Appendix C11.01

Section 1 Flood Risk Assessment

Co-financed by the Connecting Europe Facility of the European Union

Appendix C11.01

Section 1 Flood Risk Assessment Report

TEN-T Priority Route Improvement Project, Donegal

Section 1 Flood Risk Assessment Report

March 2026

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Appendix A: Hydrological Impact Study River Finn Crossing, Drumboe Lower

Appendix B: Hydrological Impact Study Mullaghagarry River Crossing at Stranorlar

Appendix C: Technical Report for OPW Section 50 Applications

1 INTRODUCTION

In January 2017, Donegal County Council appointed joint venture RPS/Barry Transportation as design consultants for the Trans-European Network - Transportation (TEN-T) Priority Route Improvement Project (PRIP), Donegal; hereafter referred to as the proposed development in this report.

The TEN-T PRIP, involves the targeted and appropriate intervention on three sections of the Ten-T/National Road network in Donegal. The intervention includes online improvement and upgrade, bypass of three urban centres, route realignment and complete, independent and integrated active travel network.

The project is divided into three sections as illustrated in Figure 1.1:

- **Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region**
  Full active travel, modal hubs, urban bypass
- **Section 2 – N56/N13 Letterkenny to Manorcunningham**
  Full active travel, online/upgrade, route realignment, urban bypass (Letterkenny), modal hub
- **Section 3 – N14 Manorcunningham to Lifford/Strabane/A5 Link**
  Full active travel, route realignment, urban bypass (Lifford) and cross border connection (Lifford/Strabane), modal hubs.

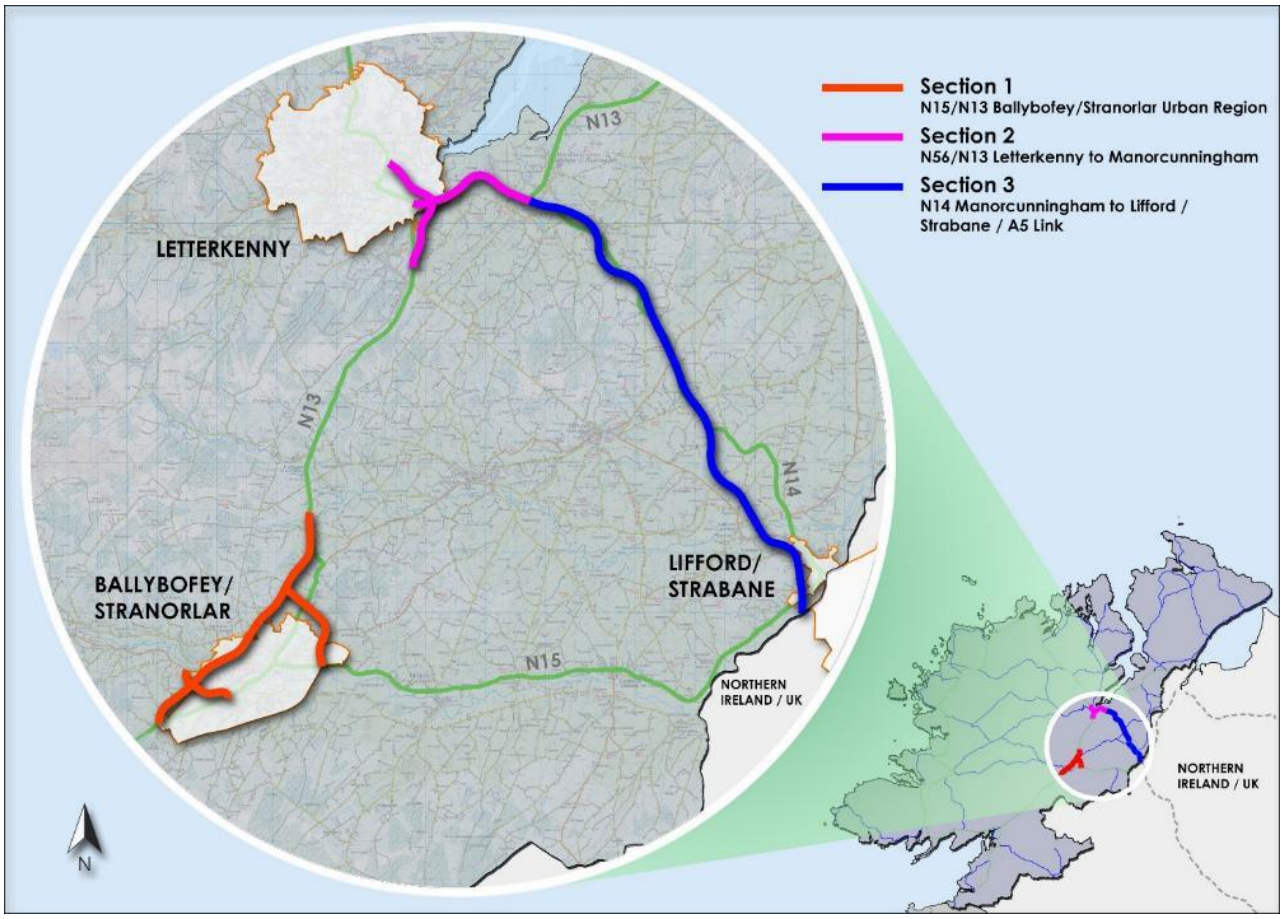

Figure 1.1 Ten-T Priority route improvement project, Donegal

The three sections of the proposed development are being considered as three components of one project. This Flood Risk Assessment report considers Section 1 only.

The proposed route for Section 1 lies within the River Foyle Catchment and forms part of the National Hydrometric Area -01. The major sub-catchments within this area are the River Finn and River Deele catchments.

This FRA has been undertaken in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (Dept. of the Environment, Heritage and Local Government and The Office of Public Works, Nov 2009).

Chapter 2 of this report outlines the flood risk management policies and guidelines used for this assessment. Chapter 3 presents a description of the road project and its relevant drainage features. Chapter 4 presents the flood risk assessment that includes flood risk identification and preliminary flood risk assessment for screening purposes, followed by a detailed Flood Risk Assessment of the identified risks and mitigation.

2 FLOOD RISK MANAGEMENT POLICY

2.1 EU Floods Directive

The European Floods Directive 2007/60/EC on the assessment and management of flood risk aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. This directive applies to both inland waters and coastal waters across the whole territory of the European Union.

The directive requires all member states to undertake a national preliminary flood risk assessment in order to identify areas where significant flood risk exists or might be considered likely to occur and to prepare flood hazard and flood risk maps for such areas by December 2013. The Directive requires the preparation of catchment-based Flood Risk Management Plans (FRMPs) by 2015, which will set out flood risk management objectives, actions and measures. These Flood Risk Management Plans are to include measures to reduce the probability of flooding and its potential consequences. Implementation of the EU Floods Directive is required to be coordinated with the requirements of the EU Water Framework Directive and current River Basin Management Plans.

2.2 National Flood Policy Review

2.2.1 Background

Historically management of flooding was implemented by drainage commissioners and focused on the protection and improvement of land for agricultural purposes, and this is reflected in the various Drainage Acts passed (1842, 1867, 1925, 1928, and 1945).

The Brown Commission (Report of the Drainage Commission 1938-1940) which examined flooding and improvement of land through drainage resulted in the development of the Arterial Drainage Act, 1945. The Brown Commission recommended the establishment of a single national drainage authority with a remit to embark on a national drainage programme. The Office of Public Works (OPW) became the Statutory Authority responsible for implementing arterial drainage schemes nationally.

The emphasis of the 1945 act was improvement of agricultural land and following the act a priority list of river basins was set out and a programme of drainage works commenced and continued up until the early 1990's. This drainage act was amended in 1995 to allow the OPW to implement localised flood relief schemes for reliving flooding in urban areas. This amendment recognised that urban flooding had become a significant problem and signalled a departure away from arterial drainage of lands with no new arterial drainage schemes being implemented.

The various drainage districts and arterial drainage schemes, local flood relief schemes carried out under the drainage act continue to be maintained today by the OPW and Local Authorities.

2.2.2 Report of the Flood Policy Review Group

In 2003 a review of the National Flood Policy was carried out by a review group of relevant stakeholders. The review focuses on fluvial (river) and tidal flooding and concentrates on the roles of the state agencies in these areas. The scope of the review included the following:

- Causes, extent and impacts of the flooding problem
- Current roles and responsibilities of the main state bodies
- International best practice
- Future flood policy
- Proposals for future organisational structures and responsibilities
- Resource requirements and strategic programme.

The review group prepared a report by December 2003 that was approved by government and published in September 2004. The adopted policy has many specific recommendations, including:

- Minimise the national level of exposure to flood damages through identification and management and future flood risks in an integrated, proactive and river basin-based approach.
- The OPW is to be the lead agency in delivering this policy.
- All future expenditure in the area of flood relief will need to satisfy strict prioritisation criteria.
- A two-pronged approach to flood management is to be pursued with a greater level of importance attributed to non-structural flood relief measures supported where necessary by traditional structural flood relief measures.
- River basin flood management plans to be developed along with comprehensive Flood Hazard Maps and all information made available to the Dept. of the Environment, Heritage and Local Government now known as Housing, Planning and Local Government to inform future planning and development processes.
- Programmes of necessary hydrological research were identified and included the update of the Flood Studies Report and river basin (hydrological) modelling, analysis of potential impact of climate change on flood frequency and severity and Meteorological forecasting.

2.3 National CFRAM Studies

The OPW is the lead agency for flood risk management and part of its responsibility is the coordination and implementation of Government Policy on the management of flood risk in Ireland. The SI No. 122 on the European Communities (Assessment and Management of Flood Risks) 2010 identifies the Commissioners of Public Works as the competent authority with overall responsibility for the implementation of the Floods Directive (2007/60/EC).

In order to comply with the Floods Directive (2007) and the National Flood Policy Review Group (2004) a national Catchment Flood Risk Assessment and Management (CFRAM) programme commenced in 2011 and flood risk and hazard mapping was completed in 2015; in addition, the catchment management plans and the Strategic Environmental Assessment (SEA) process was completed in 2016. This followed preparatory studies involving the Preliminary Flood Risk Assessment mapping and AFA (areas for further assessment) identification and followed a number of Pilot Catchment studies including the Lee Catchment FRAMs (commenced 2006), the River Dodder FRAMS (commenced 2007) and the Fingal East Meath FRAMS (commenced 2008) to refine the approach and methodologies to be adopted. The areas deemed to be at significant risk are identified as AFAs and more detailed assessment on the extent and degree of flooding was undertaken in the CFRAM studies and involved detailed survey hydrological and hydraulic modelling, flood mapping, flood risk management plans and supporting Strategic Environmental Assessments.

2.4 Planning Guidelines Concerning Flood Risk Management

2.4.1 Background

In November 2009, the OPW and DoEHLG jointly published the Planning System and Flood Risk Management - Guidelines for Planning Authorities which are aimed at ensuring a more consistent, rigorous and systematic approach to fully incorporate flood risk assessment and management into the planning system.

The core objectives set out in these guidelines are to:

- Avoid inappropriate development in areas of flood risk.
- Avoid new developments that may increase flood risk elsewhere.
- Ensure effective management of residual risks for developments permitted in floodplains.

- Avoid unnecessary restriction of national, regional or local economic growth.
- Improve the understanding of flood risk among the relevant stakeholders.
- Ensure that the requirements of EU and National law in relation to the natural environment and nature conservation are compiled with at all stages of flood risk management.

The key principles to be adopted by regional and local authorities, developers and their agents are to:

- Avoid the risk, where possible.
- Substitute with less vulnerable uses, where avoidance is not possible.
- Justify that the need for the development is a strategic need, where avoidance and substitution are not possible.
- Mitigate and manage the risk.

