2.91	
1815	2.73	2.73	
1837	2.54	2.54	
1852	2.71	2.71	
1866	2.95	2.95	
1897	3.16	3.16	Fergus Railway Bridge (E3)
1920	3.08	3.08	
1932	3.19	3.19	
1951	3.03	3.03	
1958	3.45	3.45	
1963	2.85	2.85	
1979	3.35	3.35	
1998	3.36	3.36	
2013	3.27	3.27	
2026	3.29	3.29	
2043	2.89	2.89	
2053	2.78	2.78	
2062	2.28	2.28	
2095	2.40	2.40	
2112	2.48	2.48	
2128	2.55	2.55	
2141	2.51	2.51	
2158	2.31	2.31	
2183	2.49	2.49	Section 7
2206	2.23	2.23	
2224	3.06	3.06	
2256	2.93	2.93	
2328	3.80	3.80	
2351	3.53	3.53	
2378	3.13	3.13	
2401	3.08	3.08	
2426	3.36	3.36	
2446	3.45	3.45	
2460	3.57	3.57	
2470	3.78	3.78	
2486	3.78	3.78	
2517	3.88	3.88	
2543	3.72	3.72	
2582	3.54	3.54	
2584	3.83	3.83	
2601	3.50	3.50	
2637	4.23	4.23	
2654	3.38	3.38	
2685	3.67	3.67	
2720	3.75	3.75	Tidal Barrage (E4)

- LEGEND**
- Existing Embankment (GA1)
 - Existing Backrain (CW2)
 - Sluice Works Location
 - Works Area

- Recolonising bareground (E03)
- Dry meadows
- Reed and large (FSA) sedge swamp
- Net grassland (GSA)
- Free-line / scrub
- Improved agricultural grassland (GA2)
- Drainage ditch (FW1)

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<input type="checkbox"/> New Year Resolution	<input type="checkbox"/> At Construction	<input type="checkbox"/> Draft

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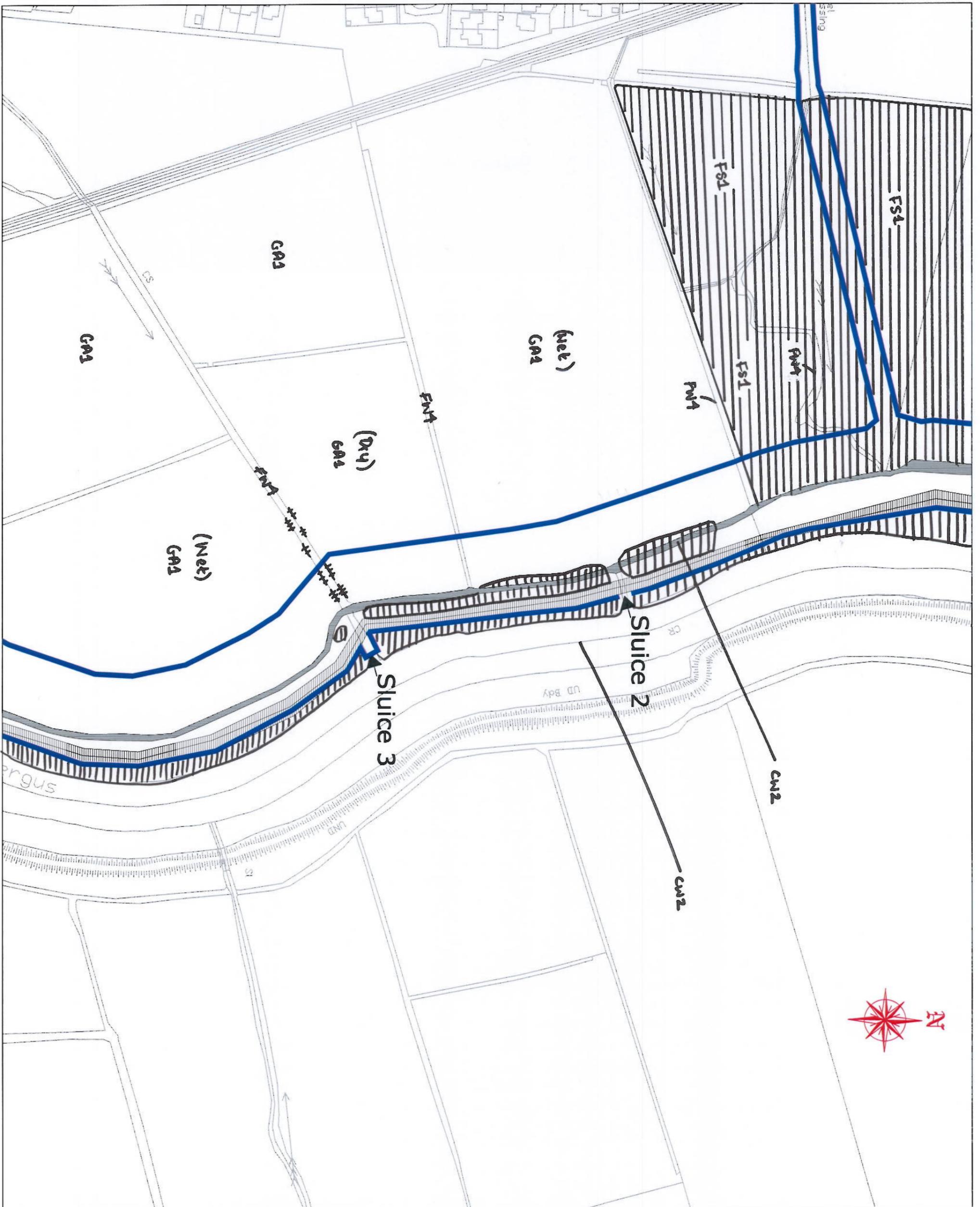
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HABITAT MAPPING (Sheet 2 of 6)

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LEGEND

- Works Area
- Road and large Sedge swamp
- FS1
- Tree-line/(WL2)
- Scrub
- Improved (GA1) agricultural grassland
- Drainage ditch (FW1)

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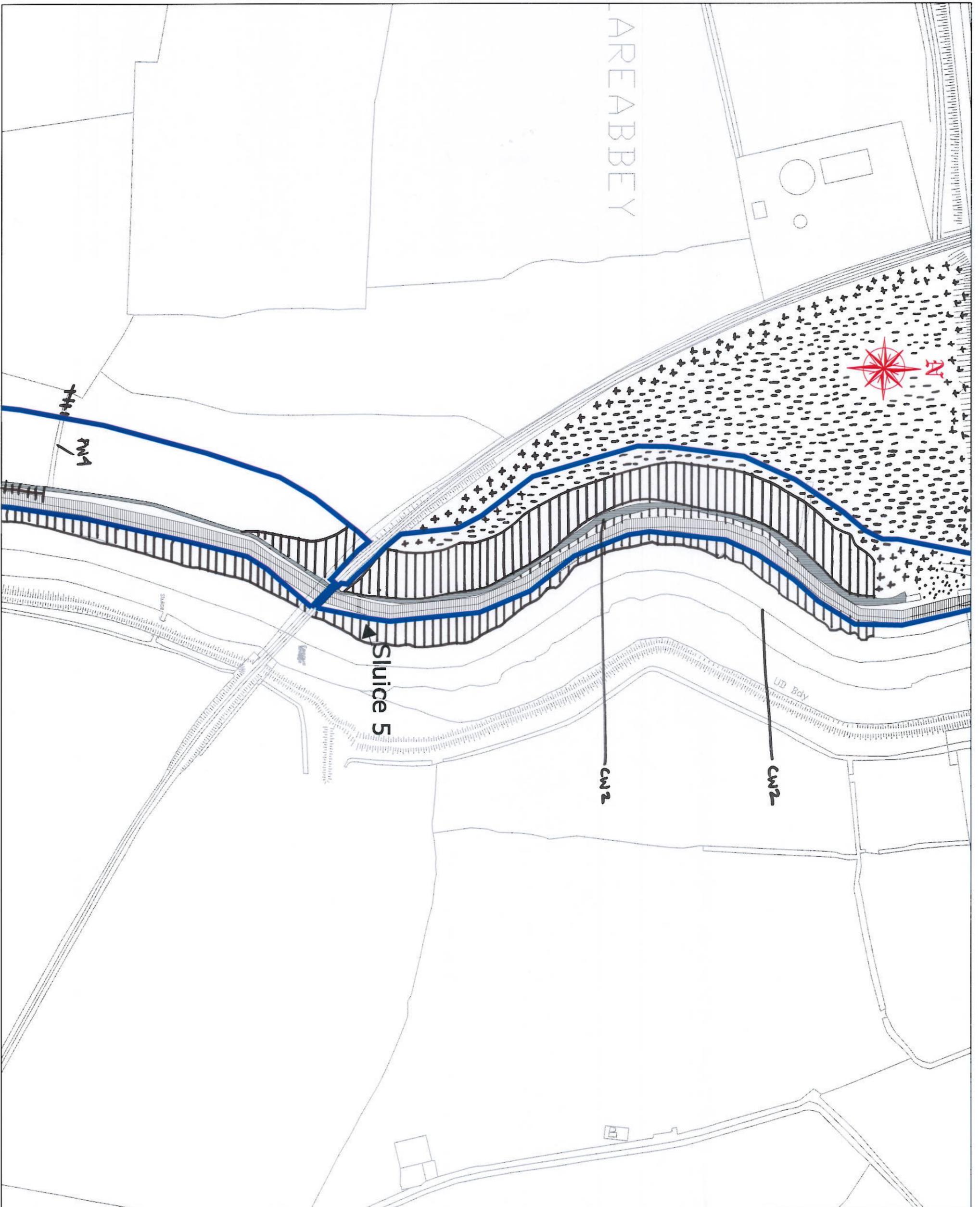
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2188	HAB/3		



LEGEND

Works Area

Wet grassland (GSA)

Dry meadows (GS2)

Reed and large sedge swamp (FSA)

Tree-line (W12) / Scrub (WS1)

Improved agricultural grassland (GA1)
Damage ditch (CA1)

REV	DATE	BY	DESCRIPTION	CHK	APP

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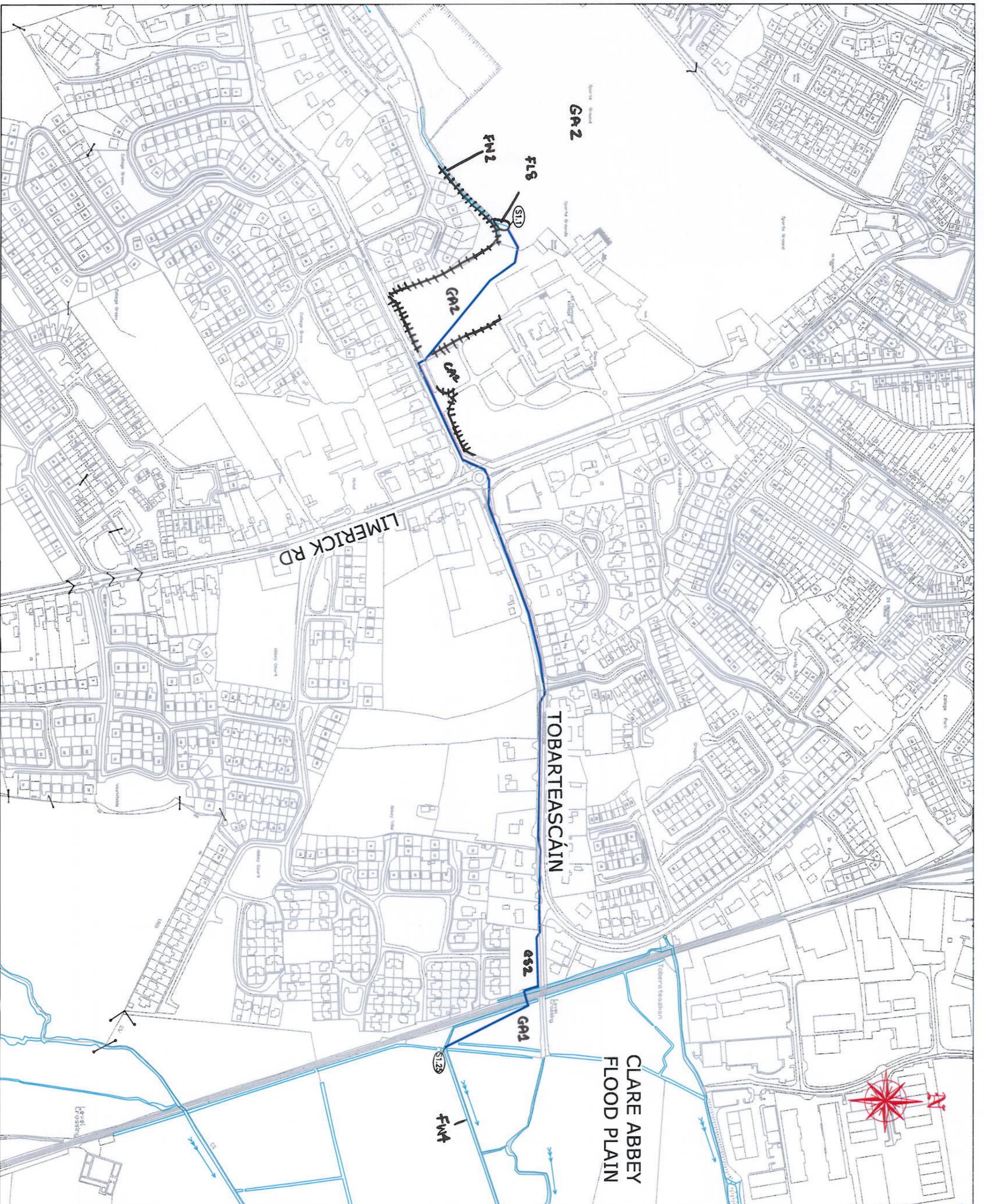
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TITLE
 HABITAT MAPPING
 (Sheet 4 of 5)

SCALE @ A3
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JOB No. 2188 **DRAWING No.** HAB/4



LEGEND
 Proposed Culvert Route

- Ponding Water body (FLB)
- Tree-line (WL2) -||||-
- Arable grassland (GA2)
- Dry meadow (SS2)
- Drainage ditch (FW4)

REV	DATE	ORN	DESCRIPTION	CHK	APP

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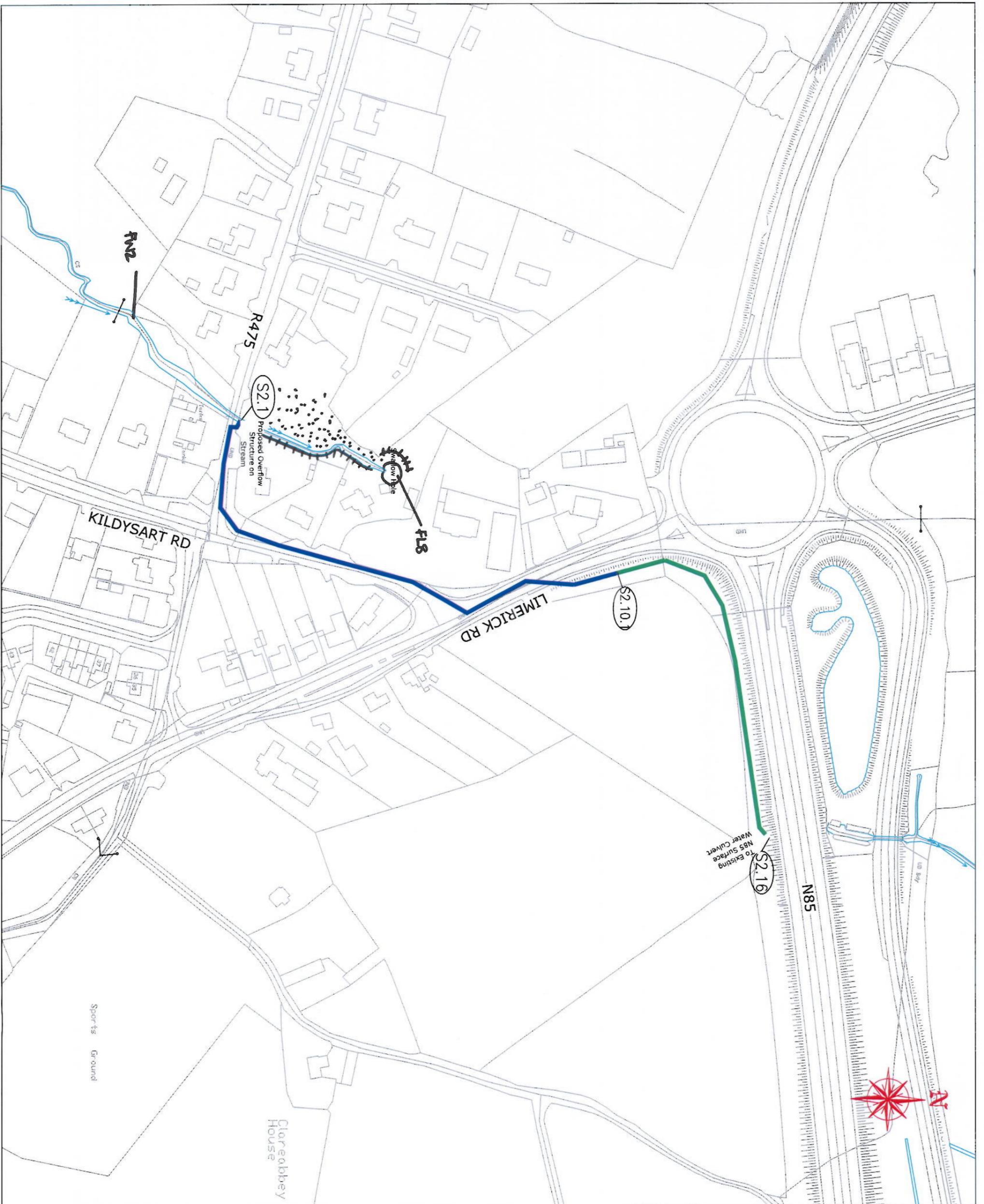
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- LEGEND**
- Proposed Culvert Route
 - Proposed Open Drain
 - Ponding Water body (FLS)
 - Redonising background (E03) tree line (WL2) / Scrub (WSA) ++++++

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Appendix D
Archaeological Assessment

**ENNIS SOUTH
FLOOD RELIEF SCHEME
Co. CLARE**

ARCHAEOLOGICAL IMPACT ASSESSMENT REPORT

MARTIN E. BYRNE, MA, Dip. EIA Mgmt., MIAI.

**Report Commissioned by
RYAN HANLEY CONSULTING ENGINEERS
Sherwood House
Sherwood Avenue
Taylor's Hill
Galway**

For

**CLARE COUNTY COUNCIL
&
OFFICE OF PUBLIC WORKS**

NOVEMBER 2011

**BYRNE MULLINS & ASSOCIATES
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OVERVIEW

This report is an Archaeological Impact Assessment of the proposed Ennis South Flood Relief Scheme, Co. Clare. The report was commissioned by Ryan Hanley Consulting Engineers, Sherwood House, Sherwood Avenue, Taylor's Hill, Galway for Clare County Council and The Office of Public Works.

The archaeological heritage assessment comprises the results of a survey and evaluation of sites of archaeological heritage potential in the immediate environs of the proposed development areas. The area examined included a c. 500m wide survey corridor, with the proposed culvert and embankment works areas acting as the central line.

The aim of the Project is to alleviate flooding in the area. The project generally consists of the construction of 2 no. 1,200mm diameter concrete flood alleviation culverts (1,120m & 520m in length), construction of an emergency pumping station, clearing works on existing drains in the flood plain and the upgrade of 2.7km of existing flood defence embankment. This embankment upgrade will include the upgrade of associated backdrain, replacement of 5 sluice gates and the installation of 3 additional sluice gates

A suggested mitigation strategy is included in the report. In general terms, this suggests that all topsoil stripping associated with the scheme be monitored by an archaeologist, under licence to the DoEHLG. In addition, it is suggested that there is no requirement for any works associated with the construction of culverts to be monitored.

November 2011

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ENNIS SOUTH FLOOD RELIEF SCHEME

Co. CLARE

ARCHAEOLOGICAL IMPACT ASSESSMENT REPORT

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1. INTRODUCTION

Clare County Council, in conjunction with the Office of Public Works, is undertaking a project, the Ennis South Flood Relief Scheme (hereinafter called the 'Project').

Byrne Mullins & Associates, Archaeological & Historical Heritage Consultants, have been commissioned by Ryan Hanley Consulting Engineers, Sherwood House, Sherwood Avenue, Taylor's Hill, Galway, to undertake a Non-Intrusive Archaeological Impact Assessment of the scheme, the results of which form the basis of this report.

1.1 Background to Assessment

The statutory and administrative framework of development control in zone of archaeological potential or in proximity to recorded monuments has two main elements:

- (a) Archaeological preservation and licensing under the National Monuments Acts – see the DAHGI *Policy & Guidelines* below; and
- (b) Development plans and planning applications under the Planning Acts.

Framework and Principles for the Protection of the Archaeological Heritage

This report, published by the Department of Arts, Heritage, Gaeltacht and the Islands in 1999, sets out the broad principles for the protection of the Archaeological Heritage. In terms of the subject scheme, the following sections of the document are of relevance:

Archaeological Assessment

3.6.1. Definition

In the present context archaeological assessment means investigation aimed at the following:
(i) gaining a better understanding of a known or suspected archaeological site or monument with particular reference to considering the implications of proposed development for such on a site or monument,

(ii) locating previously unidentified archaeological sites or monuments (or possible ones) prior to the commencement of development works with particular reference to considering the implications of proposed development for such sites or monuments,

(iii) considering the potential that proposed development works or longer term effects of a development may have on elements of the archaeological heritage not identified prior to the commencement of development works.

3.6.2. Application

Where it is considered that a development may (due to its location, size or nature) have archaeological implications, then an archaeological assessment should be carried out.

Archaeological assessment, as defined at 3.6.1 (i) above may be appropriate in relation to development located within or in the vicinity of known or suspected archaeological sites or monuments.

Archaeological assessment as defined at 3.6.1 (ii) and (iii) above may be appropriate in relation to development of such a scale or nature as to make it reasonable to consider the impact on as yet identified elements of the archaeological heritage. Examples of such development include:

- Development likely to have a substantial or significant impact (whether through direct or in-direct effects) on present or former wetlands, unenclosed lands, rivers, lakes, the inter-tidal zone, or the sea bed;
- Development located in the vicinity of large complexes of sites or monuments of archaeological interest;
- Development which is extensive in terms of area or length (this would always include development over one kilometre in length but by no means be restricted to this)...

3.6.4 Scope of archaeological assessment

Archaeological assessment may, as appropriate, include documentary research, field-walking, examination of upstanding or visible features or structures, examination of existing or new aerial photographs or satellite or other remote sensing imagery, geophysical survey, topographical assessment, general consideration of the archaeological potential of the area or areas affected by a development based on their environmental characteristics, or archaeological testing.

In all cases an archaeological assessment should consider both the direct and in-direct effects of proposed development...

Memo from Dúchas re: River Crossings and Bridges

The importance of rivers in archaeology was given added recognition in 1998 with the issuing of a memorandum from Dúchas The Heritage Service on 24th April. This required archaeological assessments to take water bodies and associated features into account. This was due to the fact "that linear developments, particularly roads, often cross rivers and impact on mills, fords, old bridges and find spots of archaeological material. Other sites such as castles and longphort (Viking) settlements are also found beside rivers".

Clare County Council Development Plan 2011-2017

The following relevant objectives in relation to Archaeological Heritage are contained in the Plan:

Objective 18.5:	<p>It is an objective of Clare County Council:</p> <ul style="list-style-type: none"> a. To safeguard sites, features and objects of archaeological interest generally; b. To secure the preservation (i.e. Preservation in situ or in exceptional cases preservation by record) of all archaeological monuments included in the Record of Monuments and Places as established under Section 12 of the National Monuments (Amendment) Act, 1994, and of sites, features and objects of archaeological and historical interest generally. c. In securing such preservation, to have regard to the advice and recommendations of the Department of Arts, Heritage and Gaeltacht Affairs. d. To have regard to the government publication Framework and Principles for the Protection of the Archaeological Heritage 1999 in relation to protecting sites, features and objects of archaeological interest.
Objective 18.6:	<p>It is an objective of Clare County Council: To protect and preserve archaeological sites discovered since the publication of the Record of monuments and Places.</p>
Objective 18.8:	<p>It is an objective of Clare County Council: To have regard to archaeological concerns when considering proposed service schemes (including electricity, sewerage, telecommunications and water supply) and proposed road works (both realignments and new roads) located in close proximity to Recorded Monuments and Places and Zones of Archaeological Potential.</p>

Objective 18.9:	It is an objective of Clare County Council: To protect and preserve the archaeological value of underwater archaeological sites in rivers, lakes, intertidal and sub tidal environments.
Objective 18.10:	It is an objective of Clare County Council: To protect and preserve the archaeological value of industrial sites such as mills, lighthouses, harbours, etc. Proposals for refurbishment works to, or redevelopment/conversion of, these sites will be subject to a full architectural and archaeological assessment.

Ennis and Environs Development Plan 2008 -2014

The following relevant policies and objectives are contained within the Plan:

Policy CN12	Protection of Archaeological Sites and Places The Council will consider proposals for developments that can clearly demonstrate that there would be no adverse impacts upon the archaeological or historical importance of recorded sites and monuments. Proposals for development which are likely to have an impact upon recorded monuments or areas of archaeological potential ...will be considered where it can be clearly demonstrated that: a. A field evaluation of the archaeological implications has been conducted by an archaeologist approved by the National Monuments Service; b. Proposals for the conservation and management of the archaeological resources have been included; c. There will be no destruction or interference with recorded monuments; d. That consideration be given to the visual impact of a development on existing recorded monuments and their setting.
Policy CN13	Safeguarding Sites of Archaeological Value No development shall be permitted within a distance deemed inappropriate to the Recorded Monument and all possible measures shall be taken to protect such structures and their visual appearance on the landscape. The Council shall safeguard archaeological sites of value, their settings and monuments, as listed in the Record of Monuments and Places. In assessing proposals for development the Council shall have due regard to national policy and the appropriate Department of Environment, Heritage and Local Government guidelines.

1.2 Statutory Protections

RECORD OF MONUMENTS AND PLACES (RMP)

Section 12 (1) of the National Monuments (Amendment) Act, 1994 provides that the Minister for the Environment, Heritage and Local Government shall establish and maintain a record of monuments and places where the Minister believes there are monuments, such record to be comprised of a list of monuments and relevant places and a map or maps showing each monument and relevant place in respect to each county of the State. This is referred to as the 'Record of Monuments and Places' (RMP), and monuments entered into it are referred to as 'Recorded Monuments'.

Section 12(3) of the National Monuments (Amendment) Act 1994 provides for the protection of monuments and places in the record, stating that
"When the owner or occupier (not being the Minister) of a monument or place which has been recorded under subsection (1) of this section or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Minister and shall not, except

in the case of urgent necessity and with the consent of the Minister, commence work for a period of two months after having given the notice.

NATIONAL MONUMENTS & MINISTERIAL CONSENT

Section 14(1) of the National Monuments (Amendment) Act, 2004 states that *in respect of a national monument of which the Minister or a Local Authority are the owners or the guardians or in respect of which a preservation order is in force, it shall not be lawful for any person to do any of the following things in relation to such national monument:...(b) to excavate, dig, plough or otherwise disturb the ground around, or in proximity to it...without the consent referred to in subsection (2) of this section or otherwise than in accordance with such consent.*

Section 14(2) refers to the granting, or otherwise, of consent and includes for a period of not more than 14 days consultation with the Director of the National Museum of Ireland following submission of a written consultation document. In addition, it should be noted that this subsection is not restricted to archaeological considerations.

In general, consent to undertake work in the environs of a National Monument is required for any works within c. 50m of the boundary to the monument. The application for consent is applied for by the landowner/local authority and should be submitted as early as possible in advance of any works proceeding.

2. METHODOLOGY

The study comprises the results of a survey and evaluation of sites of archaeological interest or potential along, and in the immediate environs of, the proposed development areas associated with the scheme. In addition, the archaeological potential of the general topographical setting and existing soil/ground conditions in the immediate areas of the proposed scheme was also examined. The specific proposed development areas and a c. 250m wide area surrounding such areas was checked for the presence of archaeological monuments by reference to map and aerial photographic sources.

The study consists of the results of a paper survey and field inspection, as follows:

(i) Paper Survey

As part of a documentary/cartographic search, the following principal sources were examined, from which a list of sites and areas of archaeological interest/potential, where appropriate with respect to each individual scheme, was compiled:

- Record of Monuments and Places – Co. Clare (RMP)
- Sites and Monuments Archive files of the Archaeological Survey of Ireland (SMR)
- Topographical Files of the National Museum of Ireland (NMI)
- *Excavations – Summary Accounts of Archaeological Excavations in Ireland* (up to 2008).
- Aerial Photographic Archive of Geological Survey of Ireland (GSI)
- Historic Map Archive of Ordnance Survey of Ireland (OSI)
- Clare County Development Plan 2011-2017 (CCDP).
- Ennis and Environs Development Plan 2008-2014 (EEDP)
- Documentary and Cartographic sources in Clare County Library (see Appendix 1).

(ii) Field Inspection

From the preceding paper survey, a list of archaeological sites and areas / sites and areas of archaeological potential, if any, with respect to each individual element of the overall scheme, was compiled for inspection. A field survey of individual scheme areas was undertaken in mid-March 2011, with a subsequent field inspection undertaken in mid-September 2011.

The field survey consisted of a walk-over inspection/surface reconnaissance of the individual proposed development areas, as well as lands immediately adjacent such areas – where

possible. In addition, the faces of existing open land-drains, surfaces of disturbed ground and the banks of streams and rivers were also inspected, where possible. Wade surveys of existing shallow open drains were undertaken, where possible – i.e. sections where vegetation growth did not hamper inspection.

An attempt was also made to identify previously unrecorded sites of archaeological potential within, and in the immediate environs of, the areas of the proposed schemes.

The overall study area did not lend itself to complete field inspection, given that areas adjacent some areas of development are located in private property, including residential plots, agricultural holdings etc. In such cases, inspections of such properties were undertaken from the road frontage boundaries. However, the proposed development areas associated with the scheme were inspected.

3. GENERAL AREA DESCRIPTION

The subject scheme is situated on the eastern/south-eastern periphery of Ennis Town – Fig. 1 – and comprises three individual development areas, as follows:

AREA A (Flood Plain)

This comprises lands forming the eastern bank of the River Fergus from an existing bridge crossing on the Quin Road in a southerly direction to a Tidal Barrage to the north of Clarecastle. Such lands are low-lying flood plain in nature, drained by streams/open-drains which run eastwards to the River Fergus. There is an existing flood embankment along the western bank of the river and an overflow drain located along the western base of the embankment.



Plate 1 Flood Embankment



Plate 2 Flood Embankment



Plate 3 Flood Embankment



Plate 4 Drain at western base of embankment

AREA B (St. Flannan's College – Tobareascáin)

This comprises open landscaped grass lands of St. Flannan's College and existing public roads leading east to a railway line. Open drains/streams run along each side of the railway line, an example of which is illustrated in Plate 5.

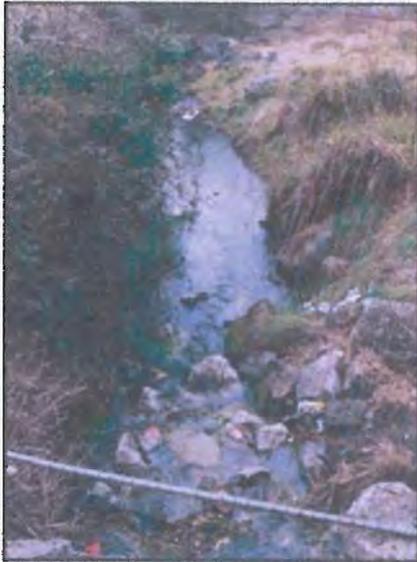


Plate 5 Stream/drain on western side of railway line (AREA B)

AREA C (Ballybeg)

This comprises lands within/adjacent existing residential properties as well as lands adjacent the N85 road and Ennis – Clarecastle road. The N85 road is constructed on an embankment and the lands immediately at the base incorporate gravel-filled drains and other services, as illustrated in Plates 6 – 8.



Plate 6 Drain at base of N85 road-embankment (south)



Plate 7 Drains and other services at base of road-embankment to N85



Plate 8 Drain and other buried services adjacent eastern edge of Ennis-Clarecastle Road

4. GENERAL HISTORICAL BACKGROUND

The subject development lands are situated in the townlands of Clonroadmore (*Cluain Ráda Mór* – 'pasture of the clearing'), Clareabbey (*Mainistir an Chláir*), Clare Commons (*Choimlín an Chláir*) and Ballaghfadha East (*Baile Locha Fada Thoir* – the 'town/settlement of the long lake'), in the civil parish of Clareabbey and in the barony of the islands.

The present county of Clare formed part of the kingdom of Thomand which, at its peak, extended eastwards as far as Birr in Co. Offaly, and Ballaghmore, a few miles northeast of Roscrea, Co. Tipperary. It spread southwards from the Slieve Aughty Mountains, part of which are now in Co. Galway, across Keeper Hill, in Co. Tipperary, through the Slieve Felim Mountains, in Co. Limerick, as far south as Ardpatrick, near Kilmallock, and included all of Co. Limerick to the east of the River Maigue from Bruree northwards.

According to tradition, the Slieve Aughty Mountains and the country extending from the Shannon to Galway Bay originally belonged to the province of Connacht but were annexed to Munster by Lughaidh Mean, the father of Conal of the Swift Horses and great-grandson of Cormac Cas, after he defeated the men of Connacht in battle.

Legend has it that in AD150 Con of the Hundred battles and Mogha Nuadhat of the Silver Hand partitioned Ireland, with Con ruling the northern half of the country (*Leathcuin* – Con's half) and Mogha ruling the south (*Leathmogha* – Mogha's half). The agreement lasted until 167 when Mogha was overthrown and killed at the battle of Moylena, following which Con became the supreme ruler. Oíllil Olum, the son of Mogha, became king of Munster and married Con's daughter. They had eight sons, seven of which were killed in the battle of Magh Macruimhne in 195. When Oíllil was dying in 234 he divided his kingdom between his surviving son, Cormac Cas, and his grandson Fiacha, the son of Eoghan. Fiacha was given the southern part of Munster where his descendants became known as Eoghacht. *Tuath Mhumhan* – north Munster or Thomand – was the name bestowed on the territory given to Cormac Cas, the descendants of whom ruled in what is now Co. Clare and north Tipperary.

The ancient territories of Thomand were Corcomruadh Oirthearach, Corcomruadh Iartharach, Uí Bracáin, Corcobhaiscinn Iartharach, Corcobhaiscinn Oirthearach, Tríocha Céd na nOileán (Uí Cormaic), Cineal Fearmaic, Uí Caisín, Uí Ainmhire, Omullod or Uí mBlóid, Uí Donghaile and Tuath Echtghe. Tríocha Céd na nOileán, which extended from Slieve Callan to the town of Ennis, was also known as the territory of Uí Cormaic or Hy Cormaic, a place-name applied to the present civil parishes of Kilmaley and Drumcliffe, and comprises only part of what became the barony of Islands (when the parish of Clondegad was added from the territory of Corcobhaiscinn Oirthearach).

During the middle ages the territory of Thomand comprised all of the present county of Clare, including the parishes of Inishcaltra and Clonrush, the entirety of Ely O'Carroll, the baronies of Ikerin, Upper Ormond, Lower Ormond, Owney, Arra and the western half of Clanwilliam in Co. Tipperary and the baronies of Owenbeg, Coonagh, Clanwilliam and the eastern halves of Coshlea and Small County in Co. Limerick. By Elizabethan times, the territory of Thomand was limited to the size of the present county of Clare, without the parishes of Inishcaltra and Clonrush (returned to the county only in 1898), and was considered part of the province of Connaught until the earl of Thomand requested that it be returned to Munster.

Prior to the Anglo-Norman invasions, the lands of Thomand were ruled by the O'Brien clan, whose main place of inauguration was at Tulla and who had a stronghold at Clonroad. Despite valiant efforts by the Anglo-Norman armies in the early-mid thirteenth century, they initially failed to capture a strong base in Clare. However, in 1248 King Henry III made grants of land to the Norman knight, Robert de Muscegros at an annual rent of £30. De Muscegros built two castles, one at Clare Castle and one at Bunratty, two strategic locations blocking the entrance to the River Fergus and Bunratty, with the former also controlling access to the O'Brien stronghold of Clonroad. The castle at Clare Castle was subsequently destroyed by Brian Rua O'Brien and this resulted in De Muscegros surrendering his lands to the king, who in 1276 granted Bunratty castle and its lands to Thomas de Clare. When Turlough O'Brien ousted Brian Rua as king of Thomand, Brian Rua asked de Clare for assistance and they

entered an agreement that the Normans would only colonise land east of the Quin River. Another de Clare, Richard, plundered the area and in 1318 was defeated at the Battle of Dysart O'Dea. Following the battle, the de Clares were expelled and the English did not re-emerge in the county for over two centuries.

In later years the O'Briens gained prominence as the Earls of Inchiquin, Barons of Clare and Marquises of Thomand. However, in 1534 when Henry VIII came to the throne, royal dominance was reasserted in Clare, with total control gained by 1541. In 1559 at Spancill Hill, Conor O'Brien and his Desmond allies were defeated in battle after which Tadhg O'Brien was appointed High Sheriff of Clare, the first occasion in which the term County Clare was used referring to the area, although Clare did not officially become a county in 1576. In that regard, the name Clare derives from the Irish *Clár*, meaning 'board' and is generally used to signify a wooden bridge, one of which may have been constructed across the River Fergus at Clare Castle, and thus providing access to the lands west of the river.

The civil parish and townland name of Clareabbey derive from Clare Abbey, founded in 1189 by Donal Mór O'Brien, King of Limerick, for the Canons Regular of St. Augustine – see SITE AR-1 below. Following the Dissolution of the monasteries, the abbey and its possessions were among the properties granted to Donnchada O'Brien, Baron of Ibracken, on condition that he gave up the name O'Brien and undertook to use English mannerisms, customs and dress (Flynn, 2004, 85). Donnchada disputed the kingship of Thomand with Turfough O'Brien and as a compromise the area was divided amongst the two, with Donnchada taking charge of the eastern section of Thomand. However, in 1583 Donnchada was drowned in the River Fergus. In 1620 the parish was given in fee to Donough, Earl of Thomond, which grant was confirmed, in 1661, to Henry, Earl of Thomond.

Lewis (1995, 28-9), writing in 1837, described the parish at that time as containing 6694 statute acres, of which approximately 200 were of bog with the remainder under pasture; with seaweed procured for manure on the shores of the Fergus and with abundant limestone. The population of the parish at that time, including the commons and town of Clare [castle] was 3881. Lewis (1995, 24) also notes regarding the River Fergus that "its banks in many places present a rich muddy strand, capable of being enclosed so as to form an important addition to the corcass lands: it receives many mountain streams, and after heavy rains rises so rapidly, that large tracts of low meadow are occasionally overflowed and the hay destroyed". The Ordnance Survey map of 1840 indicates embankments along the banks of the Fergus, particularly along the western side, while the later map of 1914-15 indicates an associated overflow drain, similar to that which presently exists. Flynn (2004, 85) notes that in the 1980s tidal barriers were erected on the river in an effort to lower water levels at Ennis during high tides that previously caused frequent flooding.

The railway line which runs through the study area formed part of the former Limerick to Sligo line. The section from Clarecastle to Ennis was opened in 1859 by the Limerick & Ennis Railway Company and included a crossing of the River Fergus. The line is still in use providing passenger services from Limerick to Ennis.

5. ARCHAEOLOGICAL RECEIVING ENVIRONMENT

5.1 Introduction

The area examined included the proposed pipeline routes as well as an associated corridor of c. 500m, the proposed pipeline routes acting as a centre line.

The area under assessment is part of a landscape which is rich in historical and archaeological material. The general region has attracted settlement from early times as evidenced by the presence of monuments dating back to the prehistoric period. Continuity of settlement is illustrated by artefacts dating to the Bronze Age and by identified monuments ranging from Neolithic to Medieval and Post-Medieval remains.

The siting preferences of particular monument types are well documented. Broadly speaking, the general landscape of the proposed development area offers a potential setting for the discovery of archaeological sites and remains, as follows:

- The landscape offer many opportunities for the location of Fulachta Fiadh (prehistoric cooking sites). These sites are location specific, generally located close to rivers and streams or in wet marshy areas, and sometimes occur in groups.
- The lands surrounding Clare Abbey were the setting of a possible battle. Consequently, there is an increased likelihood for the recovery of associated artifactual and subsurface features in this area.

5.2 Archaeological inventory

There are a total of ten previously recorded sites/monuments of archaeological interest, identified on the basis of the Paper Survey, located within the general area of the overall proposed scheme. The locations of all the sites are indicated in Fig. 2. All the sites are listed below in Table 1, following which they are described.

No additional unrecorded monuments/features of archaeological/historical interest were noted as a result of the field surveys undertaken with respect to the project. However, it is noted that the overall landscape includes a number of topographical setting which are considered to be of archaeological potential, as introduced above.

SITE No.	SMR No.	TOWNLAND	CLASSIFICATION	N.G.R.	PROTECTION
AR-1	CL033-12001	Clare Abbey	Religious House	134733 175740	Nat. Mon.; RMP; EEDP
AR-2	CL033-12002	Clare Abbey	Road/Trackway	134709 175726	Nat. Mon.; RMP; EEDP
AR-3	CL033-121	Clare Abbey	Battlefield	134733 175682	RMP; EEDP
AR-4	CL033-164	Clare Abbey	Brickworks	134957 175435	EEDP
AR-5	CL033-165	Clare Abbey	Burnt Mound	134880 175403	EEDP
AR-6	CL033-160	Clare Abbey	Burnt Mound	134582 175337	EEDP
AR-7	CL033-166	Clare Abbey	Excavation - Miscellaneous	134457 175333	EEDP
AR-8	CL033-167	Clare Abbey	Fulacht Fiadh	134463 175394	EEDP
AR-9	CL033-168	Clare Abbey	Burnt Mound	134358 175358	EEDP
AR-10		Clare Abbey	Riverbed Deposits; Logboat	135057 175069	

TABLE 1 Archaeological Inventory

SITE AR-1	CLARE ABBEY
SMR No: CL033-12001 TOWNLAND: CLAREABBEY CLASSIFICATION: RELIGIOUS HOUSE N.G.R.: 134733 175740 PROTECTION: NAT. MON; RMP	<p>This complex of buildings is situated on the northern end of a slight ridge overlooking the western bank of the River Fergus (Plate 9) with wide, but uninteresting, views all round.</p> <p>The church on the northern side of the cloister is largely complete, although a modern gate has been inserted into the western gable. None of the cloister architrave survives and the east range has been reduced in height to c. 1 – 2m, while on the southern range only part of the outer wall, greatly disturbed, survives to 1st floor level; the west wall is complete, but it only contains the western gable wall of the church and kitchen and a blank wall from the cloister with a gate which is probably late.</p> <p>The church is of coursed limestone and is an undifferentiated structure to which a tower was added, probably in the mid-15th century. The cloister and other ranges are probably coeval with the church, apart from some later windows that were inserted, and the end of the south range – the only structure to have a base batter.</p> <p>Some 19th century grave markers are contained within the complex</p>

although no medieval grave slabs have been identified.