Decision Making Process

Management of flood hazard and potential risks in the planning system is based on:

1. Sequential Approach.

2. Justification Test.

2.4.2 Sequential Approach

The aim of the sequential approach (Figure 2.1) is to guide new development away from areas at risk from flooding into areas at low risk of flooding. The approach makes use of flood risk zones and classifications of vulnerability of property to flooding but ignores the presence of flood protection structures. The sequential approach should be applied to all stages of the planning process, particularly at the plan making stage.

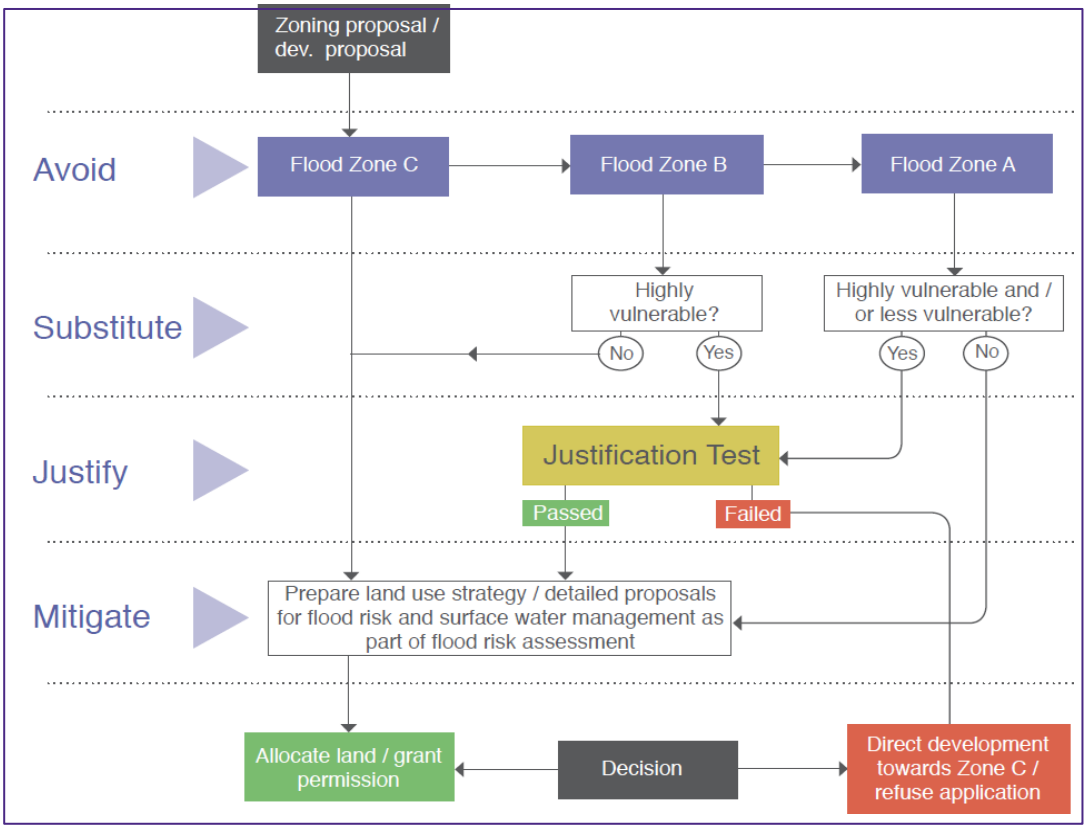

Figure 2.1 Sequential approach mechanism in the planning process (Fig. 3.2 from The Planning System and Flood Risk Management Guidelines)

The sequential approach is based on the principles shown in Figure 2.2:

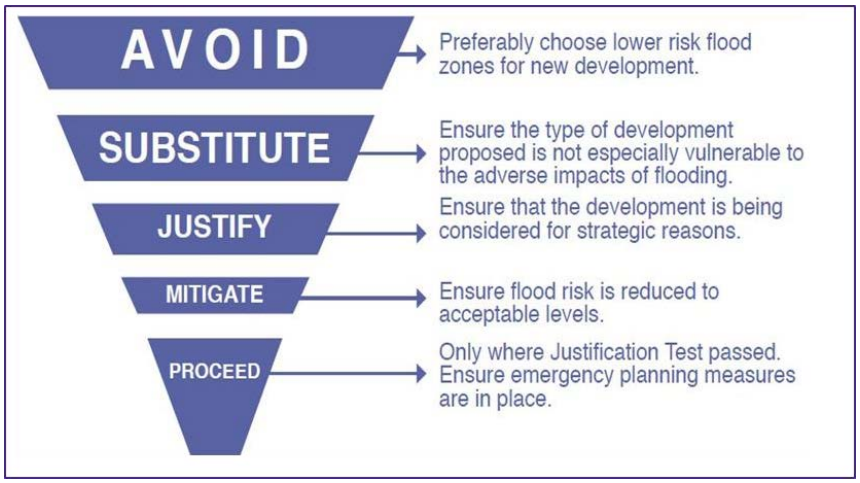

Figure 2.2 Sequential approach principles in flood risk management (Fig. 3.1 from The Planning System and Flood Risk Management Guidelines)

2.4.3 Flood Risk Zones

Definitions of flood risk zones in the planning guidelines are based on probability of occurrence with three flood risk zones (High, Moderate and Low) defined. These flood zones are as follows:

- Zone A High Probability: Highest risk of flooding: More than 1% probability of river flooding and more than 0.5% probability of tidal flooding. Development should be avoided and/or only considered through application of a justification test. Most types of development would be considered inappropriate in this zone. Development in this zone should be avoided and/or only considered in exceptional circumstances, such as in city and town centres, or in the case of essential infrastructure that cannot be located elsewhere, and where the justification test has been applied.

- Zone B Moderate Probability: Between 1 and 0.1% probability of river flooding or between 0.5 and 0.1% probability of coast flooding. Development should only be considered in this zone if adequate land or sites are not available in Zone C or if development in this zone would pass the Justification Test. Highly vulnerable development would generally be considered inappropriate in this zone, unless the requirements of the Justification Test can be met. Less vulnerable development and water-compatible development might be considered appropriate in this zone. In general, however, less vulnerable development should only be considered in this zone if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed.

- Zone C Low Probability: Less than 0.1% probability of river or coastal flooding. Development in this zone is appropriate from a flood risk perspective (subject to assessment of flood hazard from sources other than rivers and the coast) but would need to meet the normal range of other proper planning and sustainable development considerations.

These flood zones are determined on the basis of the probability of river and coastal flooding only and should be prepared by suitably qualified experts with hydrological experience. The derivation of these zones is broadly in line with those in common usage internationally. They are based on the current assessment of the 1% and the 0.1% fluvial events and the 0.5% and 0.1% tidal events, without the inclusion of climate change factors.

The provision of flood protection measures in appropriate locations, such as in or adjacent to town centres, can significantly reduce flood risk. However, the presence of flood protection structures should be ignored when determining the flood risk zones.

This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of the defences and the fact that there may be no guarantee that the defences will be maintained in perpetuity. The likelihood and extent of this residual risk needs to be considered, together with the potential impact on proposed uses, at both development plan and development management stages, as well as in emergency planning. In particular, the finished floor levels within protected zones will need to take account of both urban design considerations and the residual risk remaining.

2.4.4 Development Type Vulnerability Classification

In determining the suitability of the Development within the various flood zones the vulnerability class of the development is taken into consideration. Three categories of vulnerability are considered as described in Table 2.1 and Table 2.2 below.

Table 2.1 Classification of Vulnerability of Different Types of Development

Vulnerability Class	Land uses and types of development which include*:
Highly Vulnerable development (including essential infrastructure)	• Garda, ambulance and fire stations and command centres required to be operational during flooding. • Hospitals. • Emergency access and egress points. • Schools. • Dwelling houses, student halls of residence and hostels. • Residential institutions such as residential care homes, children's homes and social services homes. • Caravans and mobile home parks. • Dwelling houses designed, constructed or adapted for the elderly or, other people with impaired mobility. • Essential infrastructure, such as primary transport and utilities distribution, including electricity generating power stations and sub-stations, water and sewage treatment, and potential significant sources of pollution (SEVESO sites, IPPC sites, etc.) in the event of flooding.
Less Vulnerable development	• Buildings used for: retail, leisure, warehousing, commercial, industrial and non-residential institutions. • Land and buildings used for holiday or short-let caravans and camping, subject to specific warning and evacuation plans. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste). • Mineral working and processing. • Local transport infrastructure.
Water-compatible development	• Flood control infrastructure. • Docks, marinas and wharves. • Navigation facilities. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation and tourism (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category (subject to a specific warning and evacuation plan).

* Uses not listed here should be considered on their own merits

Table 2.2 Requirement for Justification Test based on Vulnerability Group and Flood Zone Category

Vulnerability Class	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification Test	Justification Test	Appropriate
Less vulnerable development	Justification Test	Appropriate	Appropriate
Water-compatible development	Appropriate	Appropriate	Appropriate

2.4.5 Justification Test

Further sequentially based decision making should be applied when undertaking the Justification Test for development that needs to be in flood risk areas for reasons of proper planning and sustainable development:

1. within zone or site, development should be directed to areas of lower flood probability.

2. where impact of the development on adjacent lands is considered unacceptable the justification of the proposal or zone should be reviewed.

3. where the impacts are acceptable or manageable, appropriate mitigation measures within the site and if necessary, elsewhere should be considered.

A justification test is required where a planning authority is considering the future development of areas at a high or moderate risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out above within the flood zones. In such cases the planning authority must be satisfied that it can clearly demonstrate on a solid evidence base that the zoning or designation for development will satisfy the justification test outline in Box 4.1 of the guidelines as presented below in Figure 2.3.

Box 4.1: Justification Test for development plans

Where, as part of the preparation and adoption or variation and amendment of a development/local area plan[1], a planning authority is considering the future development of areas in an urban settlement that are at moderate or high risk of flooding, for uses or development vulnerable to flooding that would generally be inappropriate as set out in Table 3.2, all of the following criteria must be satisfied:

1 The urban settlement is targeted for growth under the National Spatial Strategy, regional planning guidelines, statutory plans as defined above or under the Planning Guidelines or Planning Directives provisions of the Planning and Development Act, 2000, as amended.

2 The zoning or designation of the lands for the particular use or development type is required to achieve the proper planning and sustainable development of the urban settlement and, in particular:

(i) Is essential to facilitate regeneration and/or expansion of the centre of the urban settlement[2];

(ii) Comprises significant previously developed and/or under-utilised lands;

(iii) Is within or adjoining the core[3] of an established or designated urban settlement;

(iv) Will be essential in achieving compact and sustainable urban growth; and

(v) There are no suitable alternative lands for the particular use or development type, in areas at lower risk of flooding within or adjoining the core of the urban settlement.

3 A flood risk assessment to an appropriate level of detail has been carried out as part of the Strategic Environmental Assessment as part of the development plan preparation process, which demonstrates that flood risk to the development can be adequately managed and the use or development of the lands will not cause unacceptable adverse impacts elsewhere.

N.B. The acceptability or otherwise of levels of any residual risk should be made with consideration for the proposed development and the local context and should be described in the relevant flood risk assessment.

Figure 2.3 Justification Test for Development Plans

2.4.6 Flood Risk Assessment

A staged approach to flood risk assessment that covers both the likelihood of flooding, and the potential consequences is recommended in carrying out a Flood Risk Assessment (FRA). The stages of appraisal and assessment are:

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

Stage 1 Flood risk identification – to identify whether there may be any flooding or surface water management issues related to either the area of regional planning guidelines, development plans and local area plans (LAPs) or a proposed development site that may warrant further investigation at the appropriate lower-level plan or planning application levels.

Stage 2 Initial flood risk assessment – to confirm sources of flooding that may affect a plan area or proposed development site, to appraise the adequacy of existing information and to scope the extent of the risk of flooding which may involve preparing indicative flood zone maps. Where hydraulic models exist the potential impact of a development on flooding elsewhere and of the scope of possible mitigation measures can be assessed. In addition, the requirements of the detailed assessment should be scoped.