A later wall extends east from the north-east angle of the church and measures 27.45m in length, 0.75m in width and up to 2.5m in height. It has a different orientation to that of the church and its eastern end swings slightly to the north (Plate 10). It may possibly date to the abandonment of the site.

Running south from the southeast angle of the complex is a low scarp which meets the southwest angle of the field where it borders the access road to the site (Plate 11). In addition, there is a low scarp c. 100m north of the church (aligned 240 – 60 degrees magnetic) which is at the bottom of a slight slope and could be some form of lynchet (Plate 12). These are the only indications of possible field systems around the site.

Source: Archaeological Survey of Ireland - Sites & Monuments Record Files;



Plate 9 Clare Abbey (SITE AR-1) from SE



Plate 10 Clare Abbey (SITE AR-1) from E



Plate 11 Low scarp to south of Clare Abbey running southwest to access road



Plate 12 Low, almost indiscernible scarp to north of Clare Abbey

<p>SITE AR-2</p>	
<p>SMR No: CL033-120002 TOWNLAND: CLAREABBEY</p>	<p>Pre-development archaeological testing of the roadway which links the existing car park adjacent SITE AR-1 to the N85 was undertaken in 2005 (Hull, 2008a). Four linear ditches/gullies and three pits/post-holes were uncovered. The linear features were all aligned from west to east; the three</p>

<p>CLASSIFICATION: ROAD/TRACKWAY N.G.R.: 134709 175726 PROTECTION: NAT MON; RMP</p>	<p>shallowest were considered to be the remains of cultivation furrows that respect a well-defined and deep boundary ditch. Finds recovered included a copper alloy belt buckle and other possible clothing decorations.</p> <p>Pre-development testing and subsequent excavations of the associated car park/turning area immediately outside the south-western corner of Clare Abbey (SITE AR-1) produced evidence for human activity dating from the medieval and post-medieval periods as follows (Hull, 2008b; Hull & Joubert, 2008):</p> <p>Two features, probable backfilled stone-holes that were dug to remove large glacial erratics, were uncovered that pre-date the construction of the west wall of the cloister.</p> <p>In addition, the remains of a cess egress hole in the west wall of the cloister, with an associated cess-pit, were uncovered, the latter of which produced 17th century artifactual material. These features together with a post-hole alignment and a boundary ditch were sealed by collapse material associated with the west wall of the abbey and such collapse material included a quantity of limestone roofing tiles.</p> <p>The post-hole alignment may be related to a series of pug-holes on the outside face of the west wall of the abbey, suggesting that a timber 'lean-to' style structure may have been attached to the abbey.</p> <p>In addition, a number of linear features – probable furrow ditches – may be related to medieval agricultural practices (e.g. vegetable garden) associated with the abbey, although such may also be interpreted as lazy-beds associated with potato cultivation in the late 18th or early 19th centuries.</p> <p>In the centre of the site was an area demarcated by two parallel ditches. These ditches and the space between them correspond with a track, shown on the 1840 O.S. 6" map, which led to the abbey church gate.</p> <p>Artifactual evidence, in the form of a 1691 coin struck in the Jacobite-held city of Limerick, parts of two spurs and a gunflint, may be related to the historically attested presence of military forces in the neighbourhood of Clare Castle during the Jacobite/Williamite war of the later 17th century.</p> <p>Sources: Archaeological Survey of Ireland – Sites & Monuments Record Files; Hull, G. 2008a. 'Clare Abbey, Clareabbey', <i>Excavations 2005</i> – No. 138; pp. 34-5 Hull, G. 2008b. 'Clare Abbey, Clareabbey', <i>Excavations 2005</i> – No. 139; pp. 35-6. Hull, G & Joubert, S. 2008. 'Medieval Monastic Occupation and Post-Medieval Military Activity at Clare Abbey, Co. Clare' <i>The Other Clare</i>, Vol. 32, pp. 21-6.</p>
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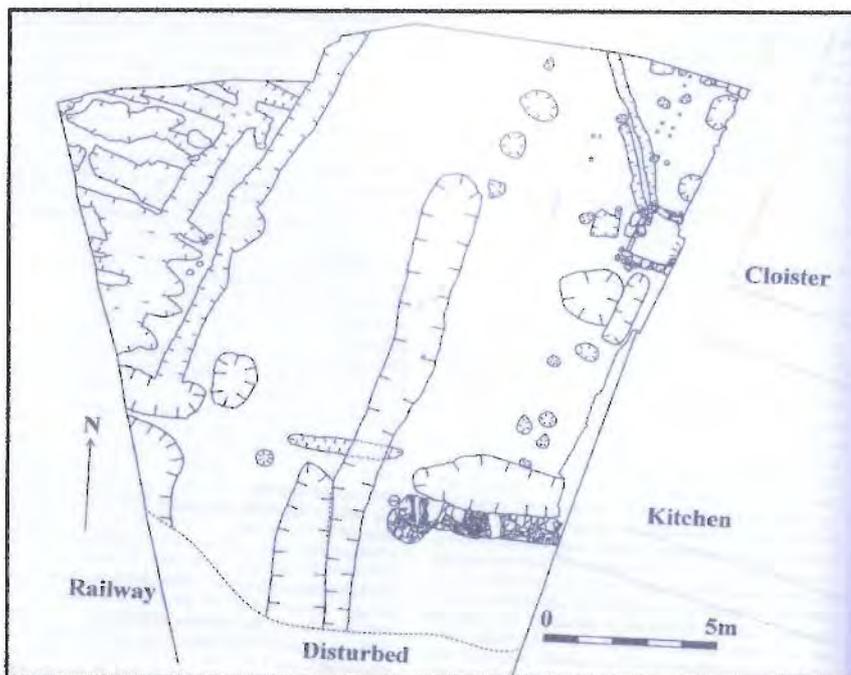


Plate 13 Plan of Excavations at Clare Abbey (SITE AR-2)

SITE AR-3	
SMR No: CL033-121 TOWNLAND: CLAREABBEY CLASSIFICATION: BATTLEFIELD SITE N.G.R.: 134773 175682 PROTECTION: RMP	<p>The <i>Ordnance Survey Letters 1841</i> (O'Donovan & Curry, 1997, 169), quoting Archdall's <i>Monast. Hib.</i>, note that "a great battle was fought here [Clare Abbey] in the year 1278 by Donnell, son of Teige Caoluiske O'Brien accompanied by the two septs of O'Coilen (Clann-Cuillein) with the tribe of Fearmaic and Owey, against Mahon O'Brien, who was defeated with great slaughter. (<i>Annals of Munster</i>). However, in a footnote, Eugene Curry notes that "it is asserted in the <i>Wars of Thomond</i> p.41, Ord. copy, that no battle was fought on the occasion, but that captives of the Kenel Dungaile were murdered.</p> <p>The O.S. 6" map of 1913-8 positions the words 'battle 1278' directly adjacent, and to the south of, the monastic complex (SITE AR-1).</p> <p>Sources: Archaeological Survey of Ireland – Sites & Monuments Record Files; Harbison, P. 1970. <i>Guide to National Monuments in Republic of Ireland</i>. Dublin, p. 40 O'Donovan, J & Curry, E. 1997. <i>The Antiquities of County Clare – Ordnance Survey Letters, 1839</i>. Clasp Press, Ennis, p. 169. Spellissy, S. 1987. <i>Clare – County of Contrast</i>. Ennis, p.46.</p>

SITE AR-4	
SMR No: CL033-164 TOWNLAND: CLAREABBEY CLASSIFICATION: BRICKWORKS N.G.R.: 134957 175435 PROTECTION:	<p>Three areas of brick-making (Brick Clamps/Kilns) were uncovered within the construction corridor of the N18 Ennis bypass and on the west bank area of the River Fergus. These were subsequently excavated by Kate Taylor under Licence No. 04E027 (Taylor, 2007a).</p> <p>Clamp A was the best preserved and was composed of six rows (benches) of unmortared brick orientated NNE – SSW. The benches were 4.5 – 4.7m long, 0.35-0.45m wide and 2-3 bricks high. Between the benches were deposits of black burnt peat that had a maximum thickness of 0.08m. Brick air vents were seen at the ends of the fuel rows.</p> <p>Clamp B was formed by then rows of brick benches, each typically 5.5 – 6m long, 0.5m wide and orientated NNE-SSW. Burnt peat was evident between the benches.</p> <p>Clamp C demonstrated evidence of three phases of brick making at the same location. Initially, the natural clay had been dug out to a depth of 0.2m to produce five slots, each 0.4m wide and 6m long, orientated NNE-SSW. These slots were filled with black burnt peat and presumably served to hold fuel for the earliest brick clamp. Later, a deposit of broken brick fragments and redeposited natural clay sealed and levelled this clamp and then two more brick kilns were built on top. These later kilns were sited next to each other, although they were not necessarily contemporary. The western kiln was 6m long; 5.8m wide and included six brick benches. The eastern kiln was 6m long and 4.2m wide. The benches of both kilns were 0.3 – 0.45m wide and orientated NNE/SSW.</p> <p>Clamps B and C were truncated by the back drain flanking the River Fergus flood bund to the east.</p> <p>Sources: Archaeological Survey of Ireland – Sites & Monuments Record Files; Taylor, K, 2007a. 'SITE AR120, CLAREABBEY' in <i>Excavations 2004</i> – No. 144; p. 234</p>

SITE AR-5	
SMR No: CL033-165 TOWNLAND: CLAREABBEY CLASSIFICATION: BURNT MOUND N.G.R.: 134880 175403 PROTECTION:	<p>Two deposits of burnt stone were uncovered during archaeological monitoring of construction works associated with the N18 Ennis bypass and were subsequently excavated under Licence 04E0031.</p> <p>The smaller deposit was a shallow oval and lenticular burnt spread that measures 4m (E-W) x 2.1m (N-S) and was up to 0.1m thick. It was covered by 0.2m of peat and overlay 0.2m of further, undifferentiated peat. The deposit was predominantly of burnt sandstone and was rich in charcoal.</p> <p>The larger deposit was situated c. 25m to the NE of the smaller and was</p>

	<p>15m in any direction and up to 0.3m thick. It was overlain by 0.1-0.2m of topsoil and was sealed by 0.2-0.3m of peat, and it lay directly on the geological natural subsoil. The spread was composed of mostly heat-cracked limestone pieces with occasional sandstone present. Charcoal flecking and staining was very evident.</p> <p>Source: Archaeological Survey of Ireland – Sites & Monuments Record Files; Taylor, K. 2007b. 'SITE AR121, CLAREABBEY', <i>Excavations 2004</i> – No. 145, p. 34</p>
SITE AR-6	
<p>SMR No: CL033-160 TOWNLAND: CLAREABBEY CLASSIFICATION: BURNT MOUND N.G.R.: 134582 175337 PROTECTION:</p>	<p>Eleven pits and a small spread of burnt stone, containing concentrations of charcoal, heat-shattered stone or both, were uncovered during the monitoring of topsoil stripping associated with the N18 Ennis bypass and excavated under Licence No. 04E0032.</p> <p>While it was not possible to directly relate all these features, especially given the distribution across the site, it is likely that all relate to the process of heating water with fired stones, with the pits perhaps acting as troughs. The presence of a small assemblage of bone at the base of one of the pits perhaps indicates that they were used for cooking or preparation of animal hides.</p> <p>Source: Archaeological Survey of Ireland – Sites & Monuments Record Files; Taylor, 2007c. 'SITE AR122, CLAREABBEY', <i>Excavations 2004</i> – No. 146, p. 34.</p>
SITE AR-7	
<p>SMR No: CL033-166 TOWNLAND: CLAREABBEY CLASSIFICATION: EXCAVATION - MISCELLANEOUS N.G.R.: 134457 175333 PROTECTION:</p>	<p>Four small pits, a small hearth and a deposit of charcoal-rich material, identified during monitoring of topsoil stripping associated with the N18 Ennis bypass, were excavated under Licence No. 04E0019. Two additional pits were subsequently identified.</p> <p>The features lay within 15m of each other and no direct stratigraphic relationship was observed, although the morphology and proximity suggests a single phase of activity.</p> <p>Iron slag from some of the features indicates ironworking and the small-scale of the deposits suggests that this dates to the pre-modern era.</p> <p>Source: Archaeological Survey of Ireland – Sites & Monuments Record Files; Hull, G. 2007a. 'SITE AR123, CLAREABBEY', <i>Excavations 2004</i> – No. 147, p. 35.</p>
SITE AR-8	
<p>SMR No: CL033-167 TOWNLAND: CLAREABBEY CLASSIFICATION: FULACHT FIADH N.G.R.: 134463 175394 PROTECTION:</p>	<p>An amorphous burnt-stone spread (8m x 3m & 0.25m thick), uncovered by works associated with the N18 Ennis Bypass, was subsequently investigated under Licence No. 04E0022.</p> <p>The spread was composed of fire-cracked and charcoal-darkened limestone pieces, truncated by a modern field drain. Stratigraphically earlier than the spread was a circular flat-bottomed pit or trough, with a diameter of 0.45-0.5m and 0.25m deep. The base was flattish, and the trough contained burnt stone with charcoal, identical to the overlying spread.</p> <p>A small part of the feature lay outside the road CPO. The exposed section indicated that a possible second trough could be present outside the road-take. This feature had a maximum observed width of 0.3m and was at least 0.1m deep.</p> <p>Source: Archaeological Survey of Ireland – Sites & Monuments Record Files; Hull, G. 2007b. 'SITE124, CLAREABBEY', <i>Excavations 2004</i> – No. 148, p. 35</p>
SITE AR-9	
<p>SMR No: CL033-168 TOWNLAND: CLAREABBEY</p>	<p>A burnt-stone spread of possible prehistoric date was found during testing of the N18 Ennis Bypass (Hull, 2006). The archaeological deposits were destroyed by a contractor rerouting services for the new road. The burnt spread was recorded at testing phase as having maximum dimensions of</p>

CLASSIFICATION: BURNT MOUND N.G.R.: 134358 175358 PROTECTION:	10m (N-S) x 8m (E-W) and was 0.35m in thickness. The spread (or perhaps 'mound') was composed of burnt limestone pieces with charcoal flecking and no evidence of a trough was observed. Source: Archaeological Survey of Ireland – Sites & Monuments Record Files; Hull, G. 2007c. 'SITE AR125, CLAREABBEY', <i>Excavations 2004</i> No. 149, p.35
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SITE AR-10 SMR No: N/A TOWNLAND: CLAREABBEY CLASSIFICATION: RIVERINE DEPOSITS LOGBOAT N.G.R.: 135057 175069 PROTECTION: N/a	<p>An underwater archaeological non-disturbance assessment and metal-detector survey of the riverbed sediments in the River Fergus was carried out as part of the BGE Pipeline to the West Scheme, where the possible remains of a logboat had been identified by Eoin Kiernan in 2002. The work involved confirming the find as well as undertaking more detailed recording of the riverbed within the proposed footprint of the gas works.</p> <p>The survey recorded an area of scouring that had exposed a submerged layer of peat and the remnants of an ancient forest. Numerous metal-detecting hits were recorded, the majority of which related to modern debris, although an iron pike/axe was recovered.</p> <p>In the area outside, and immediately downstream of the works area, the fragile remains of a largely intact logboat were discovered. It measures 6.25m long & 0.76m wide. The vessel was partly buried in the riverbed deposits, and one side of its gun wales was exposed up to 0.25m above the surrounding silts. The hull structure was filled with sediments and debris, although two sections of rib framing were identified. The remains are thought to be early medieval in date.</p> <p>Subsequent monitoring of the pipe trench excavations in this area included metal detecting of the spoil but nothing of archaeological interest was uncovered or recovered.</p> <p>The work undertaken by Kiernan also noted a large number of angular stones on the riverbed and these were interpreted as collapse resulting from efforts to apply a stone lining the adjacent flood embankment.</p> <p>Source: Kiernan, E. 2007. 'River Fergus at Clareabbey/Shehanagh', <i>Excavations 2004</i>, No. 150, p. 35. McCullough, D. 2006. 'River Fergus, Clareabbey', <i>Excavations 2003</i>, No. 96, p. 24. Hull, G. 2006. 'River Fergus Crossing, Clareabbey/Skehamagh (BGE RVX 3/07)', <i>Excavations 2003</i>, No. 97, pp. 24-5.</p>
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5.3 Results from previous documented relevant archaeological investigations

A search undertaken of the annual Archaeological Excavations Bulletin (www.excavations.ie) indicates that a number of archaeological investigations have been undertaken within the defined study area. Those investigations which yielded archaeological discoveries are outlined above with respect to Sites AR-2 to AR-10.

5.4 Reported archaeological artefacts

A search of the Topographical Files of the National Museum of Ireland was undertaken as part of the preparation of the report. No artefacts have been reported to, or acquired by, the National Museum of Ireland (NMI) within the subject study area.

6. DESCRIPTION OF DEVELOPMENT

The aim of the Project is to alleviate flooding in the area. The project generally consists of the construction of 2 no. 1,200mm diameter concrete flood alleviation culverts (1,120m & 520m in length), construction of an emergency pumping station, clearing works on existing drains in

the flood plain and the upgrade of 2.7km of existing flood defence embankment. This embankment upgrade will include the upgrade of associated backdrain, replacement of 5 sluice gates and the installation of 3 additional sluice gates. Plans of the proposed works are illustrated in Figs. 3 – 12.

Flood Defence Embankment etc. (Flood Plain)

Works associated with this element of the development, include for the construction of an emergency pumping station, clearing works on existing drains in the flood plain, the upgrade of 2.7km of the existing flood defence embankment and associated backdrain, the replacement of 5 no. sluice gates and the installation of 3 additional sluice gates. Plans and sections with respect to this element are illustrated in Figs. 3 - 8. As illustrated in Figs. 5 and 6, the existing flood defence embankment will be raised and, in some areas, widened. Such work will require that the existing backdrain be filled and new sections of the backdrain excavated. In addition, sections of the existing backdrain will be deepened and widened.

St. Flannan’s College – Tobarteascán

This element of the scheme comprises the construction of a 1200mm diameter concrete flood alleviation culvert from an exiting swallow hole at St Flannan’s College, through a landscaped grassed area of the college ground and in an easterly direction along existing public roads to the railway line where it will enter the flood plain lands (distance – 1,120m). In that regard, the culvert will cross under the railway line and will be laid adjacent to the existing open drain in the immediate environs of such, as illustrated in Fig. 9. An overflow structure will be formed at the existing swallow hole at St. Flannan’s College, as illustrated in Fig. 10.

Ballybeg

This element of the scheme proposed the construction of a 1200mm diameter concrete flood alleviation culvert from Ballybeg Stream through public roads to lands adjacent the Limerick Road (Ennis – Clarecastle) (distance – 520m) where it will join an existing open drain to an existing N85 Road surface water culvert – Fig. 11. An overflow chamber structure will be constructed at Ballybeg Stream, as illustrated in Fig. 12.

7. ARCHAEOLOGICAL IMPACT ASSESSMENT

The following table (based on NRA, 2003, 21) provides the baseline criteria used to describe the impacts that the proposed development will have on Archaeological Sites and Areas.

	Direct	Indirect
Severe	Archaeological monument/site is within a proposed development area. Construction work will entail the removal of part or the entire cultural heritage site.	Archaeological monument/site is within a proposed development area. Construction works will entail the destruction of the visual context of the site or isolate it from associated groups or features.
Potentially Severe	Archaeological monument/site is adjacent to a proposed development area. There is potential for related remains being affected by development works.	Archaeological monument/site is adjacent to a proposed development area. Construction works will greatly injure the visual context of the site or isolate it from associated groups or features.
Moderate	Existing access to a cultural heritage site will be severed. Development works will affect the context of an archaeological monument/site.	N/A
No Predicted	The proposed development will	N/A

have no predicted impact.

TABLE 2 Criteria for Assessment of Impacts

The proposed works will be located in existing agricultural lands, along existing roads, through a landscaped grassed area and require existing drains to be cleaned.

There are a total of ten monuments and features of archaeological interest located within the defined study associated with the proposed scheme. In general, most of the archaeological features have previously been excavated, although it is noted that part of SITE AR-8 exists outside the original construction corridor of the N86 road, the line of which is marked by a post-and-rail fence. In addition, low scarps associated with Clare Abbey (SITE AR-1) exist to the north and south of the extant ecclesiastical stone structures. Furthermore, there is a possible battleground to the immediate south/southeast of Clare Abbey (SITE AR-3), the extent of which is unknown. In general, however, the archaeological monuments are largely sited away from the proposed works, except particularly SITE AR-8, while the scarps to the north and south of Clare Abbey have the ability to be impacted indirectly by construction traffic.

The archaeological impacts of each element of the overall scheme are as follows:

A. Flood Plains

In general, it is considered that works associated with the upgrading of the flood defence embankment, associated back drain provision of emergency pump house, replacement of existing sluice gates and provision of additional sluice gates, together with the cleaning/clearing of existing drains, will not cause any direct impacts to any previously recorded archaeological monuments.