Stage 3 Detailed flood risk assessment – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development or land to be zoned, of its potential impact on flood risk elsewhere and of the effectiveness of any proposed mitigation measures.

All stages may not be needed in the FRA in order to inform the decision-making process and often a Stage 2 assessment is sufficient at the strategic level to inform the decision-making process. This will depend on the level of risk, the level of conflict with the proposed development and the scale of mitigation measure being proposed. For the purposes of applying the sequential approach, once a flood risk has been identified it can be avoided. Where development is planned in flood risk areas, a detailed assessment may be carried out within the FRA, so that the potential for development of the lands and their environmental impact can be assessed.

The FRA of the Ten-T Priority Route Improvement Project will:

- Identify the broad nature of flood risk (type and source) within the study area.
- Provide an improved understanding of flood risk issues along the route of the proposed road development; and
- Provide a more detailed assessment and management strategy for the transport infrastructure within the identified flood risk areas.

3 THE PROPOSED DEVELOPMENT

This Section provides a brief description of the proposed works for Section 1 including the drainage/cross-drainage works proposed under this proposed road route.

The Section 1 route corridor is approximately 9.7 km long and runs from south to north and to the west of Ballybofey/ Stranorlar. Additionally, there are two link roads located to the south and the north of the towns providing connections from the proposed development to the existing N15 (to the southwest of Ballybofey), N13 (north of Stranorlar) and N15 (to Lifford) respectively. (See Figure 3.1).

The interfaces with the existing roads include:

- Tie-in to N15 south of Dooish.
- Tie-in to R252 Glenties Road at Cappry from Ballybofey Link Road North.
- Tie-in to N15 Ballybofey/ Cappry (Graham) from Ballybofey Link Road South.
- Tie-in to N13 north of Meenavoy.
- Tie-in to N13 at Tircallan.
- Tie-in to N15 at Treanamullin

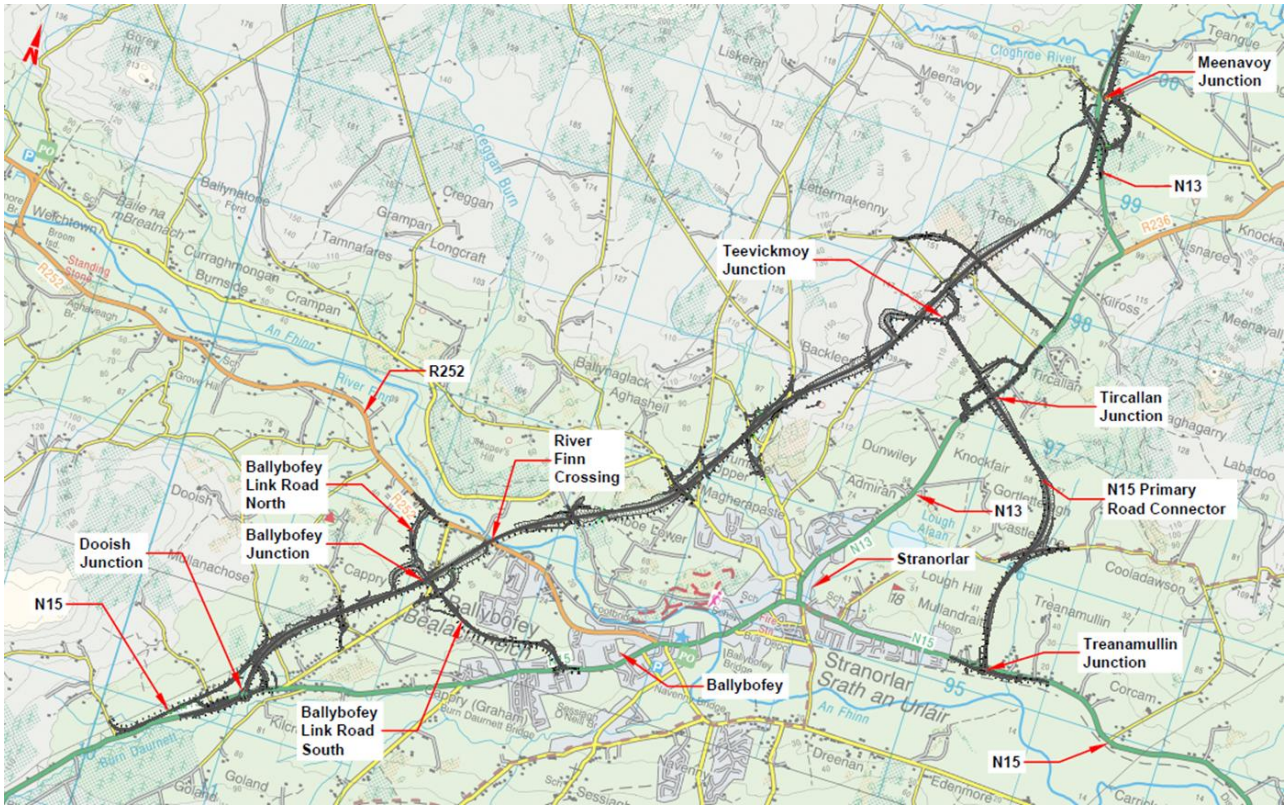

Figure 3.1 Section 1 Proposed Road Development

The proposed road development can be summarised under the following elements:

Roads:

- Mainline Section 1.1 which is 0.5 km of Type 1 Single Carriageway cross section between the existing N15 southern tie in and Dooish Junction (EIAR Drawing 4.1, sheet 1 of 8).

- Mainline Section 1.2 which is 8.6 km of Type 2 Divided Road bypassing Ballybofey/ Stranorlar between Dooish Junction and Meenavoy Junction (EIAR Drawing 4.1, sheets 1, 2, 4, 5, 6 and 7 of 8).
- Mainline Section 1.3 which is 0.6 km of Type 1 Single Carriageway cross section between Mainline Section 1.2 (Meenavoy Junction) and the existing N13 to the north of the Proposed Development (EIAR Drawing 4.1, sheet 7 of 8).
- Ballybofey Link Road (north and south sections) which is 2.1 km Type 2 Single Carriageway connecting Mainline Section 1.2 to the local road network at Ballybofey (EIAR Drawing 4.1, sheets 2 and 3 of 8).
- N15 Primary Road Connector which is 3.1 km of Type 3 Divided Road connecting Mainline Section 1.2 to the existing N15 Lifford Road (Teevickmoy Junction to Treanamullin Junction) (EIAR Drawing 4.1, sheets 6 and 8 of 8).
- Provision of approximately 10.6 km of additional Type 1, Type 2 and Type 3 Single Carriageway roads not already mentioned above (includes new and realigned).

Junctions:

- Three compact grade-separated junctions, one each at Cappry (EIAR Drawing 4.1, sheet 2 of 8), Teevickmoy, and Tircallan/ Dunwiley (both shown on EIAR Drawing 4.1, sheet 6 of 8), including structures, link roads and roundabouts.
- Three at-grade roundabout type junctions at tie-in transition points at Dooish (EIAR Drawing 4.1, sheet 1 of 8), Meenavoy (EIAR Drawing 4.1, sheet 7 of 8), and Treanamullin (EIAR Drawing 4.1, sheet 8 of 8).

Structures:

- 360 m long, seven span bridge (ref: N15R024) over the River Finn and flood plain at Ballybofey/ Stranorlar (clear span over the river channel).
- Two river/stream bridges.
- Seven overbridges.
- Five underbridges.
- Three underpasses (including active travel / mammal underpass).
- Culverts, gantries and environmental barriers.

Active Travel:

- Provision of active travel infrastructure. This includes connections to existing infrastructure and three new Park and Share / Cycle facilities, one each near Dooish, Cappry, and Meenavoy as illustrated in Volume D: Book of Drawings (EIAR Drawings 4.1 and 4.50).

Other Works:

- Access roads.
- Provision of attenuation ponds, flood compensation measures, watercourse diversions and associated drainage infrastructure.
- Provision of existing utility diversions and new utility infrastructure.
- Provision of landscape planting, signage, lighting, safety barrier, and other works ancillary to the construction and operation of the Proposed Development.

3.1 River Bridge Crossing

There are three bridge structures proposed along the mainline carriageway of Section 1 road, namely, River Finn Crossing, Backlees River Crossing and Cloghroe River Crossing. Table 3-1 represents locations and bridge types and their span/lengths details. Hydraulic designs of these bridge openings have been carried out through building the HEC-RAS hydraulic model for the relevant watercourses. Refer to Section 4-5 for further details of the hydraulic models. The locations of these bridge crossings are illustrated in Figure 3.2.

Table 3.1 Section 1 Proposed Bridge Schedule

Bridge Reference	Chainage	Referenced Mainline / Side Road	Location X	Location Y	Structure Type	Approx. Length (m)
River Finn Bridge	CH2+400	Mainline	612485.6	895001.8	7 Span Bridge	360
Backlees River Crossing	CH4+150	Mainline	613890.5	896001.5	Single Span Bridge	45
Cloghroe River Crossing	CH0+300	N15 Tie-in South	616020.3	900024.9	Single Span Bridge	18

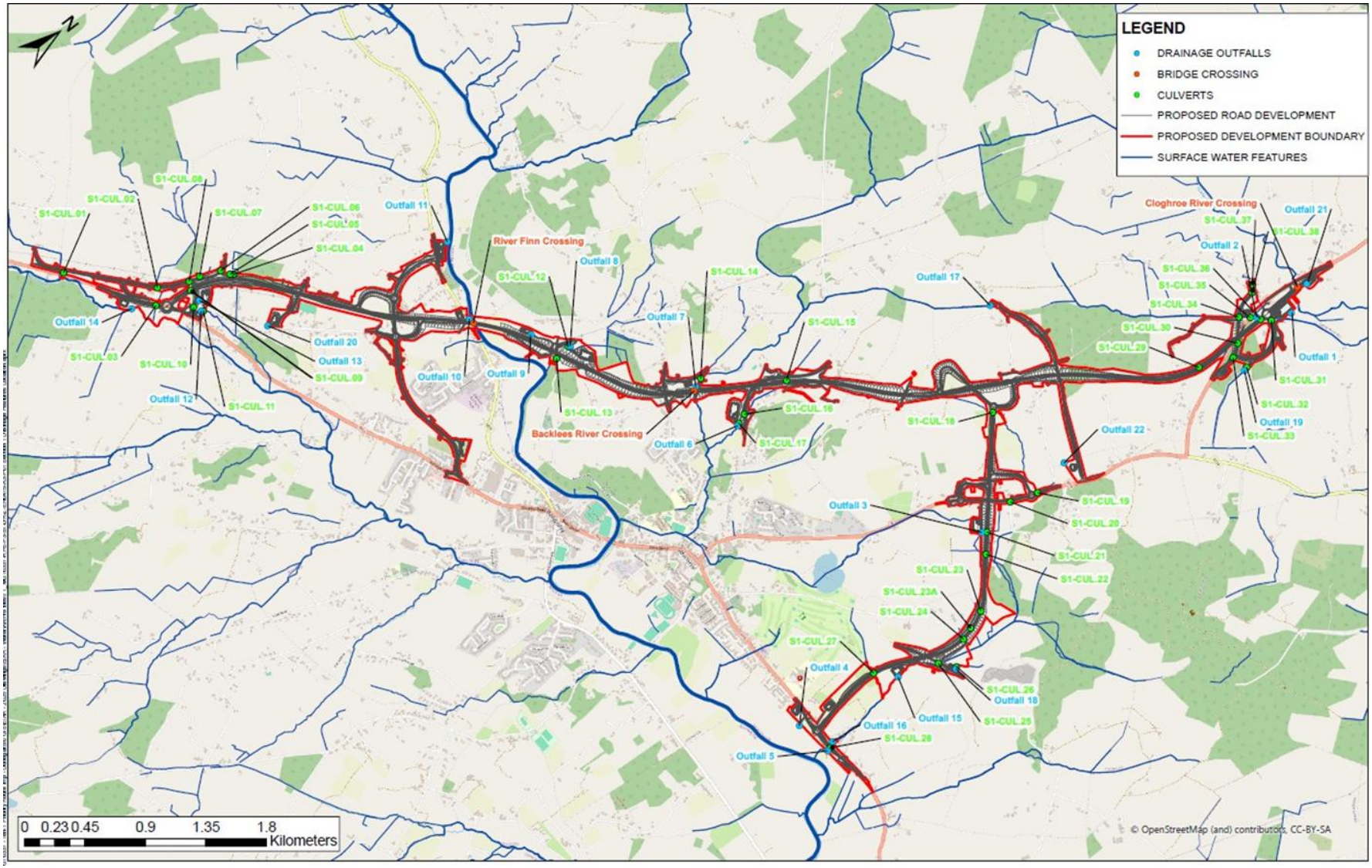

Figure 3.2 Locations of Bridges / Culvert Crossing and Drainage Outfalls

3.2 Other Culvert Crossings along the Proposed Road

There are 39 No. culverts for watercourse crossings. Table 3.2 lists these culverts along with their required size and lengths. Figure 3.2 illustrates the location of these culverts. Drawing no. TT_MGT0337-RPS-P3-S1-DR-C-DR1001 included in Section of Design Report show their layout plans. Typical cross-section details are shown on TT_MGT0337-RPS-P3-S1-DR-C-DR1004. Culverts or pipes with a clear span greater than 2.0 m are classified as structures in accordance with the DN-STR-03001 (BD 2).

Most culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786; S1-CUL.14 and S1-CUL.28 were sized using HEC-RAS modelling software.

Table 3.2 Section 1 Proposed Culvert Schedule

Culvert Reference	Chainage	Referenced Mainline / Side Road	Location X	Location Y	Culvert Diameter (m) / Width (m) x Height (m)	Approx. Length (m)
S1-CUL.01	1+300 m	L-6564 Connector	610,325.8	892,814.7	3.2 x 2	51.8
S1-CUL.02	0+600 m	L-6564 Connector	610,840.2	893,300.1	1.2Ø	34.1
S1-CUL.03	0+455 m	Mainline 1.1	610,938.5	893,210	1.2Ø	30.5
S1-CUL.04	0+550 m	Farm Access	611,106.4	893,808.6	1.2Ø	9.0
S1-CUL.05	0+530 m	Farm Access	611,091.1	893,789.5	1.2Ø	9.0
S1-CUL.06	0+105 m	L-6564 Connector	611,028.5	893,750.4	1.5Ø	21.8
S1-CUL.07	0+270 m	L-6564 Connector (Farm Access)	610,964.8	893,601.1	1.5Ø	15.2
S1-CUL.08	0+355 m	L-6564 Connector	610,950.2	893,514.2	2.5 x 2.2	27.9
S1-CUL.09	0+220 m	Mainline 1.2	611,008.4	893,484	1.8Ø	37.4
S1-CUL.10	0+208 m	L-2794 Connector	611,121.6	893,424.5	2.5 x 2.5	34.8
S1-CUL.11	0+200 m	L-2794 Connector (Farm access)	611,186.9	893,459.5	2.75 x 2.25	6.9
S1-CUL.12	0+060 m	L-2754 Connector (Farm Access)	613,055.9	895,453.8	1.8 x 1.8	18.3
S1-CUL.13	0+155 m	L-2754 Connector	613,070	895,329.3	2.5 x 1.8	26.7
S1-CUL.14	0+335 m	L-2734 Connector (Domestic Access)	613,843.1	896,090	6.0 x 2.5	8.5
S1-CUL.15	4+800 m	Mainline 1.2	614,244.5	896,588.4	1.2 Ø	110.5
S1-CUL.16	0+830 m	L-2724 Connector	614,254.4	896,181.4	1.2Ø	81.9
S1-CUL.17	0+895 m	L-2724 Connector (Farm Access)	614,279.3	896,114.1	1.2Ø	13.9
S1-CUL.18	0+680 m	N15 Primary Road Connector	615,370	897,660	1.5Ø	33.1
S1-CUL.19	0+680 m	LX-1004	616,047.2	897,558.8	2.8 x 2.1	25.1
S1-CUL.20	0+470 m	LX-1004 (Farm Access)	615,975.8	897,356.4	2.8 x 2.1	12.3
S1-CUL.21	1+610 m	N15	616,046.8	897,083	3.5 x 2.1	56.7

Culvert Reference	Chainage	Referenced Mainline / Side Road	Location X	Location Y	Culvert Diameter (m) / Width (m) x Height (m)	Approx. Length (m)
		Primary Road Connector				
S1-CUL.22	1+765 m	N15 Primary Road Connector	616,174.8	896,976.5	4.5 x 2.2	56.5
S1-CUL.23	2+195 m	N15 Primary Road Connector	616,490	896,688	1.2Ø	84.4
S1-CUL.23A	1+650	N15 Primary Road Connector	616543.7	896551.0	1.2Ø	78.9
S1-CUL.24	2+445	N15 Primary Road Connector	616571.4	896458.1	1.2Ø	86.9
S1-CUL.25	0+375	L-2714 Connector (Farm Access)	616599.0	896194.1	5.0 x 4.5	76.6
S1-CUL.26	0+250	L-2714 Connector	616702.0	896291.7	1.5Ø	7.8
S1-CUL.27	3+175	N15 Primary Road Connector	616362.5	895774.7	1.5Ø	32.0
S1-CUL.28	0+155	Mullaghagarry at N15 Treanamullin Tie-in	616597.4	895195.3	Twin culverts 2.3 x 2.7 each	34.0
S1-CUL.29	7+920	Mainline 1.2	616041.7	899079.3	1.5Ø	73.5
S1-CUL.30	0+505	L-6674 Connector	616076	899417.5	2.4 x 2.1	87.2
S1-CUL.31	0+025	LX-1011 Connector	616094.4	899720.4	4.5 x 2.2	45.4
S1-CUL.32	0+410	LX-1011 Connector (Farm Access)	616258.2	899361	1.8Ø	22.5
S1-CUL.33	0+615	L-6674 Connector	616139.1	899324.7	2.0 x 2.0	46.2
S1-CUL.34	0+310	L-6674 Connector	615927.5	899542.3	3.5 x 2	42.2
S1-CUL.35	n/a	LX-1004 (Cycleway)	615981.5	899607.2	3.5 x 2	26.9
S1-CUL.36	8+500	Mainline 1.2	616039.4	899660.4	3.5 x 2	30.7
S1-CUL.37	0+040	L-6674 Connector (Domestic Access)	615799.9	899767.1	1.5Ø	6.9
S1-CUL.38	0+095	L-6674 Connector	615841.1	899729.3	1.5Ø	20.0

3.3 Proposed Road Drainage Features

Table 3.3 below provides details of the road network associated with each outfall for Section 1. Drawing TT_MGT0337-RPS-P3-S1-DR-C-DR0001 (included in Section 6 of Design Report) provides the location of these drains. For the mainline carriageway a total of 7 no. drainage networks have been proposed, while for the side roads 16no. separate drainage network have been proposed. Road runoff from the drainage network will initially be discharged into 22 No. attenuation ponds and then into the existing natural watercourses via 22 No. outfalls. One drainage work for a side road will discharge into the infiltration pond in the absence of any surface watercourse in its vicinity. Figure 3.2 illustrates the locations of all outfalls.

Table 3.3 Carriageway Drainage Network Details

Drainage Network Ref.	Mainline / Side Road (No.)	Chainage	Outfall
S1-ML-DN-01	Mainline 1.2	6+220 to 8+550	Outfall 01
	L-7084 Connector	0+248 to 0+715	
	L-6674 Connector	0+475 to 0+612	
	Meenavoy Junction	0+000 to 0+227	
	Mainline 1.3	0+000 to 0+534	
	LX-1011 Connector		
S1-ML-DN-02	Mainline 1.2	5+857 to 4+600	Outfall 06
	L-2724 Connector	0+000 to 0+974	
S1-ML-DN-03	Mainline 1.2	4+600 to 3+250	Outfall 08
	L-2724 Connector	0+210 to 0+361	
S1-ML-DN-04	Mainline 1.2	3+250 to 2+267	Outfall 09
S1-ML-DN-05	Mainline 1.2	1+769 to 2+267	Outfall 10
	LX-1004	0+000 to 0+274	
	L-2794 Cappry Road Tie-in	0+000 to 0+222	
	Ballybofey Link Road	0+700 to 0+795	
S1-ML-DN-06	Mainline 1.2	0+965 to 1+769	Outfall 11
	L-2794 Cappry Road Tie-in	0+000 to 0+222	
	Ballybofey Link Road	0+000 to 0+700	
	Ballybofey NB Link	0+000 to 0+349	
S1-ML-DN-07	Mainline 1.2	0+000 to 0+965	Outfall 13
	L-6564 Connector	0+000 to 0+272	
	Dooish Junction	-	
	Mainline 1.1	0+358 to 0+530	
	L-6584 Connector	0+000 to 0+118	
S1-SR-DN-01	Mainline 1.3	0+227 to 0+592	Outfall 21
S1-SR-DN-02	L-6674 Connector	0+000 to 0+475	Outfall 02
S1-SR-DN-03	L-6674 Connector	0+612 to 0+840	Outfall 19
S1-SR-DN-04	L-7084 Connector	0+715 to 1+510	Outfall 22
S1-SR-DN-05	L-7084 Connector	0+000 to 0+248	Outfall 17
S1-SR-DN-06	Mainline 1.2	5+857 to 6+220	Outfall 03
	Teevickmoy NB Link	0+085 to 0+860	
	N15 Primary Road Connector	0+000 to 0+700	
	Teevickmoy SB Link	0+000 to 0+300	
S1-SR-DN-07	N15 Primary Road Connector	0+700 to 2+260	Outfall 15
S1-SR-DN-08	L-2714 Connector	0+220 to 0+438	Outfall 18
S1-SR-DN-09	L-2714 Connector	0+000 to 0+220	Outfall 16
	N15 Primary Road Connector	2+260 to 2+858	
S1-SR-DN-10	Treanamullin Tie-in	0+000 to 0+294	Outfall 04
	N15 Treanamullin Tie-in	0+000 to 0+160	
	Treanamullin Junction		
	N15 Primary Road Connector	2+858 to 3+086	
S1-SR-DN-11	N15 Treanamullin Tie-in	0+160 to 0+512	Outfall 05
S1-SR-DN-12	L-2734 Tie-in	0+000 to 0+357	Outfall 07
	L-2784 Connector	0+102 to 0+210	
S1-SR-DN-13	Ballybofey Link Road	0+795 to 1+964	Infiltration Pond 01
S1-SR-DN-14	L-6584 Connector	0+118 to 0+412	Outfall 20
S1-SR-DN-15	L-2794 Connector	0+000 to 0+271	Outfall 12
	LX-1001	0+000 to 0+223	
S1-SR-DN-16	Mainline 1.1	0+000 to 0+358	Outfall 14
	AR 1.41	0+000 to 0+235	
	L-6564 Connector	0+272 to 1+619	

4 FLOOD RISK ASSESSMENT

4.1 General

Flood risks to the proposed road scheme have been investigated by reviewing all available historical flood information and any flood maps prepared for the study area under any previous flood studies (source: www.floodinfo.ie). Further to this, a detailed flood risk assessment was also carried out through a detailed hydrological assessment and hydraulic modelling of the relevant watercourses.

The FRA has been undertaken in accordance with The Planning System and Flood Risk Management – Guidelines for Planning Authorities (Dept. of the Environment, Heritage and Local Government and The Office of Public Works, Nov 2009).