It is noted that none of the easement wayleaves/construction transport routes associated with the project will be situated in the immediate environs of Clare Abbey or associated extra-mural features – see Fig. 14. Consequently it is not envisaged that any indirect impacts will occur with respect to such features. Likewise, it is noted that it is unlikely that the section of open drain to the north of Clare Abbey, and adjacent an associated low scarp feature, will be subjected to clearing/cleaning works. Consequently, it is not considered that any impacts will occur with respect to this low scarp feature.

B. St. Flannan's – Tobartascáin Culvert

There are no features of archaeological interest associated with this development area. In general, the proposed culvert will be routed along previously disturbed road ways, through existing streams adjacent a railway or through a landscaped grasses area. Consequently, it is not considered likely that any direct or indirect archaeological impacts might occur.

C. Ballybeg Culvert

This element of the scheme will be routed through existing roads or lands previously disturbed by works associated with the construction of the N86 road or by the laying of service adjacent Limerick Road. Consequently, it is not considered likely that works have the ability to cause any direct or indirect impacts to previously identified or possible unknown subsurface archaeological remains.

8. SUGGESTED MITIGATION STRATEGY

The impact of the overall scheme with respect to Archaeological Heritage is discussed above in Section 7. In summary, it is considered that no direct impacts with respect to the development, as proposed, will occur to any previously identified archaeological monuments.

In general, ground reductions associated with a development of this kind have the ability to uncover and disturb hitherto unrecorded subsurface features, deposits, structures and finds of archaeological interest and potential within previously largely undisturbed green-field areas. In

addition, there remains the possibility that subsurface features and artifactual material associated with the possible battle ground (SITE AR-2) in the environs of Clare Abbey could be uncovered. Without specific mitigation strategies, such subsurface archaeological features which might exist within the green-field areas of the subject development lands would be disturbed and destroyed and not identified and recorded. It is also noted that, in general, the proposed culvert works will be located in areas of previous ground reduction and disturbance works and that there is a very low possibility for subsurface archaeological remains to be uncovered in these areas.

Given the above, the following mitigation strategies are offered with regard to overall scheme, subject to the approval of the National Monuments Service, Department of Arts, Heritage and Gaeltacht:

1. Prior to the commencement of works, an archaeologist should be appointed to oversee all the mitigation measures suggested below, in that regard, the archaeologist should obtain a licence from the Dept. of Arts, Heritage and Gaeltacht for the scheme. It is not considered that Ministerial Consent is required for any works associated with the scheme. However, in the event that the stream to the north of Clare Abbey, adjacent an associated low scarp, is to be subjected to clearance/cleaning works, than it is likely that Ministerial Consent may be required for such works. This should be clarified with the National Monuments Service and included in their recommendations resulting from the submission of this report.
2. All topsoil stripping/general ground reductions associated with the scheme with the flood plains area should be monitored, on a full-time basis by an archaeologist. In that regard, it is not considered necessary to undertake archaeological monitoring of the proposed culvert works.
3. In the event of works being undertaken to the stream situated to the north of Clare Abbey, the archaeologist should, prior to the commencement of such works, delineate a buffer/exclusion area around the northern low scarp feature. No construction traffic should enter such buffer area and no spoil, construction debris or materials should be stored with the defined buffer area.
4. In the event of archaeological material being uncovered during the course of such monitoring, the archaeologist shall be empowered to have works ceased in the vicinity of such material pending the receipt of advice from the Heritage and Planning Division of the Department of Arts, Heritage and Gaeltacht (National Monuments Section). Likewise, should archaeological/historical artifactual material be uncovered/recovered during such works, the requirements of the National Museum of Ireland with regard to such items should be implemented.
5. Following completion of all monitoring, and other possible archaeological investigations, the archaeologist shall prepared a report for submission to both Clare County Council and the Department of the Environment, Heritage and Local Government.
6. No spoil, fill material or pipes should be stored on, or within 40m of any of the identified extant archaeological sites. In addition, the locations of work compounds, offices etc, should be sited well away from the identified archaeological sites.
7. The locations for spoil dumps should be discussed in advance with the appointed archaeologist in order that no damage is caused either by the dumping of soil on archaeological remains or the movement of vehicles through or close to archaeological monuments and areas.

Appendix 1

List of Consulted Sources

(See Section 5.2 for monument specific references)

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FIGURES

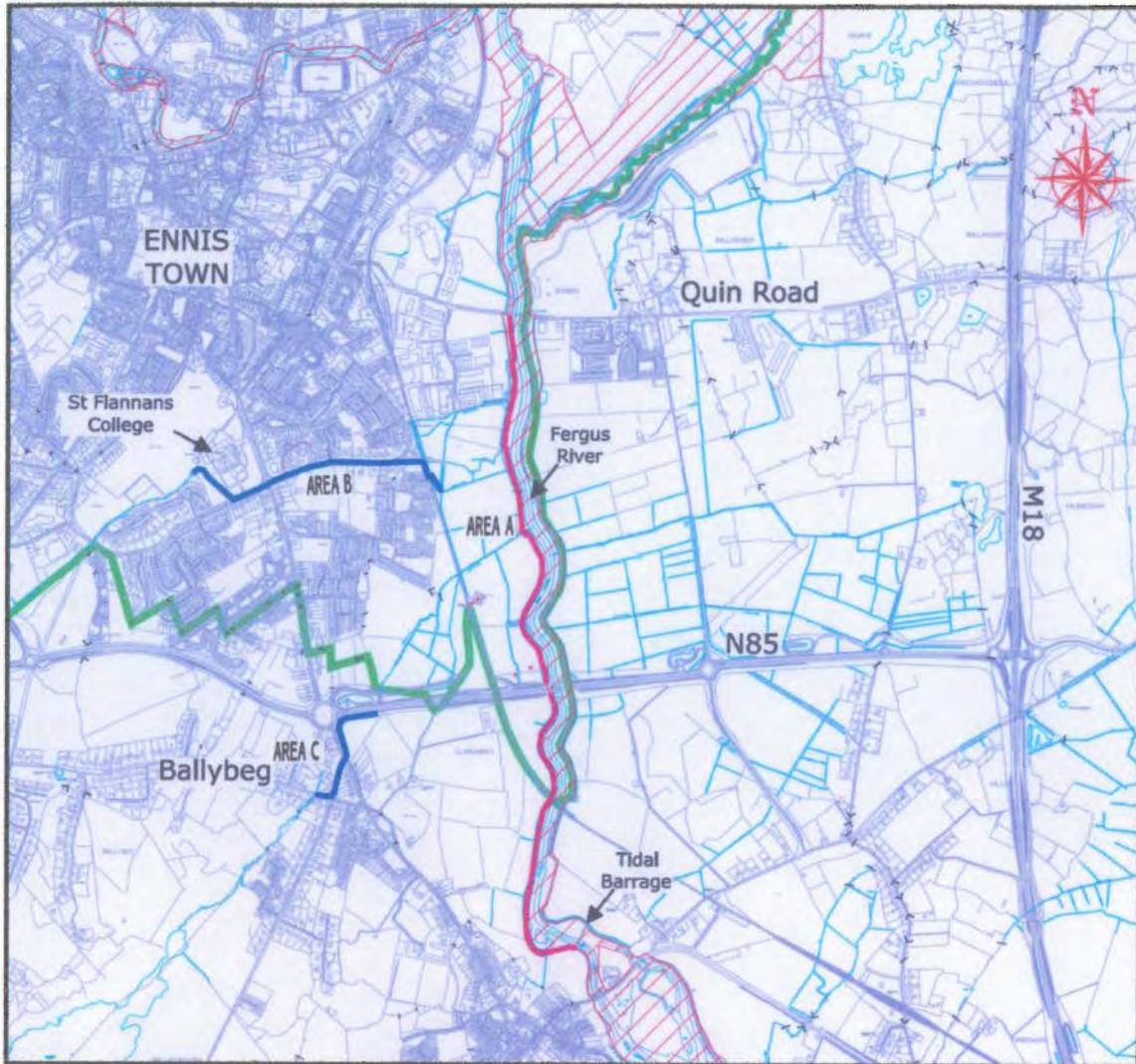


Figure 1 GENERAL LOCATION MAP

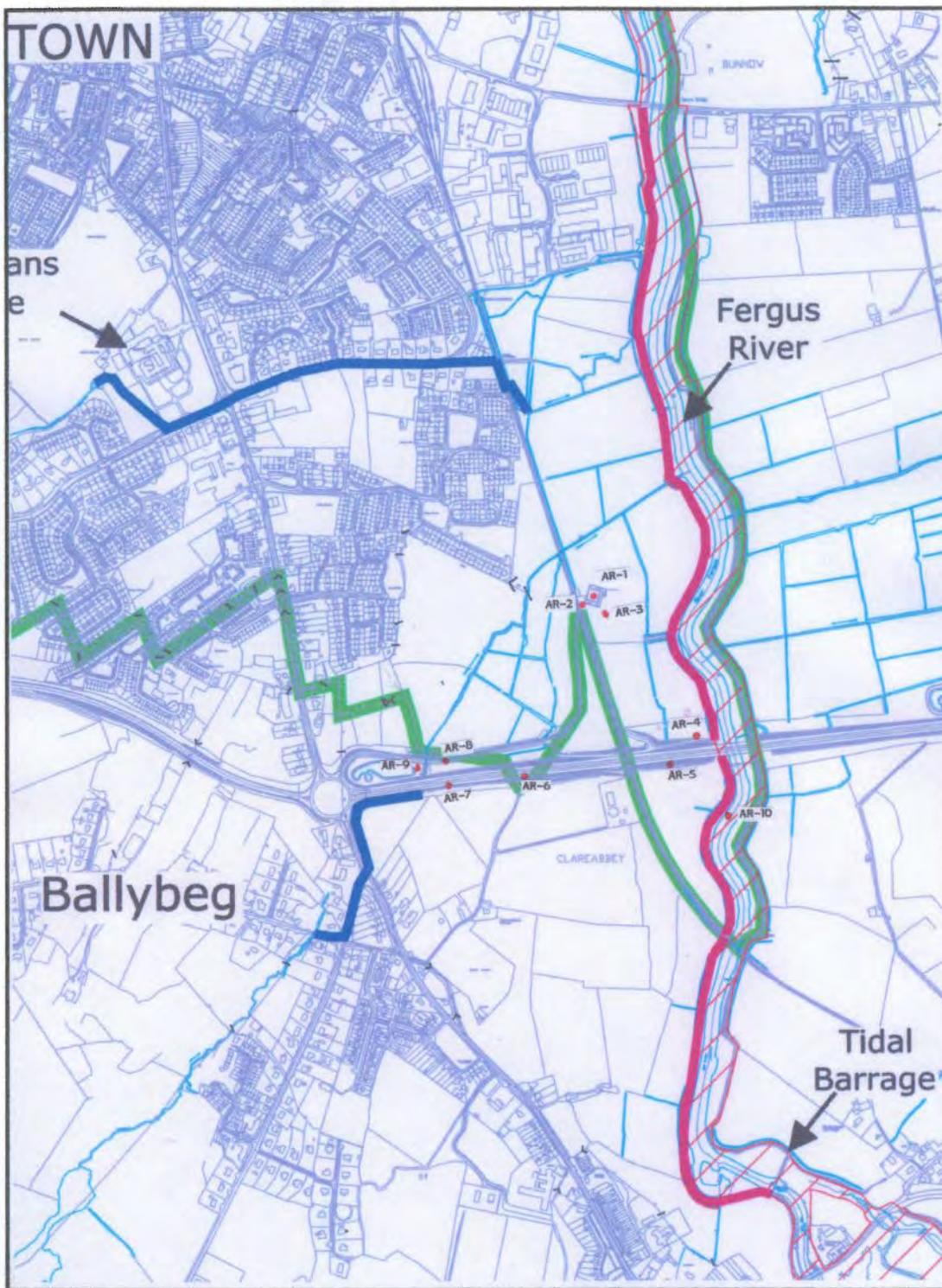
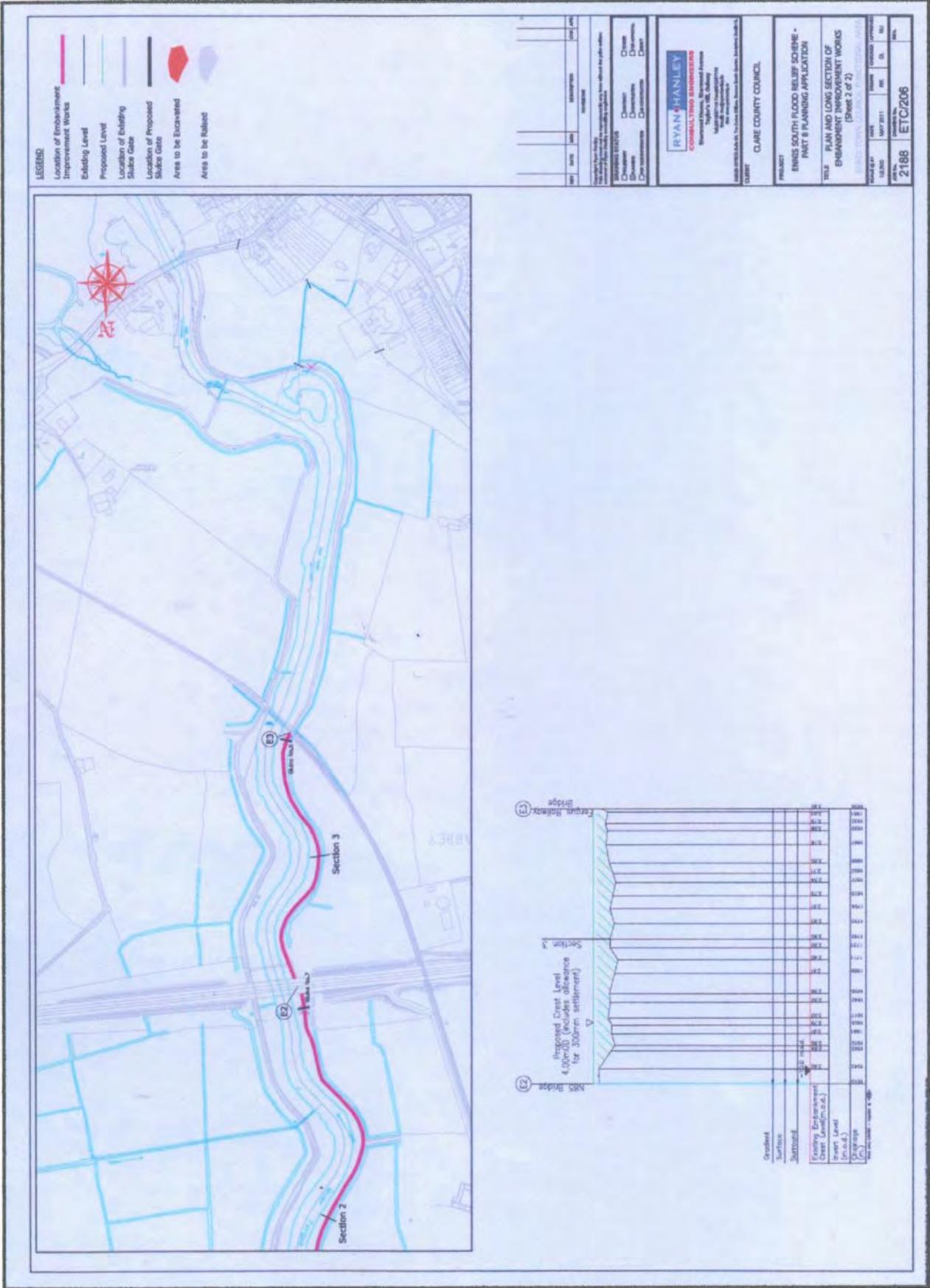


Figure 2 ARCHAEOLOGICAL INVENTORY LOCATION MAP



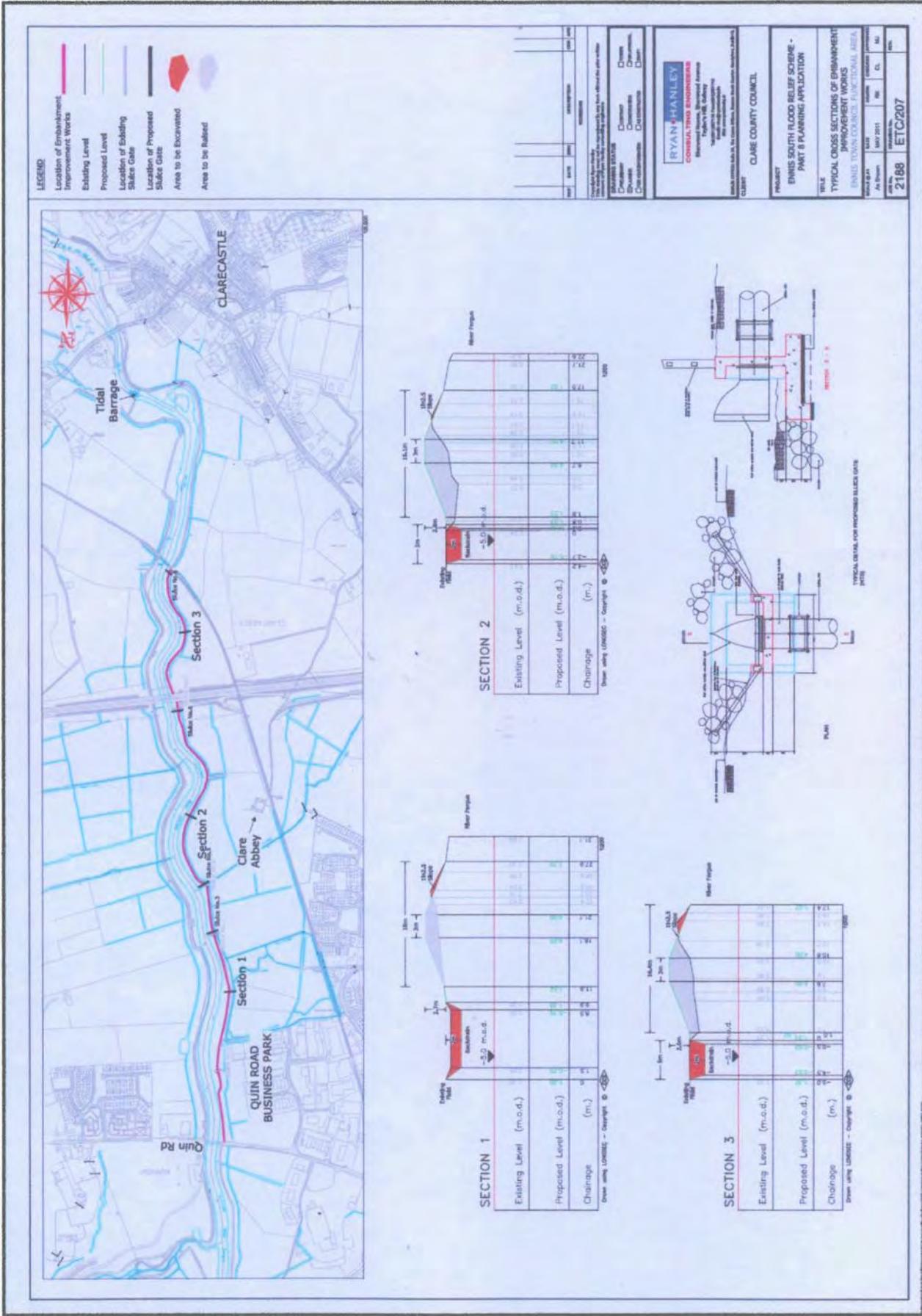


Figure 5 TYPICAL CROSS-SECTIONS OF EMBANKMENT IMPROVEMENT WORKS (ENNIS TOWN COUNCIL FUNCTIONAL AREA)