The following sources of records have been collected and reviewed to identify any existing flood risk to the proposed development site area and its vicinity:

- 6" & 25" OSi historical maps for the Sligo Area,
- Historic flood maps and reports from (www.floodmaps.ie),
- OPW and EPA Hydrometric Data (http://www.opw.ie/hydro/index.asp?mpg=main.asp; http://hydronet.epa.ie/hydronet.html),
- The National Preliminary Flood Risk Assessment (PFRA) – Overview Report & Indicative Flood Maps (OPW, March 2012, www.cfram.ie),
- North-Western CFRAM Study Reports (www.floodinfo.ie),
- Strategic Flood Risk Assessment, Donegal County Development Plan 2024 – 2030, August 2023.
- Groundwater Flood Maps, Geological Survey of Ireland (www.gsi.ie)
- Met Eireann rainfall records (www.meteireann.ie),
- Irish Coastal Protection Strategy Study Report– North West Coast (OPW, November 2013)
- Irish Coastal Wave and Water Level Modelling Study (OPW, 2018)

4.2 Existing Hydrological Environment

The proposed route for Section 1 lies within the River Foyle Catchment and forms part of the National Hydrometric Area -01. The major sub-catchments within this area are the River Finn and River Deele catchments. There are a significant number of existing streams and rivers that the proposed road traverses along its route.

The Finn catchment is a medium to large sized catchment (502km^2) with a mixture of peat, pasture and forest coverage. The study area is affected by a number of tributaries of the Finn with catchments ranging in size from 2km^2 to 26km^2. The largest of these is the Daurnett Burn which flows from the southwest of the study area. The tributaries largely emanate from farmland within the Finn Valley, although the Daurnett Burn represents a more upland catchment with a fair degree of peat land coverage.

The River Deele is a medium sized catchment (134 km^2) that forms part of the greater Foyle Catchment and originates in the hilly area to the west of the village of Convoy. The catchment is largely agricultural land with some peat and forest land coverage.

Figure 4.1 shows the River Finn and River Deele catchments extents along with their tributaries.

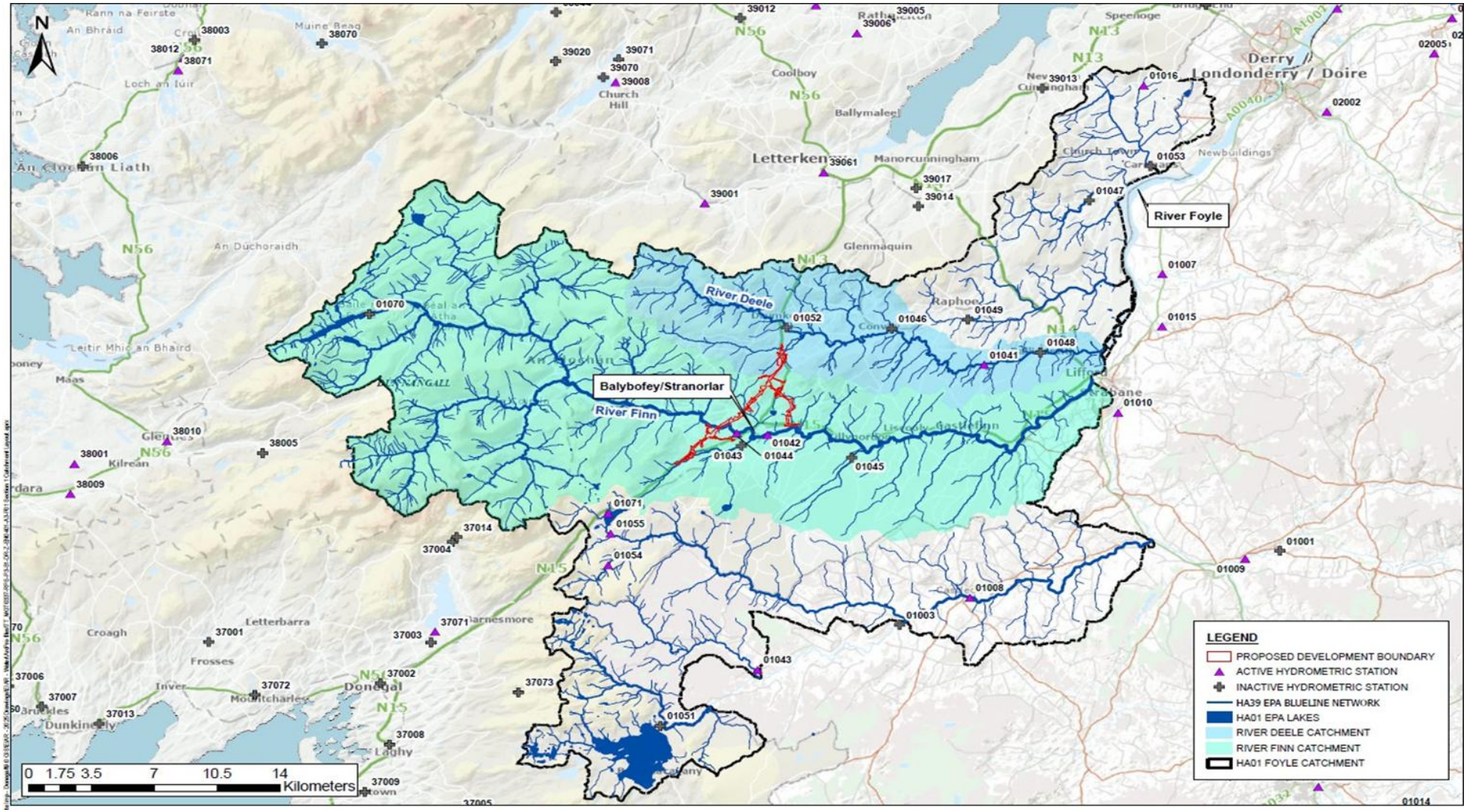

Figure 4.1 River Finn and River Deele catchments extents

4.3 Stage 1 – Identification of Sources of Flooding

The Stage 1 FRA identified the existing information pertinent to flood risk along the proposed road route. The information used to inform this assessment includes historical mapping and indicative sources relating to previous predictive flood studies and risk assessments.

4.3.1 Flood History

OPW Flood Hazard Mapping

The Flood Hazard Mapping Website (www.floodmaps.ie) is a record of historic flood events maintained by the OPW. The data available was reviewed in order to obtain information on recorded flood events within the study area. There were several instances of flooding reported in the Ballybofey-Stranorlar area but none of these events coincide with the proposed road extent (see Figure 4.2). Table 4.1 summarises the four instances of flooding recorded within a 2 km radius. All are located downstream of the proposed road crossings. The road will pass over River Finn and through the flood extent for this waterbody (Figure 4.3).

It is apparent from the recorded flood history that the River Finn frequently floods its banks. There are no recorded instances of flooding at the proposed crossing. FloodInfo.ie can be interrogated for further flood reports and press articles. It is important to note that the area of the proposed flood crossing is less densely populated than downstream areas at Ballybofey / Stranorlar and vulnerable receptors may be at a higher level than areas that flood so flood events may have escaped identification and reporting.

Table 4.1 River Finn Crossing - Summary of Historical Flood Events provided by Floodinfo.ie

Flood ID	Location	Date(s) of Report(s)	Recorded date of occurrence	Frequency	Description
4188	Trusk Rd / Townview Heights, Ballybofey	13/01/2006	N/A	Annual	Runoff from high ground causes flooding every year after heavy rain. The road is liable to flood, and properties are affected. Surface water system is unable to cope with the volume of water.
4176	Navenny Bridge, Ballybofey	26/09/1985 06/02/1995 13/01/2006 26/11/2006 01/05/2005	20/09/1985-21/09/1985	Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.
232 2373 2434	Ballybofey Bridge downstream	26/09/1985 06/02/1995		Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.
12741	St. Mary's National School, Stranorlar	12/01/2017	05/12/2015-06/12/2015	N/A	Flooding at St Marys NS Stranorlar Co. Donegal 5th-6th Dec 2015. Report prepared by CFRAM consultant

The winter of 2015/2016 saw exceptional and widespread flooding due to prolonged intense rainfall in Ireland. The floods recorded across the country during the winter of 2015/2016 are believed to be the worst on record. This holds true for the River Finn catchment where the catchment experienced the highest flow ever recorded at Ballybofey hydrometric station 01043 on 15 November 2015 and the second highest flow ever recorded at the station on 05 December 2015. The annual maximum flow recorded in 2015 is an outlier when compared to other annual maxima data fitted to the statistical distribution curves. The return period for the two floods recorded in November (568.75 m3/s) and December 2015 (555.42 m3/s) have proven to be in excess of the predicted 100-year flood.

The low-lying floodplains of the River Finn and Mullaghgarry River, particularly at their confluence, generally floods every year during the winter months. The causes of flooding are due to high water levels in River Finn and the flow-backup caused in the Mullaghgarry River as a result of this.

Figure 4.2 Historical Flood Points

OSI Historical Mapping:

Ordnance Survey of Ireland (OSi) historical maps were interrogated for any evidence of historical flooding. Both the 6 inch and 25 inch Cassini historical maps do not illustrate any evidence of flooding in the past in the vicinity of the proposed road.

Historical Groundwater Flooding:

There was no historical groundwater flooding identified along the proposed Section 1 road route.

4.3.2 Predictive Flooding

OPW CFRAM Study and National Indicative Fluvial Mapping (NIFM):

Ballybofey / Stranorlar has been identified as an Area for Further Assessment (AFA) in the OPW Preliminary Flood Risk Assessment (PFRA) in 2012. Under the Northwest -Neagh Bann CFRAM study (OPW, 2016) flood levels in all high priority watercourses (River Finn & Backlees), located within this AFA were estimated through a detailed hydrological and hydraulic modelling. Also, under the OPW National Indicative Fluvial Mapping (NIFM) Project (2020), predictive flood extent maps were produced for all watercourses with catchment area greater than 5 km2, and for which flood maps were not produced under the National CFRAM Programme. For example, the Cloghroe river channel at the proposed section 1 road crossing was not modelled under the CFRAM study, however, predictive flood extent maps were prepared for this watercourse under the NIFM study.

The above studies showed that the proposed Section 1 road route crosses / encroaches the 0.1%AEP flood extents at a number of locations as listed in Table 4.2. Figure 4.3 illustrates these flood extents for the current climatic condition.

Table 4.2 Section 1 Road Route- Predictive flood risks (CFRAM & NIFM Studies)

EPA Name	Watercourse Segment Code	Crossing/ Encroachment	Flood risk details
(Burn) Daurnett	01_1815	Crossing & Encroachment	Proposed tie in with the existing N15 at Ch0+340 is located in close vicinity the CFRAM study estimated 1%AEP flood extent of the (Burn) Daurnett River (between Ch. 0+200 & Ch.0+350) (CFRAM) Also proposed southern tie in road embankment with the existing N15 road crosses the 1%AEP flood extent estimated under the NIFM study. This road crosses the stream segment 01_1026, a tributary of (Burn) Daurnett.
Finn	01_7147 01_590 01_591	Crossing & Encroachment	The main line crosses the River Finn where there is also a considerable encroachment on the CFRAM study estimated 0.1% AEP flood extents (between Ch2+350 and Ch3+000).
Aghasheil	01_553	Crossing & Encroachment	Proposed underpass for R252 of main line crosses the Aghasheil stream while also encroaching upon the 0.1% AEP flood extents (CFRAM).
Backlees	01_186	Crossing	The mainline 1.2 crosses the Backlees stream with slight encroachment on the CFRAM study estimated 0.1% AEP flood extent. of the 0.1% of road embankment.
Mullaghagarry	01_67, 01_68	Crossing & Encroachment	A local access/link road to the primary N15 link road crosses/encroaches the CFRAM study estimated 0.1%AEP flood extents at Ch. 2+050 of primary N15 link road.
Mullaghagarry	01_776	Crossing & Encroachment	The proposed tie in road and roundabout with existing N15 crosses/encroaches upon the CFRAM study estimated 0.1%AEP flood extents (between Ch0+00 & Ch0+250).
Cloghroe 010	01_1796	Crossing & Encroachment	The NIFM shows that the proposed tie in with the existing N13 road crosses the 1%AEP flood extents and also road embankment and roundabout is located within the 0.1% AEP extents.

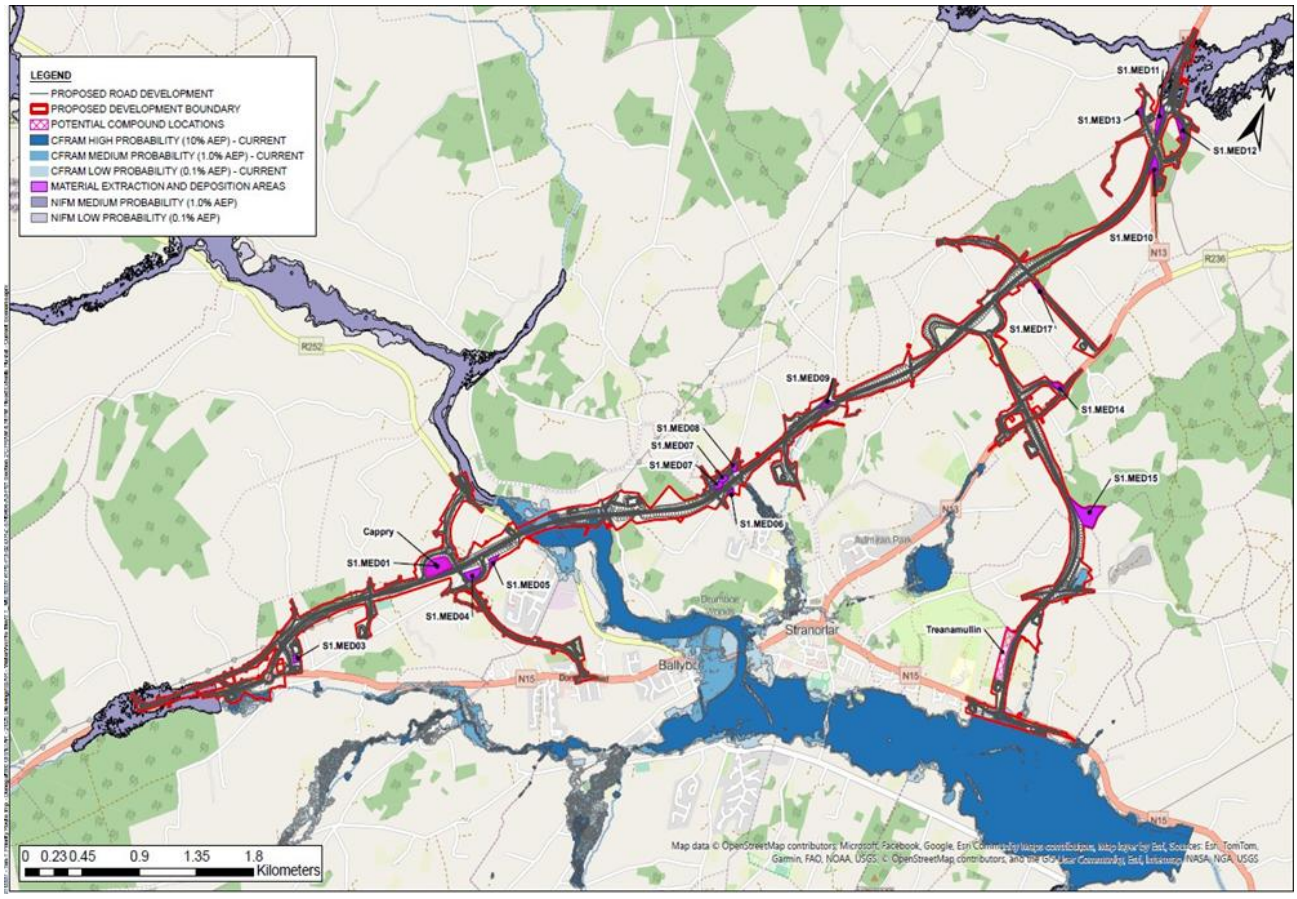

Figure 4.3 CFRAM and NIFM Flood Extent Map (Fluvial – Current Scenario)

Strategic Flood Risk Assessment (SFRA), County Donegal Development Plan 2024 - 2030:

Under the County Donegal Development Plan 2024-2030 a Strategic Flood Risk Assessment were prepared in accordance with the requirements of "*The Planning System and Flood Risk Assessment Guidelines for Planning Authorities (2009) Circular PL02/2014 (August 2014)*". In this SFRA, flood zone maps were prepared for all planning areas. These flood zones were derived from the North-Western Neagh Bann CFRAM and ICWW studies predicted flood maps. **Figure 4.4** presents the flood zone maps prepared under this SFRA along the proposed Section 1 road route and in its vicinity. It can be seen from this map that much of the road route of Section 1 is located in Flood Zone C, however the low-lying floodplains of the River Finn and its tributaries are zoned as Flood Zone A & B. The proposed road embankments will encroach this flood prone areas at the relevant bridge crossing (see **Figure 4.4**). Also based on the NIFM map the proposed road embankment will also encroach the Cloghroe River floodplain in the vicinity of its intersection with N13. This river is a tributary of River Deele. Further to this, the proposed N15 link road will also encroach the River Finn and Mullaghagarry River's floodplains, at it's tie-in location with N15 at Treanamullin (east of Stranorlar).

A detailed flood risk assessment at all of the above-mentioned river crossings was carried out as part of this Ten -T project, details of which are provided in Section 4-5. Appropriate mitigations measures were also proposed to deal with any potential flood risks to any adjacent lands and properties.

Further to this, Donegal County Council in conjunction with OPW are currently implementing the Ballybofey / Stranorlar Flood Relief Scheme. This scheme is currently at Scheme Development Stage (Stage 1). The existing flooding problems within the scheme area will be resolved under this scheme.

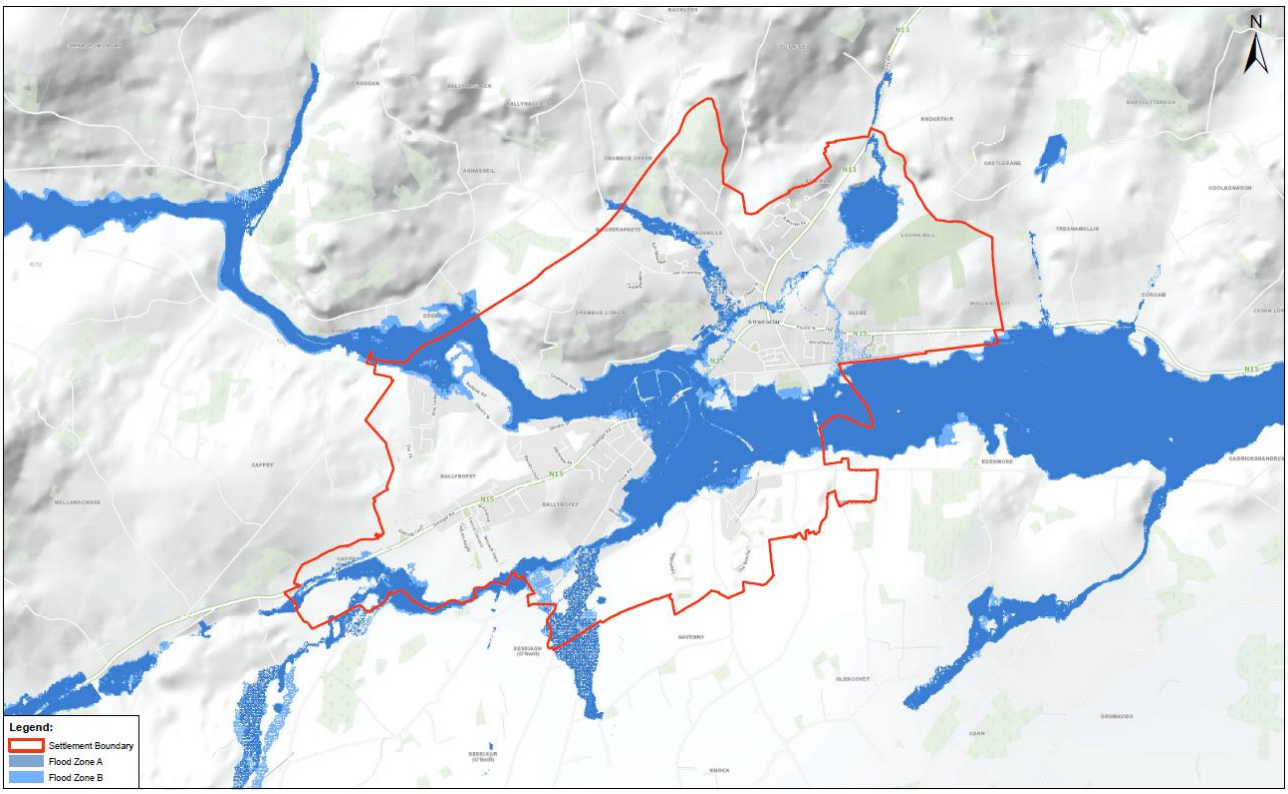

Figure 4.4 Flood Zone Maps prepared under the 2024 SFRA

4.4 Stage 2 - Initial Flood Risk Assessment

This Stage 2 assessment investigated in more detail the flood risk implications for the proposed road development from available sources. It was carried out to confirm sources of flooding that could affect the development, and to appraise the adequacy of existing information and to scope the extent of the risk of flooding.

The North-Western CFRAM has generated flood zone mapping which have been deemed suitable as a Stage 2 Initial Flood Risk Assessment. The SFRA examined the Flood Zones A, B and C identified in the North- Western / Neagh Bann CFRAM study. This flood risk information enabled the application of 'The Guidelines' sequential approach, and where necessary the Justification Test, to appraise locations where the proposed road traversed the flood zones.

By the nature of transport infrastructure the crossing of watercourses (rivers and floodplains) are often unavoidable as the purpose is to link lands that are likely to be separated by a number of watercourses. A sequential approach have been adopted in respect to a route selection process for the project which takes into account many environmental factors which include flood risk and hydrology in order to select the most suitable route.

Flood extents maps for the River Finn and most its tributaries were prepared under the North-Western Neagh Bann CFRAM studies through a detailed hydrological and hydraulic modelling of the associated watercourses. These flood extents maps were used in deriving flood zones maps in 2024 SFRA. These flood maps show that much of the road route of Section 1 is located in Flood Zone C, however the low-lying floodplains of the River Finn and its tributaries are zoned as Flood Zone A & B. The proposed road embankments will encroach this flood prone areas at the relevant bridge crossing. NIFM shows the proposed southern tie-in embankment to the N15 crosses the 1% AEP flood extent of Burn Daurnett river. The proposed tie-in to the N13 likewise crosses the 1% AEP of Cloghroe river, and the embankment and roundabout lie within the 0.1% AEP extents. Further to this, the proposed N15 link road will also encroach the River Finn and Mullaghagarry River's floodplains, at its tie-in location with N15 at Treanamullin (east of Stranorlar).

The above mentioned CFRAM study prepared flood maps can be used reliably in assessing the initial flood risk for the proposed road section where it exists. However, any impacts of the proposed road scheme on the existing flooding regime cannot be assessed without doing a further detailed flood study. Further to this NIFM flood maps are very indicative, which are only recommended for Stage 1 FRA use.

In the above contexts a Stage 3 -Detailed Flood Risk Assessment are carried out in order identify any risks to the proposed road development and also to assess any impacts of the proposed development on any existing flooding risk to any lands and properties.

4.5 Stage 3 - Detailed Flood Risk Assessment

The extents of the CFRAM mapping and the NIFM (National Indicative Fluvial Mapping) in the vicinity of the proposed route shows that there are locations where the proposed route impacts on the flood events modelled as part of these studies. Where considered necessary, more detailed flood studies have been carried out as part of the Schemes Flood risk Assessment for Section 1. Table 4.3 below shows these locations.