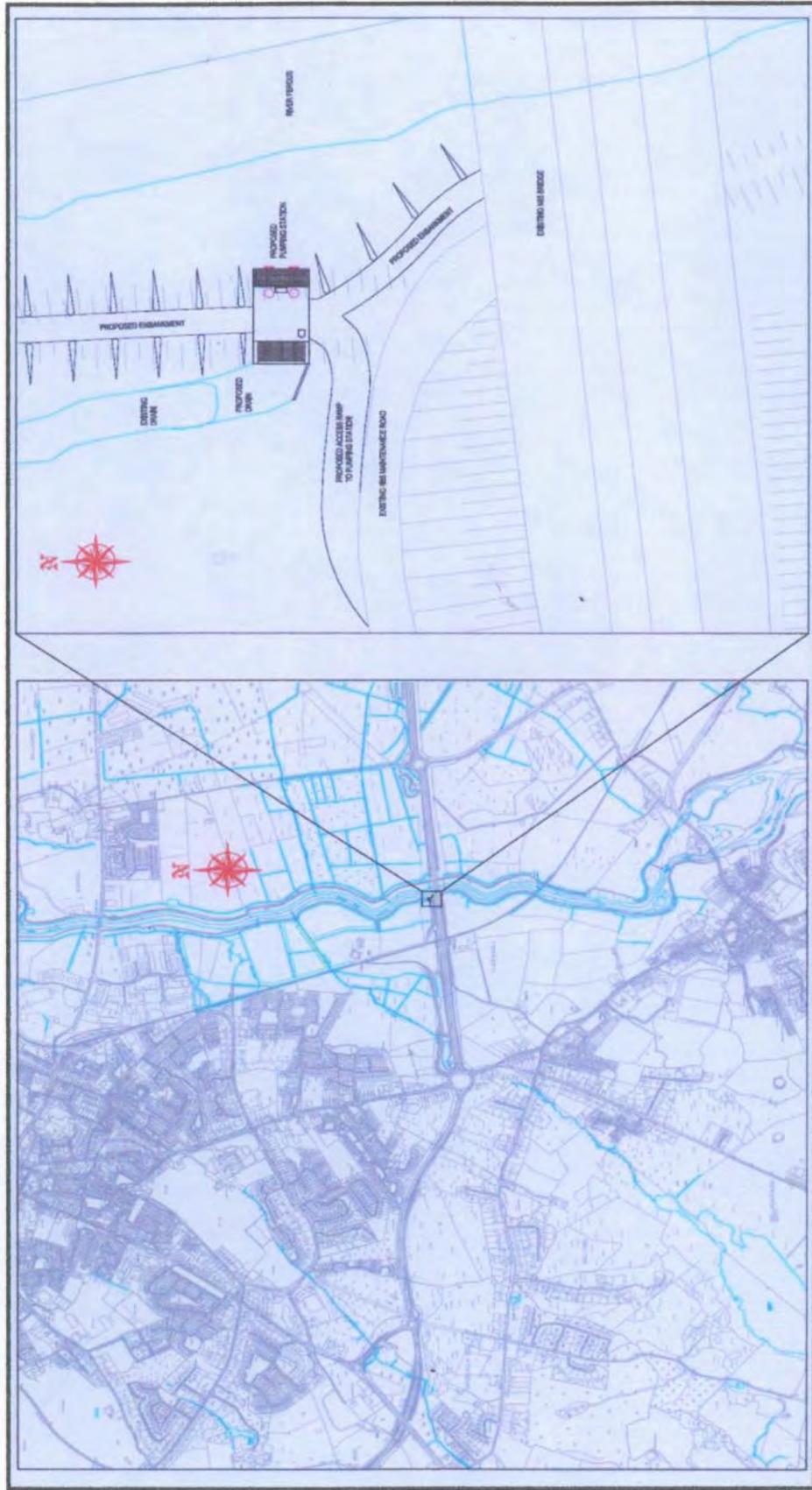


Figure 7

LOCATION & SITE PLAN OF PROPOSED EMERGENCY PUMPING STATION

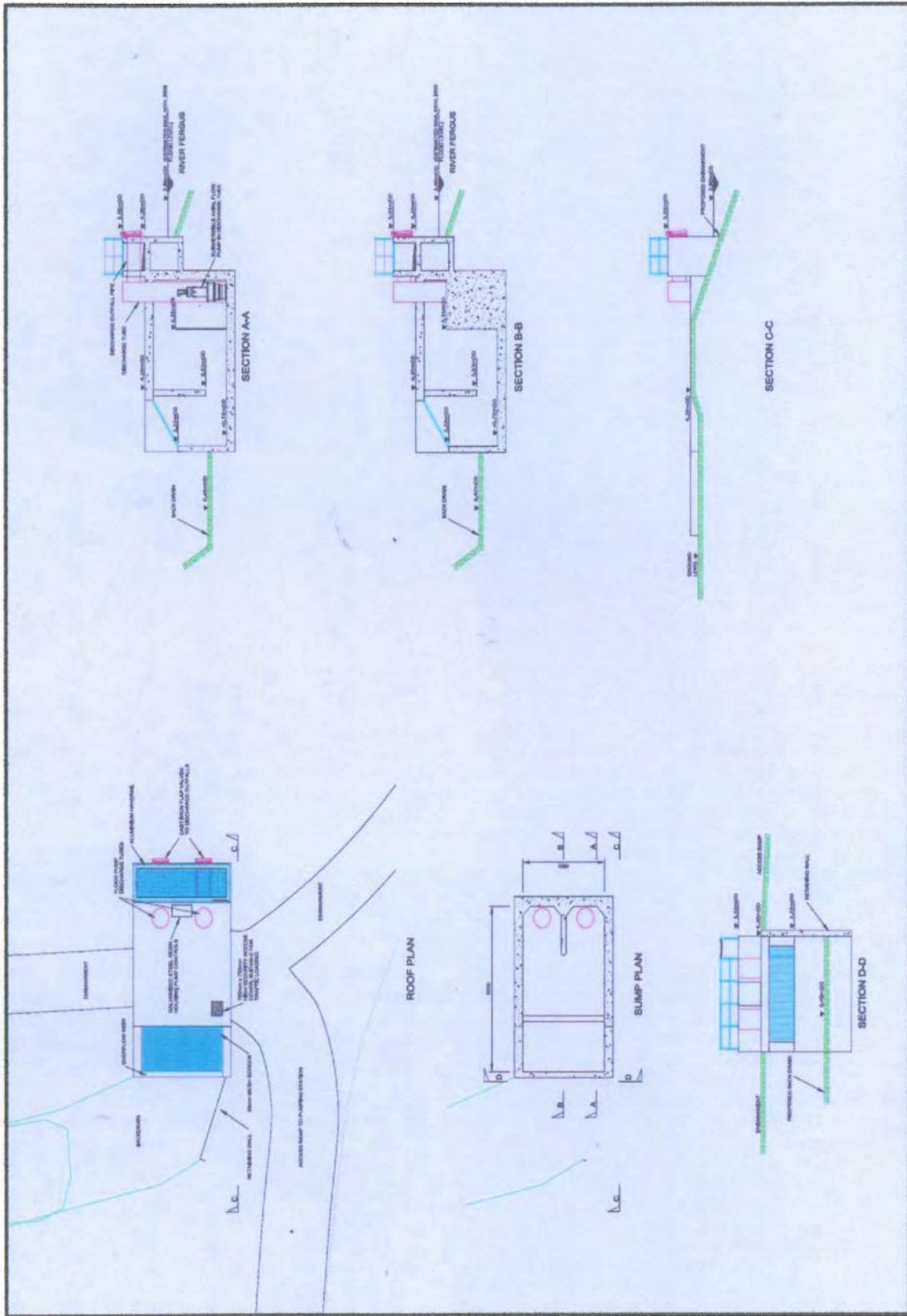


Figure 8
PLANS & SECTIONS OF PROPOSED EMERGENCY PUMPING STATION

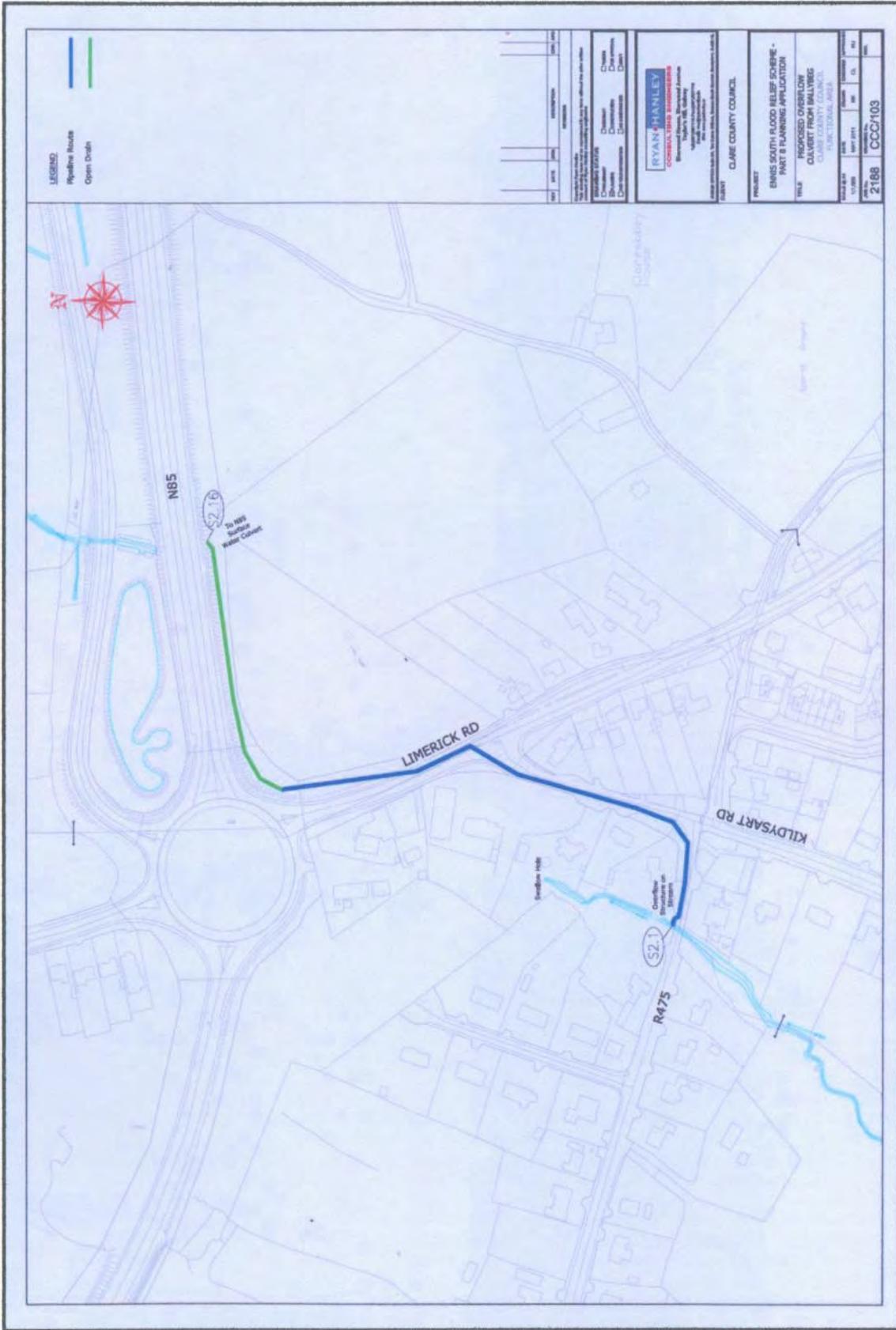


Figure 11
PROPOSED OVERFLOW CULVERT FROM BALLYBEG

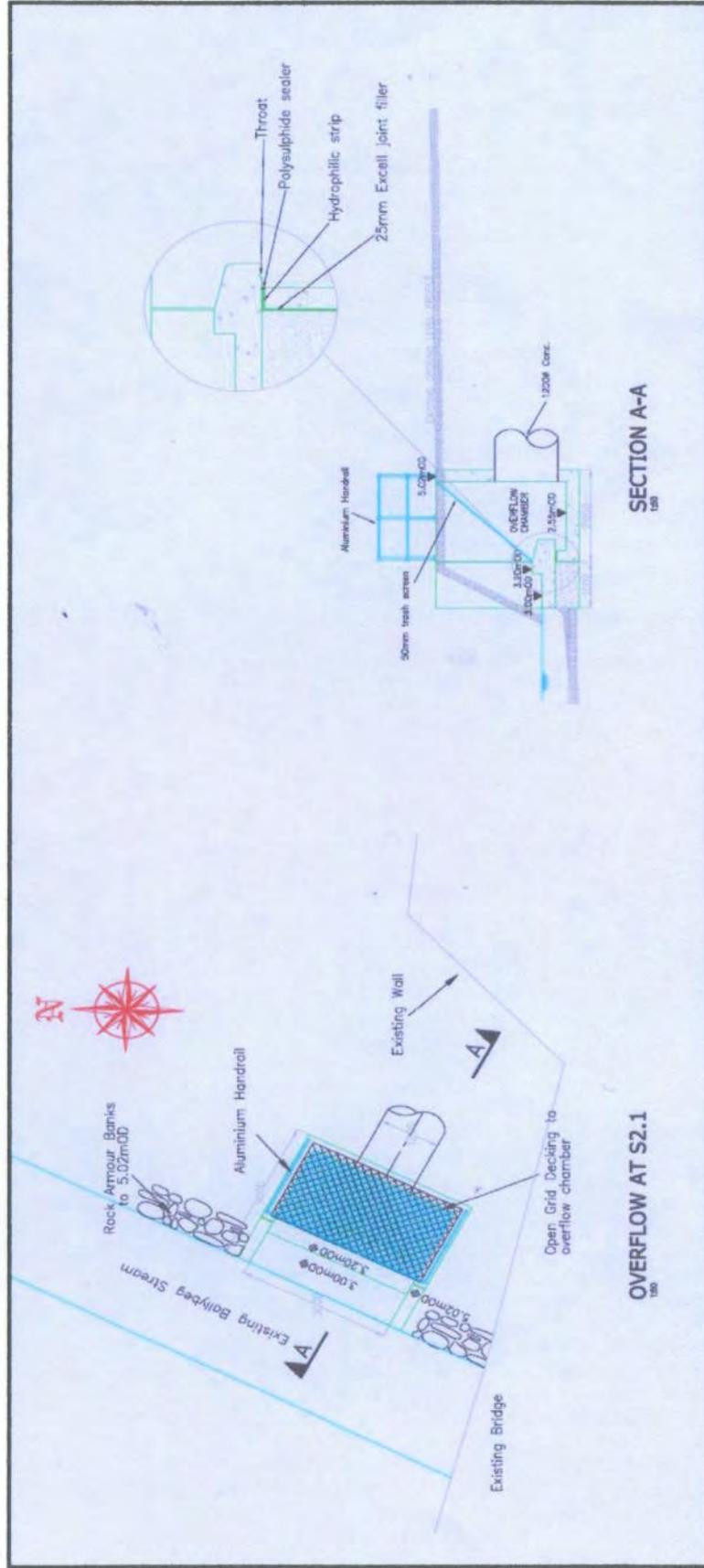


Figure 12
PROPOSED OVERFLOW STRUCTURE ON BALLYBEG STREAM

Appendix E
Environmental Impact Assessment Screening



Comhairle Contae an Chláir
Clare County Council

ENNIS SOUTH FLOOD RELIEF SCHEME

ENVIRONMENTAL IMPACT ASSESSMENT SCREENING

AUGUST 2012



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Client	Clare County Council
Project No.	2188
Project Title	Ennis South Flood Relief Scheme
Report Title	EIA Screening

Rev.	Status	Author(s)	Reviewed By	Approved By	Issue Date
0	Draft	R Kiely	C Lyons	C Lyons	April 2012
1	Minor edits	C. Lyons	L. Dolan	C. Lyons	25 May 2012
2	Final	C. Lyons/L. Dolan	L. Dolan	C. Lyons	16 Aug 2012

1. INTRODUCTION

This report constitutes an Environmental Impact Assessment (EIA) Screening Report for the Ennis South Flood Relief Scheme to determine the requirement for a mandatory or a sub-threshold Environmental Impact Statement (EIS).

This report documents the steps and methodology involved in the screening process and the rationale for the conclusion pertaining to the requirement, if any, for a mandatory or a sub-threshold EIS, with reference to relevant legislation and guidance documents. The report concludes with recommendations for further assessment, as necessary.

Screening is the first stage in the EIA process, whereby a decision is made on whether or not EIA is required. The 1997 amending EIA Directive (97/11/EC) introduced guidance for Member States in terms of deciding whether or not a development is likely to have '*significant effects on the environment*'. The criteria have been transposed in full into Irish legislation, in the Third Schedule to the EC EIA (Amendment) Regulations 1999 (S.I. No. 93 of 1999) and in Schedule 7 to the Planning and Development Regulations 2001 – 2011.

An EIA screening report initially assesses the development for Mandatory EIA using classifications defined in the appropriate legislation. Where no mandatory requirement is concluded, screening advances to sub-threshold development assessment, where the competent authority evaluates whether the project is likely to have a *significant* effect on the environment, with reference to its scale, nature, location and context.

An EIA is mandatory for all Annex I project classes (listed under the EIA Directive 97/11/EC) on the basis that these project classes will always have significant environmental effects. In most cases, mandatory thresholds are specified in respect of the project classes in Annex I. In certain cases e.g. integrated chemical installations, EIA is necessary regardless of size of project.

Irish legislation, which implements the EIA Directive, addresses the possible need for EIA below the mandatory thresholds following the criteria laid down for Annex II project classes in the EIA Directive. In this regard there is a requirement to carry out EIA where the competent/consent authority considers that a development would be likely to have significant effects on the environment. The key issue for the competent/consent authority in the context of the possible need for EIA of sub-threshold development is whether or not such development is likely to have significant effects on the environment. Consideration of *significant effect* should not be determined by reference to size only.

DoEHLG (2003) '*Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-threshold Development*' provides guidelines for sub-threshold EIA screening and states that '*In light of the approach adopted by Ireland (i) in setting mandatory thresholds for each of the Annex II project classes and (ii) in setting these thresholds at substantially lower levels than comparable Annex I thresholds in the Directive, the need for sub-threshold EIA should be fairly limited in Ireland*'.

However, the guidelines also state that '*where complexity of impacts is deemed to apply in the case of a specific sub-threshold development proposal, there should be a predisposition towards the preparation of an EIS*'.

The criteria for assessing the requirement for a sub-threshold EIA as transposed in Irish legislation are grouped under three headings:

- Location of Proposed Development
- Characteristics of the Proposed Development
- Characteristics of Potential Impacts

The DoEHLG (2003) states that "*those responsible for making the decision must exercise their best professional judgment, taking account of considerations such as the nature and size of the proposed development, the environmental sensitivity of the area and the nature of the potential effects of the development. In general, it is not intended that special studies or technical evaluations will be necessary for the purpose of making a decision*".

2. OTHER RELEVANT REPORTS AND STUDIES

A **River Habitat Corridor Survey** has been undertaken in relation to the proposed work in the Clare Abbey floodplain and a full walkover survey of all aspects of the development has been undertaken by a qualified ecologist. An **Appropriate Assessment** has also been carried out in accordance with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC). This Appropriate Assessment considers potential impacts during the construction and operational phase of the Ennis South Flood Relief Scheme in the context of proposed Natura 2000 sites, their Qualifying Interests, Special Conservation Interests and their conservation objectives. Avoidance and standard mitigation measures for the protection of Qualifying Interests of the SAC and Special Conservation Interests of the SPA are also set out. Overall, it is not predicted that the favourable conservation status of the Qualifying Interests of the SAC and the Special Conservation Interests of the SPA or the *integrity* of the Lower River Shannon cSAC or the River Shannon and River Fergus SPA would be significantly affected by the proposed Ennis South Flood Relief Scheme taking cognisance of the avoidance and standard mitigation measures proposed.

An **Archaeological Impact Assessment** has also been carried out for the project. Ten previously recorded sites/monuments of archaeological interest were identified, including Clare Abbey. The assessment concludes that proposed works are not being carried out in the immediate environs of Clare Abbey, or other monuments and as such, no adverse impacts are predicted. A mitigation strategy has been proposed which includes for supervision of the works by a licensed archaeologist.

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3. CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The main objective of the Ennis South Flood Relief Scheme (referred to hereafter as the Project) is the provision of flood overflow culverts between Ballybeg and St. Flannan's College in the southern suburbs of Ennis town to the Clareabbey floodplain in order to formalise the existing situation that occurs during flood events, whereby floodwaters flow overland (generally by road) through the southern suburbs of Ennis town to the Clareabbey floodplain at Clareabbey, Ennis, Co. Clare. The Project also includes for the rehabilitation of an existing earthen flood defence embankment located between the River Fergus and the Clareabbey Floodplain.

The Clareabbey floodplain is bounded by the Quin Road Industrial Estate and Quin Road to the north, the Ennis to Limerick Railway line to the west, the River Fergus flood embankments to the east and the high ground at Clare Abbey and the Ennis Western Relief road to the south. The Flannans and Ballybeg Rivers outfall to the backdrains in the flood plain which in turn discharge to the River Fergus through existing sluice gates when water levels in the main channel allow. The storm sewers from the adjoining developed lands also discharge to the flood plain.

The water levels in the Lower River Fergus (between Tulla Road and Clarecastle) are controlled by a tidal barrage located at Clarecastle. During high tide in the Fergus Estuary, the barrage gates close thereby preventing high tide levels making their way upstream to Ennis while the River Fergus flows are stored between the flood embankments that line the Lower Fergus Channel.

The River Fergus at Ennis floods as a result of persistent heavy rainfall associated with winter antecedent conditions (upstream karstic catchment requires groundwater storage to be saturated) and remains elevated for many days before any noticeable recession in flow magnitudes occurs. This combined with tidal conditions in the Fergus Estuary at Clarecastle results in a build-up of water level in the Fergus Lower reach upstream of the tidal barrage with little difference between low water and high water conditions upstream of the Clarecastle Barrage.

The existing flood defence earthen embankment between the Clare Abbey Floodplain and the River Fergus, constructed in the 1950's has reduced in height due to settlement over the years, while the existing sluice gates are malfunctioning, thereby allowing water from the River Fergus to pass under the existing embankment into the Clareabbey flood plain at high tide. As a result of the settlement that has taken place, the flood defence embankment is being overtopped during a 1 in 100 year flood event or larger, allowing water from the River Fergus to enter the Clareabbey floodplain. This happened most recently in November 2009. The November 2009 flood event and previous floods in December 1999, January 2005, and December 2006, resulted in extensive flooding of St. Flannan's College grounds, the Ballybeg Stream near the Limerick Road, Tobertaistean road, Abbeyville and the Clareabbey Floodplain.

Two reports were prepared as a result of the flood event in November 2009 i.e. "Ballybeg Stream Limerick Road, Ennis" (Hydro Environmental Ltd, 2010a) and the "Proposed Flood Relief Scheme and Flood Alleviation Feasibility Report St. Flannan's (Edenvale) Stream, Ennis, Co. Clare" (Hydro Environmental Ltd, 2010b) to investigate potential solutions to the issue of flooding at St. Flannan's

College and a number of private dwelling houses and local businesses. These reports recommended measures to formalise the existing flooding scenario including the construction of underground culverts to convey the floodwaters to the floodplain at Clareabbey by culvert rather than the existing dangerous scenario where they are conveyed overland through the suburbs of Ennis town.