Table 4.3 Road Route Predictive Flood Risks

Chainage	River	Flood Source	Description of Flood Risk
Mainline 1.2: Ch. 2+350 to 3+000	Fluvial	River Finn	The main line crosses the River Finn where there is also a considerable encroachment on the CFRAM study estimated 0.1% AEP flood extents (between Ch2+350 and Ch 3+000) A detailed flood risk assessment has been carried out to size the bridge and determine the impact on the flood plain.
Mainline 1.2 Ch.4+100	Fluvial	Backlees	The mainline crosses the Backlees stream with slight encroachment on the CFRAM study estimated 0.1% AEP flood extent. of the 0.1% of road embankment. A detailed flood risk assessment has been carried out to size the bridge and determine the impact on the flood plain.
Mainline 1.3 Ch.0+300 to 0+592	Fluvial	Cloghroe	The NIFM shows that the proposed tie-in with the existing N13 road crosses the 1%AEP flood extents and also road embankment and roustabout is located within the 0.1% AEP extents. A detailed flood risk assessment has been carried out to size the bridge and determine the impact on the flood plain.
N15 Link Road: Ch. 2+050	Fluvial	Mullaghgarry	A local access/link road to the primary N15 link road crosses/encroaches the CFRAM study estimated 0.1%AEP flood extents at Ch. 2+050 of primary N15 link road. Also The proposed tie in road and roundabout with existing N15 crosses/encroaches upon the CFRAM study estimated 0.1%AEP flood extents (between Ch0+00 & Ch0+250). A detailed flood risk assessment has been carried out to determine the impact on the existing flood risks in the area.

4.5.1 River Finn Bridge Crossing

The proposed River Finn crossing is located at CH2400 on the Section 1 main alignment and stretches from the townland of Cappry to the south of the River Finn to Drumboe Lower to the north of the river. In order to span the flood levels of the River Finn and the River Finn SAC, the approaching routes to the proposed structure are in fill. The proposed route also crosses the Drumboe Lower tributary to the River Finn in this area at CH3050. It is a 360 long 7-span bridge, spanning over the main channel and associated floodplains. The largest span is 85m long clearly spanning over the main channel.

It is apparent from the North – Western Neagh Bann CFRAM Study that the low-lying floodplains of River Finn at the proposed bridge crossing are predicted to be liable to flooding from 1% AEP &).1%AEP flood events. Some part of the northern approach road embankment will pass through these floodplains as can be seen in Figure 4.5.

A detailed flood study was carried out in order to determine any flood risks to the proposed bridge crossing and associated approach road and also to assess any impacts of the proposed works on the existing flooding regime in the vicinity. The flood study report is included in Appendix A. A summary of this flood study is provided below:

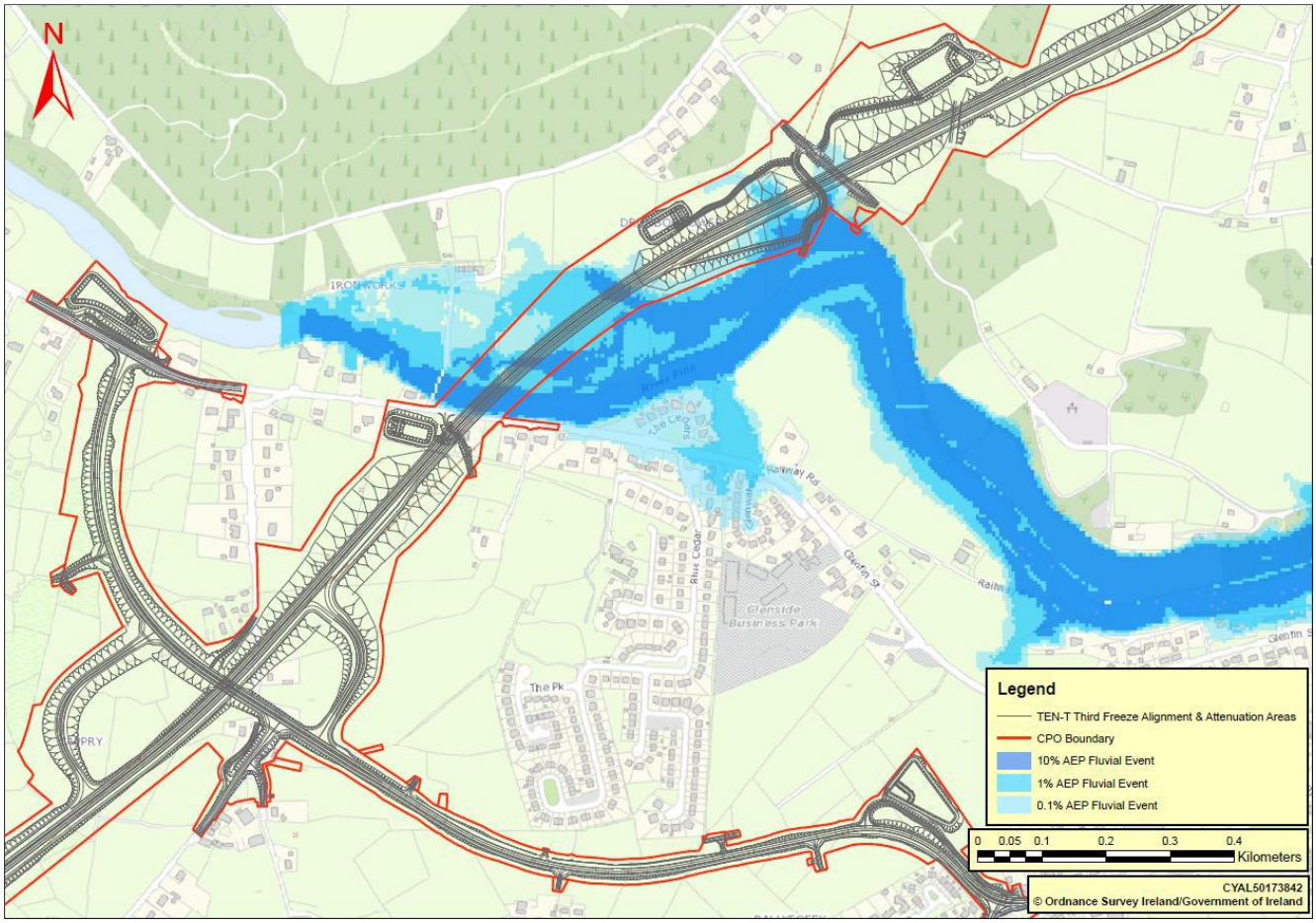

Figure 4.5 River Finn Crossing - CFRAM current fluvial flood extents with proposed route alignment

- The CFRAM flood maps indicate that there are works proposed that encroach upon a portion of the 0.1%, 1% and 10% AEP flood extents predominantly at the low-lying lands surrounding the River Finn confluence with the Drumboe Lower watercourse.
- A steady 1D model was built using HEC-RAS software in order to produce flood water levels for the

100-year design flood event inclusive of climate change at the proposed crossing. The model geometry for the existing scenario was modelled using topographical cross-section survey data provided by Murphy Surveys in September 2020. The cross-sections were imported into HEC-RAS and suitable manning coefficients were applied for the main channel (0.035) and the overbanks (0.05). The existing bridge at Mill Cottage was built into the model using the bridge data editor.

- The hydrological inputs to the model were determined using the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). The Qmed gauged value at Ballybofey hydrometric station 01043 was brought forward for design flow estimates due to lack in confidence in the Qmed PCD calculated at the FSU ungauged node at the proposed crossing. The flood growth factors were developed using pooling group analysis and a GLO distribution was selected. A Climate Change consideration of 20% in line with Mid-Range Future Scenario (MRFS) climate projections was included in the design peak flow as recommended in OPW Section 50 guidance documents.

- The model output design water levels at the upstream and downstream face of the proposed river crossing are 21.68 MOD and 21.47mO. This bridge has approximately 7.14 m freeboard over the 1%AEP flood level.

- The proposed scenario was modelled in order to assess the impacts of the proposed bridge on the flood levels in the River Finn. The proposed bridge was incorporated into the model and the increase in flood level in the River Finn for the proposed scenario was imperceptible.

- No mitigation proposed as the crossing completely spans the River Finn.

- The hydraulic model has been constructed using topographical survey and hydrological inputs were determined using the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). The model could not be calibrated to the downstream hydrometric gauge as the topographical survey did not extend to that reach of the River Finn. Manning ‘n’ channel and floodplain roughness parameters were estimated using survey photographs.

A Section 50 Application for the above-mentioned Finn River bridge crossing was submitted to OPW.

4.5.2 Backlees River Bridge Crossing

The mainline Section 1 road crosses the Backlees river at CH4150. A 45 m long single span bridge is proposed at this location. Based on the CFRAM study prepared flood map, the approach road to this bridge slightly encroaches the 1%AEP and 0.1%AEP flood extents.

A detailed flood risk assessment for this bridge crossing was carried out to determine any flood risks to the proposed bridge crossing and associated approach road and also to assess any impacts of the proposed works on the existing flooding regime in the vicinity.

Backlees river is a tributary river of River Finn. It has an approximate catchment area of 4.98 km2 upstream of the subject bridge crossing. The estimated 1% AEP design peak flood flow for this river catchment is 20.77 m3/s (inclusive of 20% climate change allowance). This design flow has been estimated using the FSU recommended method. Further details of this flow estimates are provided in Appendix C.

The hydraulic sizing of this bridge crossing was carried out through a building a HEC-RAS hydraulic model for the associated river channel. Figure 4.6 shows an extract of the 1%AEP flood profile through the bridge crossing. The bridge soffit level is at 67.10 mOD. The estimated maximum 1%AEP flood level at the upstream vicinity of the bridge crossing is 63.35mOD, suggesting an available freeboard of 3.75m. The estimated net head loss through the bridge crossing is in the order of 200mm.

A Section 50 Application for the above-mentioned Backlees bridge crossing was submitted to OPW (see Appendix C).

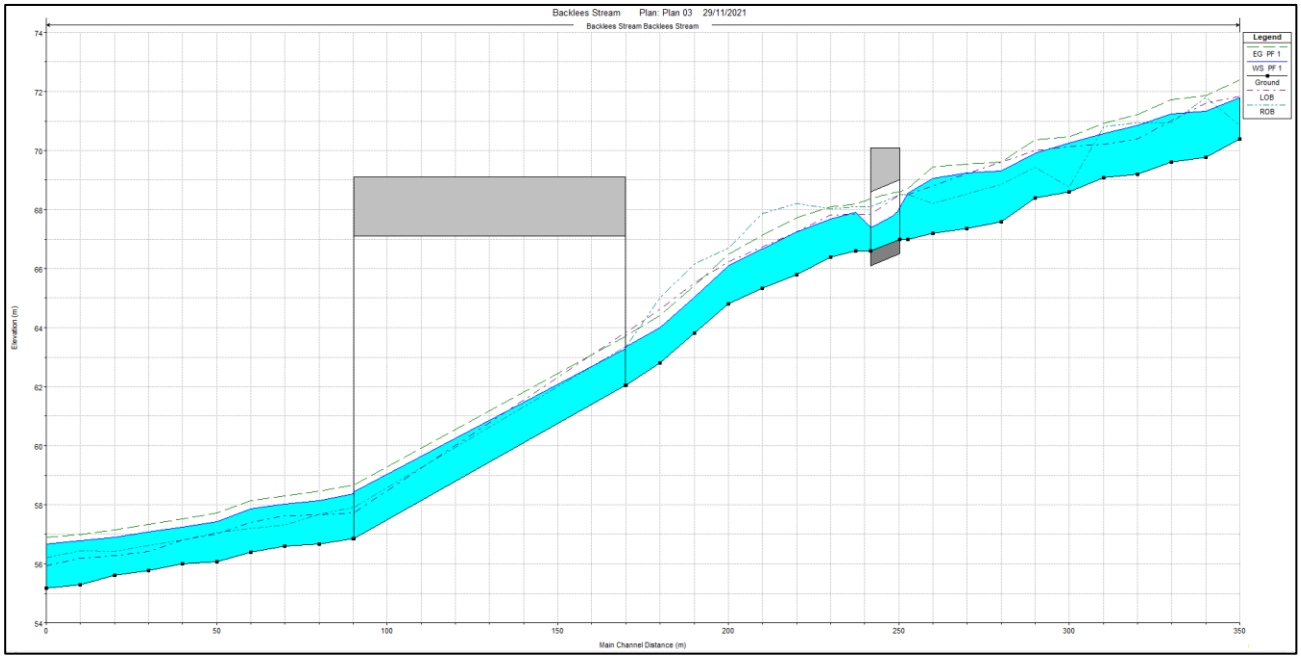

Figure 4.6 Backlees River - 1%AEP flood profile

There is no increase in flood risk, the peak flow is contained by the bridge. There is no significant change of the current hydraulic characteristics and dynamics of the river system.