A report entitled “Clare Abbey Flood Plain River Embankments Upgrade Works Feasibility Study” (Hydro Environmental Ltd, 2010c) was prepared in June 2010 on behalf of Clare County Council which assessed the hydrological, hydraulic and physical condition of the existing flood defence earthen embankment and the Clareabbey flood plain as a whole. This report concluded that the existing embankment originally constructed in the 1950’s had been overtopped by a flood event in November 2009 and that the existing sluice gates were malfunctioning and allowing water to flow from the River Fergus under the embankment and onto the Clareabbey floodplain at high tide.

This report recommended measures to improve the flood defences, including raising the existing embankment and increasing the capacity of the backdrain, replacing the existing and installing additional sluice gates and the construction of an emergency pumping platform which is required to pump any floodwaters from the Clareabbey floodplain to the River Fergus in the event that a spring tide in the River Fergus estuary coincides with an extreme flood event (i.e. 1 in 100 year flood event). The purpose of the works is not to enable drainage of the floodplain to facilitate development, rather it is to correct an existing deficient structure and take account of the potential impacts of future climate change.

The three proposed schemes were submitted by Clare County Council to the OPW Arterial Drainage Office for funding. The OPW has agreed to provide funding to bring these minor flood schemes through the planning process as a single integrated scheme referred to as the Ennis South Flood Relief Scheme. Delivery of all aspects of the Project, except for funding provision, is the responsibility of Clare County Council.

A part of a separate OPW scheme, the River Fergus Lower (Ennis) Certified Drainage Scheme, located upstream of the Project, it is proposed to upgrade the river embankments upstream of Doora Bridge at Clonroadmore and Cappahard and downstream of the tidal barrage at Clarecastle and Skehanagh. At Clonroadmore it is proposed to drive steel sheet-piles into the existing embankments while at Cappahard and downstream of the tidal barrage it is proposed to replace the existing embankments with improved earthen embankments. All sluice gates in these embankments are being replaced.

The design flood level at Clonroadmore and Cappahard is 3.2mOD and the design high tide level at Clarecastle is 4.25mOD. A freeboard of 0.5m is being provided above the design flood level and an additional allowance (varies based on location) is provided to allow for settlement. The final crest level (following settlement) will be 3.7mOD upstream of Doora Bridge and 4.75mOD downstream of the barrage. This scheme is currently at the tender stage and it is expected that construction on the Certified Drainage Scheme will be completed prior to this Project commencing construction.

3.1 SCOPE OF PROPOSED WORKS

The works proposed to achieve the objectives of the Project are;

- Provision of 2 No. 1,200mm internal diameter concrete flood overflow culverts, 1,135m and 522m in length, respectively, mainly in road and road verge.
- Raising and widening (required to facilitate the increase in height) of the existing flood defence earthen embankment over a length of 2.7km on the landward side of the existing embankment.
- Re-aligning where required, of the existing associated flood defence embankment backdrain (man-made) located on the landward side of the existing embankment.
- Replacement of 2 No. existing malfunctioning sluices and the construction of 1 No. additional sluice from the backdrain to the River Fergus on the riverside of the existing embankment at 3 No. discrete locations on the riverbank.
- Construction of an emergency pumping platform to facilitate the pumping of flood water from the Clare Abbey flood plain to the River Fergus, if required in an emergency situation.

The general location of the proposed works is shown on Plate 3.1 below.

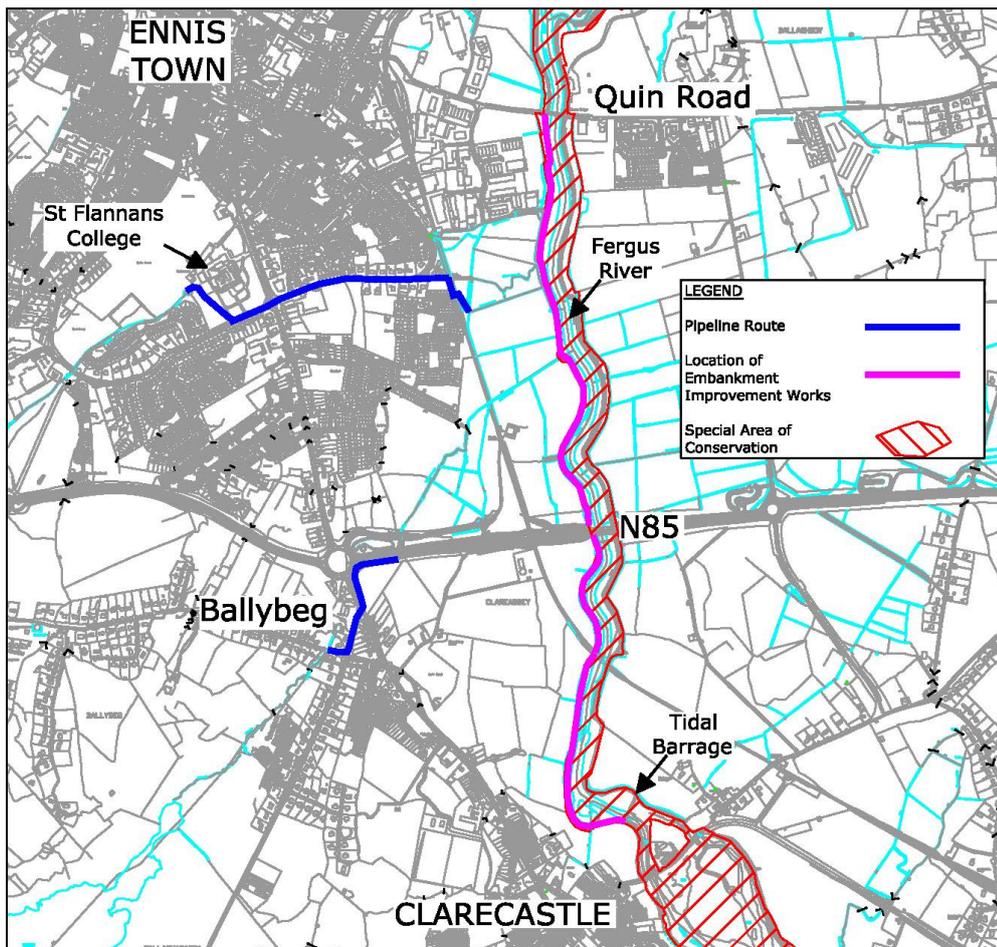


Plate 3.1

Location of Proposed Works

3.2 DESCRIPTION OF PERMANENT WORKS

A description of each element of the scope of the permanent works summarised above is provided in the sections that follow. Each element of the works is described further in the drawings which accompany the planning application and are listed below:

100/BP	Overall Scheme Location Plan
101/BP	Proposed Overflow Culvert from St. Flannans
102/BP	Plan and Longsec of Proposed St. Flannans Culvert
103/BP	Proposed Overflow Structure at Swallowhole
104/BP	Proposed Outfall Structure on St. Flannans Culvert
105/BP	Proposed Overflow Culvert from Ballybeg
106/BP	Plan and Longsection of Proposed Ballybeg Culvert
107/BP	Proposed Overflow Structure on Ballybeg Stream
108/BP	Proposed Outfall Structure on Ballybeg Culvert
109/BP	Location Plan and Site Plan of Proposed Emergency Pumping Station
110/BP	Plan and Sections of Proposed Emergency Pumping Station
111/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 1 of 2)
112/BP	Plan and Long Section of Proposed Embankment Upgrade (Sheet 2 of 2)
113/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 1 of 3)
114/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 2 of 3)
115/BP	Cross Sections of Proposed Embankment Upgrade (Sheet 3 of 3)
116/BP	Indicative Sluice Design
117/BP	Site Compound, Access Routes and Extent of Works Area

These drawings should be read in conjunction with this Environmental Impact Assessment Screening.

3.2.1 Proposed Flood Overflow Culverts

3.2.1.1 St. Flannan's Flood Overflow Culvert

During November 2009, following an exceptionally prolonged and intense wet spell, Saint Flannans College (Ennis, Co. Clare) and built up areas in its environs experienced severe flooding from the Flannans Stream (also known as the Edenvale River and locally known as "The Haun"). This flooding, which was reported to be the worst in living memory, forced the college to close for several days in addition to flooding or cutting off access to a number of homes in the Ard Aoibhinn and Honeywell estates, Toberteascain and Saint Flannans Drive areas. Furthermore, important town access roads in the area were impassable and an electricity supply substation at the college had to be switched off as a precaution due to the high flood levels.

The Flannans Stream, which has a catchment of less than 5km², upstream of the college, drains to a sink or swallow-hole located at the edge of the college sports field. The swallow hole has been proven (by KT Cullen as part of the Ennis Main Drainage Report) to be connected to springs located 880m east at Toberteascain via an underground karst conduit system. When the capacity of this underground system is exceeded the Flannans Stream backs up and begins to flood the lands in the vicinity of the swallow-hole.

Flooding around the swallow hole at Saint Flannans is reported to be a regular event, occurring following prolonged wet spells and generally in winter when groundwater levels are high.

During severe flood events, the resultant high water levels overtop a wall downstream of the swallow hole and floodwaters flow through the college campus and buildings towards a low point located at the front of the college where further overland flow is blocked by the natural stone boundary wall between the college grounds and the Limerick Road. During the period of 18th to 21st November 2009, the flood water level overtopped the Limerick Road wall cascading over it and crossing the Limerick Road and flowing downhill through the Ard Aoibhinn housing estate (flooding a number of homes there). From Ard Aoibhinn, floodwater flowed through properties to reach the Toberteascain Stream. From there the flood waters entered the Clare Abbey flood plain and back-drain system which was in flood. High water levels in the Clare Abbey floodplain, due to the combination of high inflow from the Ballybeg and St. Flannans Streams and high flood levels in the Fergus Lower, posed a severe risk to the low lying housing and industrial estates between Quin Road and Clare Abbey.

It was subsequently recommended in the "Flood Alleviation Feasibility Report St. Flannan's (Edenvale) Stream, Ennis, Co. Clare." (Hydro-Environmental, 2010) that a flood overflow culvert be constructed from the swallow hole at St. Flannan's College to the Clareabbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the suburbs of Ennis town to the floodplain at Clareabbey, through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters over an overflow weir to a dedicated overflow culvert which will cross St. Flannan's grounds and follow St Flannan's Drive, across the Limerick Road and down Toberteascain road to the Clare Abbey Flood Plain area where it will discharge to the existing back-drain channels. Works required include the construction of a concrete overflow weir structure adjacent to the swallow-hole, laying 1,135m of 1200mm diameter culvert, and the construction of associated manholes and chambers. A crossing under the Ennis Railway line will also be required. Drawing 101/BP shows the route of the proposed flood overflow culvert. A headwall is required at the outfall of the culvert to the drain in the floodplain. This headwall will reduce the risk of erosion of the ground at this outfall.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 8.0mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment.

It is noted that this culvert is solely for the purpose of conveying floodwater from the area around the swallow hole and will not come into operation until the groundwater capacity has been exceeded to such a level that it threatens to flood property and road infrastructure.

Details of the works proposed as part of the St. Flannan's flood overflow culvert are shown in Drawing 101/BP, 102/BP, 103/BP, 104/BP.

3.2.1.2 Ballybeg Flood Overflow Culvert

The Ballybeg Stream is a small stream which outfalls from Ballybeg Lough and disappears underground via a swallow hole in the rear garden of a private dwelling, 100m south of the Limerick Road between Ennis town and Clarecastle town. The stream re-emerges on the far side of the N85 road some 380m away. The swallow-hole has limited capacity which may have deteriorated in recent years, resulting in flood levels surcharging upstream of it and inundating surrounding properties and roads. Extreme flooding has occurred in this area in 1995, 1999 and in November 2009. The nature of the system is such that flooding can prevail for many weeks with roads and house entrances cut off. The November 2009 event saw the most dramatic flooding of recent history with the Ballybeg stream backing up and inundating large areas of agricultural land and private properties. Two properties were flooded and a further 12 dwellings saw flood waters reaching the driveway and footpath surrounding their houses. A peak flood level of 4.3mO.D. at the swallow-hole rising to 4.45m O.D. immediately upstream of the Ballybeg Road culvert was observed.

A site visit in early January, approximately 5 weeks after the peak of the flood, found that water levels were still relatively elevated indicating that the swallow-hole may have become partially blocked. There is a strong possibility that a less severe flood in the future could result in more extensive damage due to the deterioration of the underground pathway.

It was recommended in the report "Ballybeg Stream Limerick Road, Ennis - Proposed Flood Relief Scheme" (Hydro-Environmental, 2010) that a flood overflow culvert be constructed from the swallow hole in Ballybeg to the Clareabbey floodplain, to formalise the existing flooding scenario only, whereby floodwaters flow overland (generally by road) through the provision of a dedicated underground flood overflow culvert.

The works proposed as part of this Project will divert flood waters over an overflow weir to a dedicated flood overflow culvert and open drain which will convey the floodwaters from the Ballybeg Stream to the culvert under the N85 which drains to the Clare Abbey floodplain. This proposed overflow structure is located in the townland of Ballybeg, adjacent to the Ballybeg Stream and just downstream of the bridge on the R475 road. Its function is to divert flow from the Ballybeg Stream to a proposed 1200mm overflow culvert once the water level in the stream reaches a height of 3.20mOD, just upstream of the swallow hole. The total length of the proposed flood overflow culvert and open drain is 522m. Details of the proposed flood overflow culvert and associated overflow weir and headwall are described in Drawing Nos. 105/BP, 106/BP, 107/BP and 108/BP.

The flood overflow culvert will only come into operation once the water level at the swallow hole reaches a height of 3.2mOD and therefore will not have any effect on the existing hydrogeological regime of the catchment.

3.2.2 Proposed Rehabilitation of Existing Earthen Flood Defence Embankment

The existing flood defence earthen embankment was constructed in the 1950's and runs from the Quin Road to the tidal barrage at Clarecastle. It is 2.7km in length and has an existing crest level ranging from 2.23mOD to 4.23mOD. The width of the existing embankment ranges from 1.5m to 2.5m, with a

backdrain running parallel to the embankment on the landward side which facilitates drainage from the Clareabbey floodplain to the river through the existing sluices. Over the years, the existing flood defence earthen embankment has reduced in height due to settlement. Some of the existing sluices are not providing the non-return function for which they were designed, which is allowing water from the River Fergus to pass under the existing embankment into the flood plain at high tide.

The main aim of the proposed embankment rehabilitation works is to raise the crest level of the existing embankment where it has settled and to replace the existing malfunctioning sluices with new sluices fitted with non-return valves.

It is proposed to increase the crest level of this embankment to 4.0mOD which includes an allowance for potential future embankment settlement. Because the existing level of the embankment is being raised, the width of the embankment will also have to increase to provide stability. All of this increase in the width of the embankment footprint will take place to the landward side of the existing embankment. The side slopes of the embankment will be constructed at a slope of 1:2.5 which will result in the embankment footprint increasing on the landward side throughout the 2.74km length. The finished footprint of the proposed embankment will be 4.1hA, representing a 1.9hA increase on the existing footprint of 2.2hA.

As the embankment footprint will increase, the existing manmade backdrain on the landward side of the existing embankment will have to be realigned to accommodate the increase in the embankment footprint, which will encroach on the footprint of the existing backdrain. The proposed backdrain works are described in Section 4.2.3 below.

The proposed embankment profile will be formed by placing imported cohesive material on the crest and the landward side of the existing embankment to form a consistent cross-section along the length of the embankment. The cross-sections shown on Drawing Nos. 113/BP, 114/BP and 115/BP show how the existing embankment will be integrated into the proposed embankment at typical sections along the length of the embankment. In order to reduce seepage through the proposed embankment, cohesive material will be used to form the proposed embankment cross-section. A sustainability assessment has been carried out to determine whether material excavated for the backdrain (discussed below) would be suitable for re-use in the proposed embankment. It has been determined, however, that the existing material on site is unsuitable for this purpose and therefore, the cohesive material required will have to be sourced elsewhere. It will be the responsibility of the Contractor appointed to construct the scheme to source this material, subject to the appropriate permissions and permits being in place. The volume of cohesive material that will need to be imported is 65,000m³.

In order to minimise the risk of erosion from water and wind action, a geo-grid will be placed over the entire embankment profile and the embankment will be planted with suitable native vegetation.

Due to space constraints at the riverbank under the N85 road bridge, it will not be possible to upgrade the existing embankment at this location. Along this section, a flood wall will need to be constructed on the landward side of the existing embankment. Due to the ground conditions in this area, it is likely that

the wall will need to be sheet-piled. The flood wall is required over a length of 80m and will have a crest height of 3.7mOD, the same crest level as the proposed embankment.

No embankment works are proposed on the river channel itself. The closest point of the existing flood defence earthen embankment to the river channel is 3.0-4.0m and on average 10m and all embankment improvement works will be carried out from the landward side of the existing embankment.

The lands on the landward side of the embankment will continue to remain subject to frequent periodic shallow inundation. This is due to the fact that the water level in the River Fergus fluctuates over the course of the tidal cycle, as a result of the tidal barrage located downstream at Clarecastle. When the barrage closes on a rising tide, the River Fergus cannot discharge to the estuary therefore the water level in the river rises. Once the water level in the River Fergus becomes higher than the water level in the floodplain, water cannot discharge from the landward side of the embankment to the river and must be stored on the landward side until levels in the River Fergus fall to below the water level in the floodplain on the ebbing tide. At this point, water from the landward side of the embankment will continue to discharge to the River Fergus as is currently the case.

See Drawing Nos. 111/BP, 112/BP, 113/BP, 114/BP and 115/BP of the planning drawings for details of the proposed embankment upgrade.

3.2.3 Proposed Backdrain Works

A manmade backdrain is located on the landward side of the existing embankment along the majority of the length of the existing embankment. The purpose of the backdrain is to collect water from the floodplain and direct it to the sluice locations to discharge to the River Fergus when the water levels allow. It also collects runoff from the landward slope of the embankment itself.

During the rising tide in the Fergus Estuary, the tidal barrage at Clarecastle (located at the downstream end of the Project) closes, so that the Lower River Fergus is prevented from discharging to the sea. As a result, the water level in the Lower River Fergus rises and at the point at which the water level in the river is higher than the water level in the backdrain, floodwaters cannot discharge to the river and must be stored in the backdrain and in the floodplain. During the ebbing tide, the tidal barrage gradually opens allowing the river to discharge to the estuary reducing the water level in the Lower Fergus. Once the level of the Lower Fergus falls below the level of the floodwaters in the backdrain and in the floodplain, these floodwaters can once again discharge to the river via the sluices located at intervals along the existing embankment.

The proposed increase to the footprint of the embankment is such that the toe of the proposed embankment will encroach on the footprint of the existing embankment along all but approximately 1km of the length of the embankment. For this reason, the existing backdrain will need to be infilled over approximately 1.75km of its length. The total area of the existing manmade backdrain affected is 0.53ha.

A new backdrain will be excavated on the landward side of the proposed embankment to facilitate the discharge of floodwaters to the river via the sluices as is currently the case (described in Section 3.2.4 below). The new backdrain will have a similar capacity to the existing backdrain. The volume of material to be excavated to form the new backdrains will be approximately 11,000m³. This excavated material will be re-used where suitable in the formation of a berm on the landward side of the new embankment along certain sections of the proposed embankment as shown on the cross-sections.

This backdrain will continue to convey water from the flood plain and discharge it to the river via the replaced and additional sluices described below, thereby maintaining the existing hydrological regime, whereby floodwaters are stored in the backdrain and in the Clareabbey floodplain when the barrage is closed during high tide, following which the floodwaters discharge to the River Fergus as the tide recedes and the tidal barrage opens.

For geotechnical reasons, it will not be possible to construct a new backdrain along a 350m length of embankment located between Section 21 and 29 (see Drawing No.111/BP) as it could lead to destabilisation of the proposed embankment. An infiltration trench constructed using granular material and porous pipe will be constructed on the landward side of this section of embankment in lieu of the existing backdrain. The volume of imported granular material required will be approximately 11,000m³.

Details of the proposed backdrain works are shown on the proposed embankment cross-sections on Drawing Nos. 113/BP, 114/BP and 115/BP.

3.2.4 Proposed Sluice Works

There are 5 no. existing sluices located along the existing embankment between the Quin Road and the tidal barrage at Clarecastle. The existing sluices are generally 600mm diameter pipes fitted with a flap gate on the outlet at the riverbank. These existing sluices do not function properly as the capacity of the pipe through the embankment is too small to allow the backdrain to discharge to the river efficiently and the flap gates are malfunctioning allowing the River Fergus to flow into the floodplain during high water levels in the river.

Existing Sluice Gate No. 1, located in the vicinity of the Quin Road Business Park at the northern end of the embankment, has been installed in recent years and appears to be functioning adequately. No works are proposed at this location.

Existing Sluice No.2 is located between Sluice No.1 and the N85 road. This sluice does not have sufficient discharge capacity, is leaking and has caused the adjacent bank to erode. It is therefore proposed to replace Sluice No. 2 with a new sluice at the same location. The existing pipework and flap gate will be removed and a 2 No. new 900mm diameter pipes will be constructed through the proposed embankment at the same location. A headwall will be constructed on both the landward and the riverside of the embankment to reduce the risk of erosion in the vicinity of the pipeline. The outlet ends of the new pipelines will be fitted with non-return valves. These non-return valves will be of the duckbill valve type, an example of which would be the proprietary "tideflex" valve. This type of valve is much

less prone to malfunction than the existing flap gates which allow the river to enter the floodplain via the sluices.

Similar to Sluice No. 2, existing Sluice No.3 needs to be replaced with 2 No. new 900mm diameter pipes fitted with non-return duckbill valves at the same location as the existing sluice. Headwalls will also be required as per proposed Sluice No.2.

The existing Sluice No.4 was installed recently and appears to be functioning adequately. It is not proposed to carry out any sluice works at this location.

There is currently no sluice provided to the section of floodplain between the N85 bridge and the railway line that traverses the floodplain and it is therefore proposed to construct a new sluice just upstream of the railway line. This new sluice, Sluice No.5, will consist of a 900mm diameter pipe which will be constructed through the embankment, and will terminate in a non-return duckbill type valve. A headwall will be required on either side of the embankment.

Existing Sluice No.6 is located at the downstream end of the existing embankment. This sluice appears to be functioning adequately and it is not proposed to carry out any works to the sluice at this location.

In summary, works are required at the location of the existing Sluice No.2 and Sluice No.3 and at the location of the proposed Sluice No.5. The works proposed at these three discrete locations are the only works pertaining to the project that are required on the riverside of the existing embankment. The works at these three locations will be minor in nature and all concrete components ie. pipes and headwalls will be pre-cast. The non-return valves will be fitted inside of the downstream end of the pipes. An access chamber will be provided on the landward side of the embankment at each sluice where works are required, to facilitate future valve maintenance, without needing to access the riverbank. The locations of the proposed sluice works and a typical detail of the sluice is provided in Drawing No. 116/BP.

3.2.5 Proposed Emergency Pumping Station

It was recommended in the report entitled "Clare Abbey Flood Plain River Embankments Upgrade Works Feasibility Study" (Hydro Environmental Ltd, 2010c) that infrastructure be put in place to facilitate the installation of emergency over-pumping from the back drains / flood plain during extreme flood events when free discharge through the sluice gates from the Clare-Abbey flood plain is prevented. It is therefore proposed to construct an emergency pumping station as part of the Project, in the vicinity of the proposed embankment upgrade.

The emergency pumping station will consist of a reinforced concrete overflow sump and provision for the installation of axial flow pumps at times of exceptional flood. The overflow will divert flood water from the backdrain to the pumping station once the level reaches 2.2mOD. The existing ground level in the Clareabbey floodplain typically varies from approximately 1m OD to 1.5m OD.

The water level at which the pumps would come into operation is set so that pumping can be initiated only at the level at which the flood waters threaten to inundate infrastructure and property. The

pumping station will not be brought into operation during normal winter flooding. It is intended that the pumping station would only be brought into operation in a flood event of similar or larger magnitude to the event of November 2009. During the normal course of events, the pumps will not be installed in the pumping station; rather pumps will only be installed at times of potential flood risk. It is noted that during previous flood events, including November 2009, temporary pumps had to be brought into operation to reduce the risk to property and infrastructure. This situation is not sustainable, due to the health and safety risk to personnel installing and operating temporary pumps during high water levels and the difficulty with sourcing pumps due to demand during such events.

In the event that the flood level in the floodplain starts to exceed 2.2mOD, 2 No. axial flow pumps, with a combined capacity of 3m³/sec, will pump the water from the pump sump into the River Fergus, making it possible to begin draining the flood plain before the river recedes to such a level to allow the sluice drains to become operational.

The construction of this pumping station will not result in any in-stream works, with the aforementioned pumps discharging onto a proposed rock armour apron to be constructed on the flood defence embankment.

3.2.6 Other

There is no surface water abstraction proposed as part of these works.

There will be no additional surface water runoff from the proposed development sites with the exception of the hard surface area associated with the Pumping Station platform during the operational stage, as all green field areas are to be restored to their former vegetation type and cover post-construction and road surfaces will be restored to their former surface dressing type.

No groundwater abstraction or discharge is proposed.

3.3 DESCRIPTION OF TEMPORARY WORKS

The sections that follow describe the temporary works that are likely to be involved in the construction of each of the permanent works elements described above and in the planning drawings. It is noted that the temporary works and construction methodologies described below are based on methodologies used previously on similar projects, but, until a Contractor is appointed to carry out the construction phase of this project and the temporary works design is completed (by the Contractor), it is not possible to say with absolute certainty the methodologies that will apply. However, items such as the locations of construction compounds, access routes, haul roads etc and ecological mitigation measures will be written into the Contract as Works Requirements to which the Contractor will be required to adhere.

3.3.1 General

A construction compound will be required for the provision of welfare facilities for construction workers, car parking, site offices and storage of plant and materials. The construction compound will be located in a previously disturbed hard stand area immediately to the north of the N85 road bridge. The location of this compound is shown on Drawing No.117/BP and on Plate 3.1 below.

Any temporary access roads or haul roads required for the project will be constructed within works area outlined in blue on Drawing No.117/BP. Haul roads or access routes will be located outside of the boundary of any designated site.

No blasting or piling activities which could result in vibration related impacts are likely to be required. However, it is expected that the rock encountered during the laying of the new pipeline will require rock breaking activities.

It is intended that the design and construction methodology of the proposed works for the Ennis South Flood Relief Scheme will have, where practically feasible, minimal impacts on the existing environment during the site clearance and construction phase.

All existing services in the vicinity of the proposed works have been investigated in order to avoid any potential negative impacts on the environment.

Site investigation was undertaken in order to acquire the necessary information to inform the detailed design for the Project and was completed in January 2012. Site investigation was the subject of a separate ecological assessment report entitled "Ecological Summary of Site Investigation Works on the Ennis South Flood Relief Project (Ryan Hanley, 2011) undertaken in consultation with National Parks and Wildlife Service (NPWS). Removal of Scrub (WS1) vegetation along the existing flood defence earthen embankment was undertaken to facilitate access for Site Investigation works. Potential impacts arising from site investigation works will not be considered further in this Natura Impact Statement.

3.3.2 Proposed Flood Overflow Culverts

The majority of the route of each of the proposed flood overflow culverts are located in road or road verge and will generally be constructed within made ground above rock level.

As described earlier, an overflow weir will be required at the upstream ends of each of the culverts to ensure that the culverts will only come into operation once a particular flood water level is exceeded. The construction methodology for the flood relief works ie. overflow structures, culverts, headwalls relating to both St. Flannan's and Ballybeg will be similar.

These overflow weirs will be constructed using reinforced concrete. The overflow structures will be constructed during the summer months in low flow conditions and when the swallow holes are dry. The location of the proposed overflow at St. Flannan's is dry during the summer months and therefore, damming or dewatering of the excavation is unlikely to be required. At the Ballybeg overflow structure, which is located on the bank of the Ballybeg Stream upstream of the swallow hole, works will be carried out during low flow conditions in the stream. A small section of the stream will be dammed and pumped out in order to provide dry working conditions for excavation of the formation for the overflow structure.

The construction methodology in the case of both of the overflow structures will generally involve excavation of the riverbank, blinding of the formation, the fixing of steel reinforcement, the placing of formwork and the pouring of concrete. The type of plant that is likely to be used in the construction

works includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and poker vibrators. Precast concrete headwalls will be provided at the downstream end of each of the flood overflow culverts. These will be placed in the same manner as described for the headwalls to the sluices above.

The culverts will be constructed using an “open cut” methodology, whereby a trench will be excavated in the road to the depth shown on the longitudinal sections. Based on the ground conditions encountered during the site investigation, a substantial amount of rock breaking will be required to excavate the trenches to the required levels. Rock was identified at 0.325km (Rotary Core No. 10) and 0.63km (Rotary Core No. 15) from the Lower Shannon River SAC.

The base of the trenches will be bedded with granular material, following which the precast culvert section will be placed in the trench and surrounded in granular material. The remainder of the trench will be backfilled and the surface reinstated to its original condition.

3.3.3 Proposed Upgrade of Existing Earthen Flood Defence Embankment

As described above, all works involved in the construction of the rehabilitation works to the existing embankment will take place on the landward side of the existing embankment. In order for machinery to access the landward side of the existing embankment, a haul road will be required along the length of the existing embankment. This haul road is likely to be designed as a “floating road” and so will not involve the removal of the existing ground, apart from the topsoil. A geotextile material will be laid on the ground over which well graded granular fill will be placed in layers and compacted. The geotextile is required due to the soft nature of the existing ground and to prevent granular material settling into the undisturbed ground below. This haul road will be completely removed and reinstated following completion of the works. All construction traffic involved in the embankment upgrade, and associated works, will be confined to the haul road and the works area which will be fenced off from all other adjacent Scrub (WS1), Tall Sedge and Reed Swamp (FS1) and Improved Agricultural Grassland (GA1) habitats in the area.

The construction of the proposed embankment will involve the removal of Tall sedge and reed swamp (FS1), Scrub (WS1) and a number of semi-mature low canopy trees along and adjacent to the existing flood defence earthen embankment and backdrain and the placement and compaction of cohesive material, such as clay, to the top and landward slopes of the existing embankment and to the existing backdrain to form the design cross-section detailed in the drawings. It may be necessary to dewater the existing backdrain using submersible pumps as work progresses, depending on the level of water in the River Fergus at the time and weather conditions.

Once the clay has been placed and compacted, a layer of geogrid will be placed over the embankment, over which a layer of sub-soil from the backdrain excavation will be placed. This subsoil will be vegetated as soon as possible after construction with a native grass species to reduce the risk of embankment erosion. Works will take place in a sequential manner eg. the construction works will start at the upstream end of the existing embankment at the Quin Road Business Park and continue to the downstream end at the tidal barrage in Clarecastle. It is also possible that embankment works may be

carried out from either end of the existing embankment extents simultaneously, to reduce the overall programme of works. In this situation, a machine would commence at each end of the existing embankment and work towards the midpoint of the existing embankment. No more than two crews will work on the embankment simultaneously to reduce the impact of potential temporary disturbance.

The type of plant to be used in the construction to the embankment will most likely include tracked excavators, wheeled loaders, dozers and vibratory compactors, operating from the landward side of the existing embankment.

At the location of the proposed flood wall in the vicinity of the N85 road bridge, a different methodology will be required. The construction methodology here will include excavation of the existing ground for foundations, sheet piling, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete. Sheet piling is required here due to the soft ground conditions in this area and as a cut-off measure to prevent flood water passing underneath the foundation. It is noted that the wall will be constructed on the landward side of the existing embankment.

The type of plant that is likely to be used in the construction of the flood wall includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and a poker vibrator, operating from the landward side of the existing embankment.

Site Investigation has identified that no bedrock will be encountered during these works.

3.3.4 Proposed Backdrain Works

As described above all works on the existing and proposed backdrains will take place on the landward side of the existing embankment. Once the proposed embankment profile is completed along the entire length, the excavation of the proposed backdrain will commence. This excavation will involve the removal of existing material to attain the widths, depths and gradients shown on the embankment cross-section drawings. The new open backdrains will be similar in nature to the existing backdrains and will be excavated using a tracked machine. The material excavated to form the new backdrain will be re-used to form a berm along the landward side of the embankment which is required along some sections of the embankment to improve embankment stability.

As described above, it will not be possible to maintain an open backdrain along a 350m length of embankment as the construction of an open backdrain in this area has the potential to de-stabilise the embankment. In this area, an infiltration trench will be constructed on the landward side of the embankment. This will involve the construction of a trench which will be lined with a geotextile. Porous pipe will be placed in the bottom of the trench, which will then be filled to above ground level with imported granular material. The plant required to construct the infiltration trench will be similar to that required for the construction of the remainder of the backdrains as discussed above.

3.3.5 Proposed Sluice Works

As described above, works are required at 3 No. discrete locations on the riverside of the existing embankment where existing sluices require replacement or where a new sluice is required. Minor in-stream works will be required at these three locations.

As part of the construction of the proposed embankment described above, the existing sluice pipework will be removed and a new 900mm pipe will be laid through the embankment. This pipework may need to be piled depending on the actual ground conditions encountered at the locations of each of the sluices. If this is the case, a piling rig will be required to drive a number of pre-cast concrete piles in tandem with the construction of the embankment.

A new non-return valve will be inserted within this pipeline on the landward side of the embankment. A precast headwall will be placed and backfilled on the landward face of the embankment, behind which an access chamber will be constructed. The headwalls and access chamber may also need to be piled as for the proposed pipework.

The construction of this chamber will involve excavation of the existing ground for foundations, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete. The plant required to construct the replacement and proposed sluices will be similar to the plant described in relation to the embankment and backdrain works.

A concrete headwall will be required at the upstream and downstream end of this pipework to prevent erosion of the riverbank. The provision of the headwall to the downstream end of the pipeline will require minor in-stream works in order to found and install the headwall. During low water conditions, a small area in the vicinity of the proposed headwall will be dammed using sandbags and dewatered by pumping. The area to be dammed will be minimised in so far as possible and is likely to be less than 20m² in area. Once the area has been dewatered, a foundation will be excavated and blinded. The headwall itself will be pre-cast concrete and will be dropped into place and backfilled once the foundation has been formed. This operation is likely to be carried out within 1 day at each location. No plant or machinery will be required in-stream.

3.3.6 Proposed Emergency Pumping Station

The proposed emergency pumping station will consist of a concrete sump which will be set-up for rapid installation of axial flow pumps in the event of an extreme flood event that is threatening property and infrastructure. The proposed pumping station will be located within the proposed embankment and will be constructed using reinforced concrete. The construction works will initially involve the construction of a 1m deep (approximately) excavation in the vicinity of the N85 road bridge. Due to ground conditions in the area, the structure will need to be piled and the excavation is likely to require dewatering.

The construction methodology here will include excavation of the existing ground for foundations, driving of a number of precast piles, blinding of the formation, fixing of steel reinforcement and placing of formwork and concrete.

The type of plant that is likely to be used in the construction works includes tracked excavators, wheeled loaders, dozers, concrete mixer, truck mounted concrete pump and boom arm and poker vibrators, operating on the landward side of the existing embankment.

3.4 OPERATION AND MAINTENANCE OF THE WORKS

Once the proposed embankment construction works (including embankments, backdrains and sluices) are completed no further resource or inputs are required in relation to the operation of the embankment. The embankment and the backdrain will need to be inspected periodically to ensure its integrity, particularly following a flood event. Minor maintenance works may be required following inspections, for example, vegetation trimming, restoration of the design crest level locally, localised clearance of drains etc. It is anticipated that routine maintenance activities such as those outlined, may take place over less than one week every 2 – 3 years.

The proposed sluices have been designed such that the non-return valves can be inspected and accessed from the landward side through the provision of access chambers.

During the operation phase of the project, noise may be produced in the event that the emergency pumping station is required to come into operation during an extreme flood event on the River Fergus. This noise will be temporary in nature. Pumping is only likely to be required at a maximum for a period of a few days every 5 to 10 years. In the event that floodwaters need to be pumped to the river, there will be no difference in the quality of the water being discharged to the river, whether it is pumped or flows by gravity in the existing case or in the future.

In relation to maintenance of the flood overflow culverts, access manholes will be provided for maintenance purposes; therefore no excavation activities will be required to facilitate future maintenance. The only substance that will be conveyed in these culverts is floodwaters. The floodwater will be collected at the source of the flooding, and so will be of the same quality as the groundwaters or surface waters discharging to the Clareabbey floodplain during the normal course of events.

4. EIA SCREENING METHODOLOGY

A desktop study of the environmental, archaeological, visual and cultural receptors within the footprint of the proposed development was undertaken as well as a walkover survey of the site of the proposed development in order to inform the EIA Screening process.

4.1 ASSESSMENT FOR MANDATORY EIA

Schedule 5, Part 2 of the Planning and Development Regulations prescribe classes of proposed development requiring mandatory environmental impact assessment. The class of development with potential relevance to the Ennis South Flood Relief Scheme is Item 10(f)(ii) which states:

“Canalisation and flood relief works, where the immediate contributing sub-catchment of the proposed works (i.e. the difference between the contributing catchments at the upper and lower extent of the works) would exceed 100 hectares or where more than 2 hectares of wetland would be affected or where the length of river channel on which works are proposed would be greater than 2 kilometres.”

4.1.1 Area of Immediate Contributing Sub-catchment

The relevant part of the proposed development involves the upgrading of an existing flood defence earthen embankment. This work includes the raising and widening of the existing earthen embankment, the upgrading of 2 no. existing malfunctioning sluices and the provision of 1 no. additional sluice along the riverside of the existing flood defence earthen embankment. In this regard, the relevant proposed works consist of the raising and widening of an existing earthen embankment and not the construction of a new flood defence and therefore the works do not have a contributing sub-catchment. The purpose of the flood overflow culverts is to convey the floodwaters which currently flow overland to the floodplain during a flood event, safely underground within a culvert, and so similarly, the culvert works themselves do not have a contributing sub-catchment. No additional floodwater will be introduced to or discharged from either of the respective sub-catchments (St Flannan’s Stream or Ballybeg Stream) as a result of the proposed development.

4.1.2 Area of Wetland Affected

The existing earthen embankment has a manmade backdrain located on the landward side. As the embankment footprint will increase, the existing manmade backdrain will be realigned and the old channel filled in. This backdrain will continue to convey water from the flood plain and discharge it to the river via the sluices described above. The total area of the existing backdrain potentially affected is 0.53 hectares. In general, this existing backdrain will be replaced with a new backdrain of equal or greater capacity on the landward side of the upgraded embankment.

The lands on the landward side of the embankment will continue to remain subject to frequent periodic shallow inundation. This is due to the fact that the water level in the River Fergus fluctuates over the course of the tidal cycle, as a result of a tidal barrage located downstream at Clarecastle. When the barrage closes on a rising tide, the River Fergus cannot discharge to the estuary therefore the water level in the river rises. Once the water level in the River Fergus becomes higher than the water level on

the landward side of the embankment, water cannot discharge from the landward side of the embankment to the river and must be stored on the landward side until levels in the River Fergus fall to below the water level on the landward side on the ebbing tide. At this point, water from the landward side of the embankment will continue to discharge to the River Fergus post-completion of the works, as is currently the existing scenario.

Although an area of 0.53ha of wetland (the existing backdrain) will be affected during the construction of the works, on completion of the development, the net effect on existing wetland will be neutral as the back drain is to be replaced and all of the lands currently subject to frequent periodic inundation will remain subject to inundation to the same level and frequency.

4.1.3 Length of River Channel on which Works are Proposed

The only works that are proposed on the river channel are at three discrete locations where 2 No. existing sluices require replacement and 1 No. new sluice is required. The length of river channel works required at each of these locations will be approximately 5 to 6 metres, giving a maximum total length of river channel on which works are proposed of less than 20 metres.

4.2 CONCLUSION – REQUIREMENT FOR MANDATORY EIA

The development is not considered to have a mandatory requirement for an EIA and will therefore be assessed as a sub-threshold development in the sections that follow.

4.3 ASSESSMENT FOR SUB-THRESHOLD EIA

Table 4.1 overleaf considers the location of the proposed development and the characteristics of the proposed development, while Table 4.2 that follows describes the characteristics of the potential impacts.

Table 4.1 Location and Characteristics of Proposed Development

Has the proposed development the potential to impact directly or indirectly on any site designated for conservation interest (e.g. SAC, SPA, NHA)?

There are 9 no. Natura 2000 sites located within 15km of the proposed development. The proposed works on the existing flood defence earthen embankment are located within and adjacent to the Lower River Shannon SAC and 0.25km upstream of the River Shannon and River Fergus Estuaries SPA.

The Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA are inside the 5km buffer zone for freshwaters as per the DEHLG Circular L8/08.

While there is connectivity via water between Ballyallia Lake SAC and Ballyallia Lough SPA and the proposed works, these Natura 2000 sites are located upstream of the works. There is connectivity via groundwater between Newhall and Edenvale Complex SAC and the proposed works, this Natura 2000 site is located upstream of the works. However, as the proposed flood overflow culverts will only convey floodwater that would previously have flowed overland to the same discharge point, there will be no change in the hydrological regime and no resultant impact on upstream water levels in the Newhall and Edenvale Complex SAC.

There is also no discernible connectivity via water between Lough Gash SAC and the proposed works, which are located 7.87km away from this SAC by land. Therefore, given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land, (4) location upstream of the works in relation to Ballyallia Lake SAC and Ballyallia Lough SPA; there is no known vector, pathway or conduit for pollution between the proposed works and Lough Gash SAC, Ballyallia Lake SAC and Ballyallia Lough SPA. Therefore the proposed works are highly unlikely to have any significant direct or indirect effects on the Lough Gash SAC, Ballyallia Lake SAC and Ballyallia Lough SPA. As a result, potential impacts to these Natura 2000 sites are not considered further in this Natura Impact Statement.

In addition there is no connectivity via surface water between

Table 4.1 Location and Characteristics of Proposed Development

Pouladatig Cave SAC, Toonagh Estate and Dromore Woods and Lough SAC and the proposed works. These Natura 2000 sites are also located 4.42km, 6.64km and 6.83km away by land. Therefore, given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land there is no known vector, pathway or conduit for pollution between the proposed works and these Natura 2000 sites.

Therefore the proposed works are highly unlikely to have any significant direct or indirect impacts on Newhall and Edenvale Complex SAC, Pouladatig Cave SAC, Toonagh Estate and Dromore Woods and Lough SAC which provide roosting sites for populations of Lesser Horseshoe Bat (*Rhinolophus hipposideros*), a Qualifying Interests for these SACs. However, while there is no potential pathway or conduit for impacts on the roosts of Lesser Horseshoe Bat (*Rhinolophus hipposideros*) within these SACs there is potential for impacts on this Annex II and Annex IV species within its foraging range (i.e. 5km) outside of the SACs. Newhall and Edenvale SAC, Pouladatig Cave SAC, Toonagh Estate and Dromore Woods and Lough SAC are located 2.38km, 4.42km, 6.64km and 6.83km, respectively away by land.

Therefore the proposed works are within foraging range (i.e. 5km) of the Lesser Horseshoe Bat (*Rhinolophus hipposideros*) populations at Newhall and Edenvale SAC and Pouladatig Cave SAC.

There are 11 no. pNHAs within 15km of the proposed works. Potential impacts on the river Fergus Estuary and Inner Shannon pNHA, Lough Gash pNHA, Dromore Woods and Lough pNHA, Pouladatig Cave pNHA, Newhall and Edenvale Complex pNHA (and Newpark House pNHA located 1.84km away by land) are as above for the relevant overlapping Natura 2000 sites. In addition any proposed avoidance and mitigation measure in respect of the overlapping Natura 2000 sites will also serve to protect the pNHAs.

As Lough Gleggan pNHA, Dromoland Lough pNHA, and

Table 4.1 Location and Characteristics of Proposed Development

	<p>Ballycor Lough pNHA are located 5km, 4.77km and 7.87km away by land the assessment for the potential of any significant effects on these pNHAs are as above for Lough Gash SAC.</p> <p>There is also no connectivity via water between Cahircalla Wood pNHA and the proposed works which are located 2.73km to the east of the woodland. Therefore, given (1) the nature and scale of works; (2) the intention to implement best practice construction and operational design, standards and guidelines; and (3) distance by land there is no known vector, pathway or conduit for pollution between the proposed works and this pNHA. Therefore the proposed development is highly unlikely to have any significant direct or indirect impacts on Cahircalla Wood pNHA. As a result, potential impacts to this pNHA are not considered further as part of this Appropriate Assessment Screening Report.</p> <p>In this regard, the Natura Impact Statement will proceed with regard to Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, Newhall and Edenvale SAC and Pouladatig Cave SAC (and Newpark House pNHA).</p>
<p>Has the proposed development the potential to impact directly or indirectly on any habitats listed as Annex I in the EU Habitats Directive?</p>	<p>No Annex I habitats listed as Qualifying Interests for the Lower Shannon SAC are located within the works area for the Project. However, a number of estuarine habitats are located downstream in the potential zone of influence of the works.</p>
<p>Has the proposed development the potential to impact directly or indirectly on any habitats listed as Priority Annex I in the EU Habitats Directive?</p>	<p>The priority Annex I habitat “Coastal Lagoons” is located downstream of the proposed works and so is potentially within the zone of influence of the works. However, it is not considered that the proposed development will result in any impact, direct or indirect, on this habitat. Please refer to the Natura Impact Statement for the project for further description of potential impacts.</p>
<p>Has the proposed development the potential to impact directly or indirectly on any species listed as Annex II in the EU Habitats Directive?</p>	<p>The Annex II species listed as Qualifying Interests for the Lower Shannon SAC present within the zone of influence of works are: Otter (<i>Lutra lutra</i>), Sea Lamprey (<i>Petromyzon marinus</i>), Brook Lamprey (<i>Lampetra planeri</i>), River Lamprey (<i>Lampetra fluviatilis</i>) and Atlantic Salmon (<i>Salmo salar</i>)</p> <p><i>Atlantic Salmon</i></p>

Table 4.1 Location and Characteristics of Proposed Development

The River Fergus catchment is classified as an important system for Atlantic Salmon and Sea Trout (*Salmo trutta*). McGinnity et al. (2003) details the Owenea River as one of 173 national Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*) migratory systems and accounts for 1.12% of the national accessible spawning habitat for the species. While Atlantic Salmon are present in the Fergus River, the findings of the site survey of the existing Sluice Gates and backdrain recorded the absence of suitable spawning habitats for Atlantic Salmon within the works area because of the limited gravels found to be present.

Otter

Otter (*Lutra lutra*) are widespread within the Lower River Shannon cSAC. Otter tracks, scat and a slide were identified under the railway bridge at Clareabbey and at one location on the existing flood defence earthen embankment. Nesting holts could potentially be present in the existing flood defence earthen embankment; however, none were recorded during the survey.

Sea, River (& Brook) Lamprey

All three of the species have been confirmed present in the River Fergus in the footprint of the works according to the "River Fergus, Lower Ennis Certified Drainage Scheme- Supplementary Ecological Assessment" (Ecofact, 2009). Lamprey larval burrows are characteristically found at eddies or backwaters, on the inside of bends or behind obstructions, where current velocity is below that of the main stream and where organic material tends to accumulate (Kelly & King, 2001). They favour partially shaded areas, and the presence of aquatic plants. While Sea Lamprey (*Petromyzon marinus*) would not use the backdrain because of limited coarse substrata for spawning, the smaller River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey (*Lampetra planeri*) would most likely use the existing sluices and backdrain because of the presence of fine silt and sand in the channel. Low to moderate potential for lamprey was recorded at the existing sluices and backdrain during the site survey. No lamprey were however recorded.

Please refer to the Natura Impact Statement for the project for

Table 4.1 Location and Characteristics of Proposed Development

	further description of potential impacts.
Has the proposed development the potential to impact directly or indirectly on any species listed as Annex IV in the EU Habitats Directive?	The Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) is listed as the Qualifying Interest for Newhall and Edenvale Complex cSAC (Site Code: 002091), Pouladatig Cave cSAC (Site Code: 00037) (and Newpark House pNHA (Site Code: 00061). According to Aquafact (2011) Lesser Horseshoe Bats are present in the general area; and therefore, Lesser Horseshoe Bats may utilise the River Fergus corridor in the footprint of the works as a commuting/foraging route. The roosting sites of the Lesser Horseshoe Bats within the Natura 2000 sites are not within the zone of influence of the works. Please refer to the Natura Impact Statement for the project for further description of potential impacts.
Has the proposed development the potential to impact directly or indirectly on any species listed as Annex I of the EU Birds Directive?	The proposed development. Is located 0.25km upstream of the River Shannon and River Fergus Estuaries SPA. Of the 21 species listed as Special Conservation Interests for the River Shannon and River Fergus Estuaries SPA, Cormorant were the only species recorded during the site survey. However, this was expected due to the timing of the survey as the majority of species overwinter in Ireland, while a smaller number of species which have both resident and overwintering populations in Ireland. Please refer to the Natura Impact Statement for the project for further description of potential impacts.
Has the proposed development the potential to impact directly or indirectly on the breeding places of any species protected under the Wildlife Act?	<p>Aquafact (2011) noted that Daubenton's bat and Soprano Pipistrelle are known to be common along the River Fergus. Temporary slight to moderate negative impacts on the commuting/foraging route of these bat species are expected as a result of temporary site lighting. No significant impact on the hydrogeology of the adjacent field supporting the Moss Bladder Snail (<i>Aplexa hypnorum</i>) is anticipated as a result of the proposed works.</p> <p>Potential impacts on European Eels, Smooth Newt and Common Frog will reflect those of Lamprey as discussed above. Impacts on Brown Trout and Smelt will reflect those of Atlantic Salmon. Impacts to Badgers will also reflect those of Otter with the exception of water quality impacts.</p>

Table 4.1 Location and Characteristics of Proposed Development

	<p>During the summer months several of the non-qualifying waterbird species (e.g. Mute Swan, Grey Heron) use the River Fergus but they will most likely avoid the construction area during the works and have other large foraging areas to exploit in the SPA. There is potential for impacts on nesting resident birds which may be disturbed during site clearance. Please refer to the Natura Impact Statement for the project for further description of potential impacts.</p>
<p>Has the proposed development the potential to impact directly or indirectly on any listed Architectural Conservation Areas as listed in the County Development Plan?</p>	<p>No.</p>
<p>Has the proposed development the potential to impact directly or indirectly on listed or scenic views or protected landscapes as outlined in the County Development Plan?</p>	<p>No.</p>
<p>Has the proposed development the potential to impact directly or indirectly on any protected structures or Recorded Monuments and Places of Archaeological Interest?</p>	<p>Yes. There are a total of ten monuments and features of archaeological interest located within the zone of influence of the proposed development. In general, most of the archaeological features have previously been excavated, although it is noted that part of SITE AR-8 exists outside the original construction corridor of the N86 road, the line of which is marked by a post-and-rail fence. In addition, low scarps associated with Clare Abbey (SITE AR-1) exist to the north and south of the extant ecclesiastical stone structures. Furthermore, there is a possible battleground to the immediate south/southeast of Clare Abbey (SITE AR-3), the extent of which is unknown. In general, however, the archaeological monuments are largely sited away from the proposed works, except SITE AR-8, while the scarps to the north and south of Clare Abbey have the ability to be impacted indirectly by construction traffic.</p> <p>The archaeological impacts of each element of the overall scheme are as follows:</p>

Table 4.1 Location and Characteristics of Proposed Development

A. Flood Plains

In general, it is considered that works associated with the upgrading of the flood defence embankment, associated back drain provision of emergency pump house, replacement of existing sluice gates and provision of additional sluice gates, together with the cleaning/clearing of existing drains, will not cause any direct impacts to any previously recorded archaeological monuments.

It is noted that none of the easement wayleaves/construction transport routes associated with the project will be situated in the immediate environs of Clare Abbey or associated extra-mural features. Consequently it is not envisaged that any indirect impacts will occur with respect to such features. Likewise, it is noted that it is unlikely that the section of open drain to the north of Clare Abbey, and adjacent an associated low scarp feature, will be subjected to clearing/cleaning works. Consequently, it is not considered that any impacts will occur with respect to this low scarp feature.

B. St. Flannan's – Tobartascáin Culvert

There are no features of archaeological interest associated with this development area. In general, the proposed culvert will be routed along previously disturbed road ways, through existing streams adjacent a railway or through a landscaped grasses area. Consequently, it is not considered likely that any direct or indirect archaeological impacts might occur.

C. Ballybeg Culvert

This element of the scheme will be routed through existing roads or lands previously disturbed by works associated with the construction of the N86 road or by the laying of service adjacent Limerick Road. Consequently, it is not considered likely that works have the ability to cause any direct or indirect impacts to previously identified or possible unknown subsurface archaeological remains.

Please refer to the Archaeological Impact Assessment Report for the Ennis South Flood Relief Scheme for further details.

Table 3.2 Characteristics of Potential Impacts

Consideration	Brief Description	Is this likely to result in significant effects?
<p>Will construction, operation or decommissioning of the Project involve actions which will cause physical changes in the locality (topography, land use, changes in water bodies, etc)?</p>	<p>A localised change in topography would have occurred as a result of the original construction of the embankments in the 1950's. The upgrade works now proposed will result in a very minor localised change to the existing topography of these embankments.</p> <p>As a flood defence earthen embankment is currently in place, there will be no change to land use. It is also noted that there are existing flood defence embankment upstream and downstream of the proposed extent of the development.</p> <p>There will be a change in the location of the existing manmade backdrain of the embankment in order to accommodate the proposed widening of the embankments. The existing backdrain will be moved further landward.</p> <p>The proposed development will not cause any changes to existing hydrology or hydrogeology.</p>	<p>No</p>
<p>Will construction or operation of the Project use natural resources such as land, water, materials or energy, especially any resources which are non-renewable or in short supply?</p>	<p>As it is proposed to widen the existing embankment on the landward side, a small amount of additional land will be required. The increase in the footprint of the embankment is 1.9hA over the 2.7km of the proposed embankment upgrade.</p> <p>Resources used in the construction of the upgrades to the embankment will include cohesive clays/silts, gravel, water, hydrocarbons and electricity.</p> <p>Although some of these resources are non-renewable,</p>	<p>No</p>

Table 3.2 Characteristics of Potential Impacts

Consideration	Brief Description	Is this likely to result in significant effects?
	<p>none are considered to be in short supply. Materials for construction will come from existing sources and no new sources of natural materials will be required.</p> <p>No natural resources will be used during the operation phase of the project, except in the case where the emergency pumping station is required to come into operation for a short duration. The pumps will be operated on a diesel generator. However, pumping is only likely to be required at a maximum for a period of a few days every 5 to 10 years.</p>	
<p>Will the Project involve use, storage, transport, handling or production of substances or materials which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health?</p>	<p>The construction of the emergency pumping station may involve the pouring of concrete, which has the potential to be harmful to the environment. Standard mitigation measures will apply to this operation which will prevent any potential impact on the environment.</p> <p>The operation of the scheme will not require the use of any harmful substances.</p>	<p>No</p>
<p>Will the Project produce solid wastes during construction or operation or decommissioning?</p>	<p>Excavated material that is unsuitable for re-use within the upgraded embankment will be removed from the site by an approved waste disposal contractor to an approved waste disposal facility during the construction phase of the project. The project will not produce solid wastes during operation. It is not envisaged that the proposed works will ever be decommissioned.</p>	<p>No</p>

<p>Will the Project release pollutants or any hazardous, toxic or noxious substances to air?</p>	<p>No.</p>	<p>No</p>
<p>Will the Project cause noise and vibration or release of light, heat energy or electromagnetic radiation?</p>	<p>Noise, vibration and light will be produced during the construction stage; however the impact will be minor and temporary in nature. Standard mitigation measures will be implemented to prevent impacts from noise, vibration or light.</p> <p>During the operation phase of the project, noise may be produced in the event that the emergency pumping station is required to come into operation during an extreme flood event in the catchment. This noise will be temporary and minor in nature. There may also be noise associated with maintenance works on the embankment in the future should they be required. This noise would be minor and temporary in nature.</p>	<p>No</p>
<p>Will the Project lead to risks of contamination of land or water from releases of pollutants onto the ground or into surface waters, groundwater, coastal waters or the sea?</p>	<p>It is not anticipated that the project will lead to risk of contamination of land or water from releases of pollutants onto the ground or into water bodies.</p> <p>Normal construction practices, along with the implementation of appropriate standard mitigation measures will reduce the risk of spillage of fuels, lubricants and other hydrocarbons to the environment.</p>	<p>No</p>
<p>Will there be any risk of accidents during construction or operation of the Project which could affect human health or the environment?</p>	<p>Material used during the construction phase will mainly consist of concrete, granular and cohesive materials. The risk of accidents during construction or operation of the Project which could affect human health or the environment is not considered to be significant.</p> <p>Health and safety risk assessments and standard mitigation measures will be prepared in relation to the construction and operation phases of the project.</p>	<p>No</p>

<p>Will the Project result in social changes, for example, in demography, traditional lifestyles, employment?</p>	<p>The project will generate employment during the construction phase, which will last approximately six months.</p> <p>There will be no resulting social change overall.</p>	<p>No</p>
<p>Are there any other factors which should be considered such as consequential development which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality?</p>	<p>The only proposed development identified as potentially resulting in in-combination effects is the “<i>River Fergus (Lower) Ennis Certified Drainage Scheme</i>” to be undertaken by the OPW. OPW maintenance operations are covered by guidance given in the OPW Ecological Impact Assessment entitled “The River Fergus (Ennis) Certified Drainage Schemes Upper and Lower” (Lewis, 2005). There is no spatial overlap between the current Flood Relief Scheme and the River Fergus (Lower) Ennis Certified Drainage Scheme or at the ‘tie-in’ to the Schemes at the Regional Road (R469).</p> <p>It is expected that the River Fergus (Lower) Ennis Certified Drainage Scheme will be completed prior to the commencement of the Flood Relief Scheme which is the subject of this report. Therefore, no temporal overlap exists between the construction stages of the two schemes.</p> <p>In the absence of impacts arising from this scheme, there will be no potential for further cumulative impacts arising in combination with any other plans or proposals which could result in likely significant impacts.</p>	<p>No</p>
<p>Are there any areas on or around the location which are protected under international or national or local legislation for their ecological, landscape, cultural or other value, which could be affected by the project?</p>	<p>The proposed works are located just inside the boundary of and in the vicinity of the Lower River Shannon SAC (Site Code: 002165) and upstream of the River Shannon and River Fergus Estuaries SPA (Site Code: 004077).</p> <p>Potential impacts on these Natura 2000 sites have been assessed separately as part of an Appropriate Assessment for the development.</p> <p>Ten previously recorded sites/monuments of archaeological interest have been identified in the general location of the overall project. Potential impacts</p>	<p>No</p>

	on these sites/monuments have been assessed as part of an Archaeological Impact Assessment for the project.	
Are there any other areas on or around the location which are important or sensitive for reasons of their ecology e.g. wetlands, watercourses or other waterbodies, the coastal zone, mountains, forests or woodlands, which could be affected by the project?	Any areas around the location of the project which are important or sensitive for the reason of their ecology have been assessed as part of the River Habitat Corridor Survey (appended to Natura Impact Statement) undertaken for the project.	No
Are there any areas on or around the location which are used by protected, important or sensitive species of fauna or flora e.g. for breeding, nesting, foraging, resting, over wintering, migration, which could be affected by the project?	See above.	No
Are there any inland, coastal, marine or underground waters on or around the location which could be affected by the project?	The proposed embankment upgrade is in the vicinity of the River Fergus. Potential impacts on the River Fergus are addressed in the Natura Impact Statement for the project. With the implementation of appropriate standard mitigation measures, there will be no anticipated impact on this waterbody. The project has been designed such that all construction works will take place on the landward side of the existing flood defence embankment, except at the three discrete point locations where new or upgraded sluices are required.	No
Are there any areas or features of high landscape or scenic value on or around the location which could be affected by the project?	There are currently no features of landscape or scenic value which would be affected by the proposed works.	No

<p>Are there any routes or facilities on or around the location which are used by the public for access to recreation or other facilities, which could be affected by the project?</p>	<p>Access to a portion of the existing flood defence earthen embankment will be on an existing road leading to the Clare Abbey. This road is currently used by the public to access the Abbey.</p> <p>Construction will result in a temporary increase in traffic on this road, but will not impact on the public accessing the Abbey.</p> <p>A positive impact on local roads in the south of Ennis town will be experienced as a result of the project due to the culverting of floodwaters down to the Clareabbey Floodplain, which previously flowed across the Limerick Road and Toberteascain Road.</p>	<p>No</p>
<p>Are there any transport routes on or around the location which are susceptible to congestion or which cause environmental problems, which could be affected by the project?</p>	<p>No</p>	<p>No</p>
<p>Is the project in a location where it is likely to be highly visible to many people?</p>	<p>Yes, both the existing and proposed upgraded embankment is visible to mobile road users on the N85 dual carriageway. The existing and proposed earthen embankment will be vegetated and will therefore blend into the existing agricultural landscape.</p>	<p>No</p>
<p>Are there any areas or features of historic or cultural importance on or around the location which could be affected by the project?</p>	<p>Clare Abbey is approximately 150m from the proposed works. An Archaeological Impact Assessment has been carried out in relation to the project.</p> <p>Ten previously recorded sites/monuments of archaeological interest were identified, including Clare Abbey. The assessment concludes that proposed works are not being carried out in the immediate environs of Clare Abbey, or other monuments and as such, no adverse impacts are predicted. Standard mitigation measures will be applied including supervision of the</p>	<p>No</p>

	works by a licensed archaeologist.	
Is the project located in a previously undeveloped area where there will be loss of greenfield land?	The proposed works include for the upgrading of an existing flood defence earthen embankment. Upon completion of the construction phase, the embankment will be returned to its current grassed condition. Therefore there will be no loss of greenfield land.	No
Are there existing land uses on or around the location e.g. homes, gardens, other private property, industry, commerce, recreation, public open space, community facilities, agriculture, forestry, tourism, mining or quarrying which could be affected by the project?	<p>There is a business park located approximately 20m from the proposed works, with numerous private properties within 300m of proposed works. Access to any of these locations will not be affected by the proposed works.</p> <p>These properties will not be significantly adversely affected by the proposed works.</p>	No
Are there any plans for future land uses on or around the location which could be affected by the project?	No known plans at this time that could be affected by the project.	No
Are there any areas on or around the location which are densely populated or built-up, which could be affected by the project?	<p>The proposed works are located close to built-up areas of Ennis town and Clarecastle village. Housing estates and other developments are also in the vicinity of proposed works. It is not anticipated that the development will have a significant impact on these built up areas.</p> <p>A positive impact on densely populated and built-up areas of Ennis town will be experienced due to the alleviation of flooding as a result of the Project.</p>	No
Are there any areas on or around the location, which are occupied by sensitive land uses e.g. hospitals, schools, places of worship, community facilities, which	A positive impact on St. Flannans College will be experienced due to the alleviation of flooding as a result of the Project.	No

could be affected by the project?		
Are there any areas on or around the location which contain important, high quality or scarce resources e.g. groundwater, surface waters, forestry, agriculture, fisheries, tourism, minerals, which could be affected by the project?	There are groundwater and surface waters in the vicinity of the proposed works. Potential impacts on these waters are assessed in the Natura Impact Statement and standard mitigation measures are provided.	No
Are there any areas on or around the location which are already subject to pollution or environmental damage e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	No.	No
Is the project location susceptible to earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions e.g. temperature inversions, fogs, severe winds, which could cause the project to present environmental problems?	Yes. Works are located within the Clare Abbey floodplain, and therefore will be susceptible to flooding during times of heavy rainfall. This will not cause the project to present environmental problems.	No
Conclusion	This Environmental Impact Assessment screening exercise concludes that no further assessment is required with the exception of a full Appropriate Assessment and an Archaeological Impact Assessment.	

4.4 CONCLUSION – REQUIREMENT FOR SUB-THRESHOLD EIA

The development is not considered to require a sub-threshold EIA based on the location of the proposed development, the characteristics of the proposed development and the characteristics of the potential impacts as described in Table 4.1 and Table 4.2 above.