4.5.3 Cloghroe River Bridge Crossing

The mainline Section 1 road crosses the Clogroe river at CH0300 on the N13 Tie-in Road. An 18 m long single span bridge is proposed at this location. The NIFM study prepared flood maps showed that the proposed tie-in with the existing N13 road crosses the 1%AEP flood extents and also the road embankment is located within the 0.1%AEP flood extent.

A detailed flood risk assessment for this bridge crossing was carried out to determine any flood risks to the proposed bridge crossing and associated approach road and also to assess any impacts of the proposed works on the existing flooding regime in the vicinity.

Cloghroe river is a tributary river of River Deele. It has an approximate catchment area of 10.75 km2 upstream of the subject bridge crossing. The estimated 1% AEP design peak flood flow for this river catchment is 51.08 m3/s (inclusive of 20% climate change allowance). This design flow has been estimated using the FSU recommended method. Further details of this flow estimates are provided in Appendix C.

The hydraulic sizing of this bridge crossing was carried out through a building a HEC-RAS hydraulic model for the associated river channel. Figure 4.7 shows an extract of the 1%AEP flood profile through the bridge crossing. The bridge soffit level is at 78.72 mOD. The estimated maximum 1%AEP flood level at the upstream vicinity of the bridge crossing is 78.37mOD, suggesting an available freeboard of 350mm.

A Section 50 Application for the above-mentioned Cloghroe bridge crossing was submitted to OPW (see Appendix C).

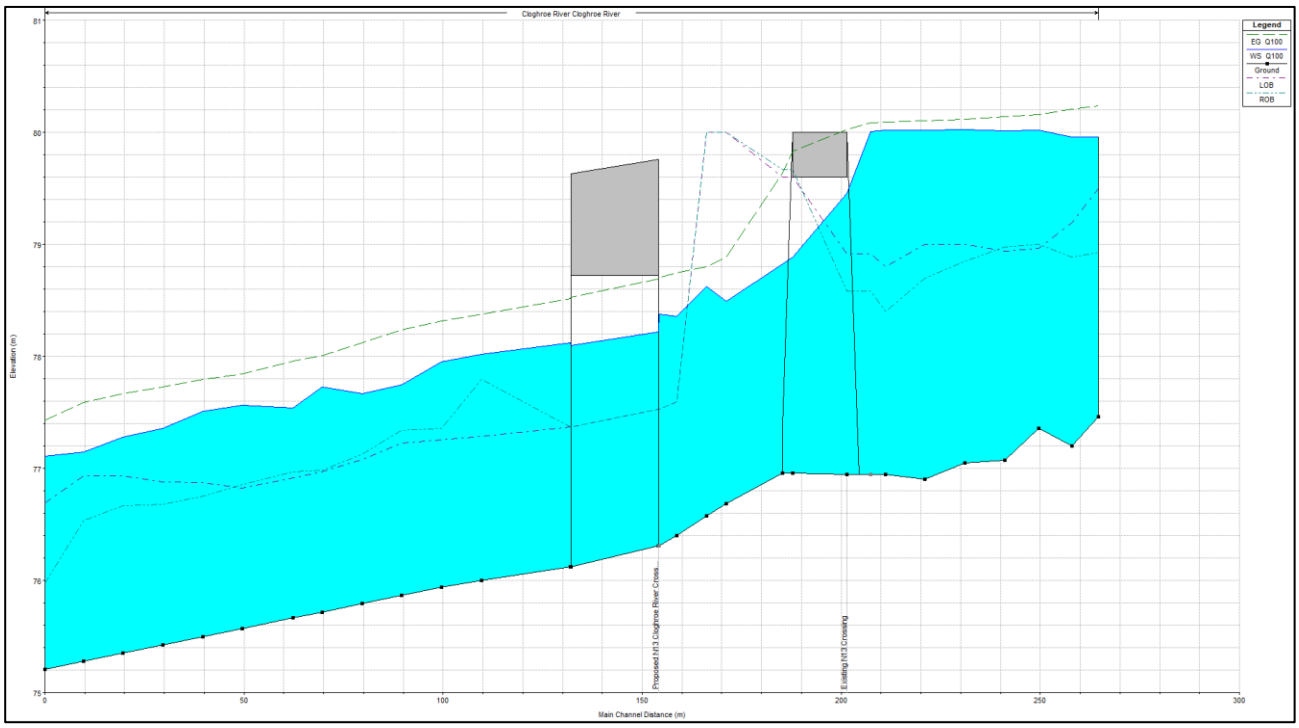

Figure 4.7 Cloghroe River - 1%AEP flood profile

4.5.4 Mullaghgarry River Crossing at Stranorlar

The proposed Section 1 road route redirects the existing N15 Sligo-Lifford national primary road from the townlands of Meencargagh and Dooish in a north-easterly direction across the River Finn upstream of Ballybofey & Stranorlar to the townlands of Teevickmoy, Meenavoy and Callan where the proposed route joins the existing N13 Stranorlar-Derry national primary road. There is also a second link road from the proposed main alignment to the existing N15. The link road crosses the River Mullaghagarry approximately 50m downstream /south side of the Existing N15 crossing at Treanamullin.

It is apparent from the recorded flood history in the OPW floodinfo website (www.floodinfo.ie) and also from local sources that the low-lying floodplains of River Finn and Mullaghagarry River flood every winter (approximately 4 to 5 times). The worst flooding occurred in the area in December 2015.

A detailed flood study was carried out in order to determine any flood risks to the proposed link road and also to assess any impacts of the proposed road works on the existing flooding regime in the vicinity. The flood study report is included in Appendix B. A summary of this flood study is provided below:

- The low-lying floodplain of Mullaghagarry River, in the vicinity of the proposed road crossing, is liable to flooding mainly from the high-water level in River Finn. This high-water level in River Finn causes significant backwater effect to the upstream catchment flow of Mullaggarry River.

- The Mullaghgarry River is ungauged, the design flood flow for this river catchment has been estimated in accordance with FSU recommended methods for ungagged catchments. The estimated 1%AEP peak flow at the proposed road crossing is 15.41 m^3/s inclusive of future climate change allowance of 20%.

- The 1%AEP flood level at the subject bridge crossing has been estimated through building an unsteady HEC-RAS hydraulic model (1D). The model geometry has been obtained from the topographical survey info procured under the TEN-T project.

- The HEC-RAS model simulation showed that the existing river channel and the bridge/culverts do not

have adequate capacity to convey the 1%AEP flood flow.

- Under the proposed design condition, i.e. with a double vent box culvert with a vent size of 2.3m (span) x
- 2.7m(high) each at the proposed road crossing along with some compensation storage associated with road embankment, the HEC-RAS model simulation showed an improved flooding scenario in the vicinity. The estimated freeboard above the predicted 1%AEP flood level at the upstream vicinity of the proposed bridge is in the order of 300 mm.
- Any increase in the flood level in the River Finn, south of the proposed road/existing railway embankment, is will be imperceptible due to the presence huge extent of River Finn floodplain in the immediate downstream vicinity of the Mullagharaggy River confluence.

A Section 50 Application for the above mentioned Mullaghgarry river culvert was submitted to OPW.

Figure 4.8 shows the HEC-RAS model simulated 1%AEP flood extent in the vicinity of the proposed N15 tie-in location. Figure 4.9 to Figure 4.11 show the proposed attenuation /compensation storage layout plan and Figure 4.12 shows the 1%AEP flood extent map for the proposed development condition with flood risk mitigation measures.

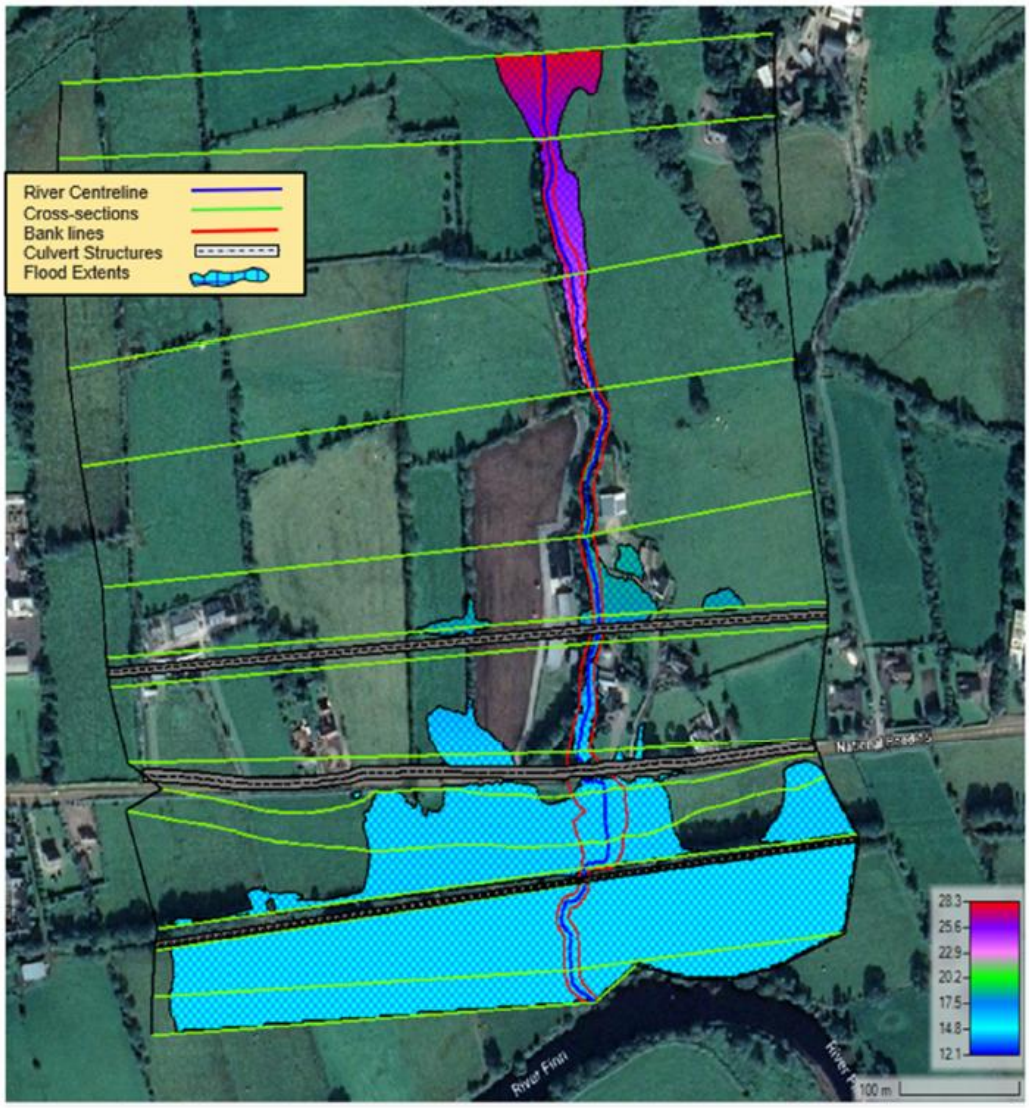

Figure 4.8 HEC-RAS model extent and 1%AEP flood extent for the existing condition

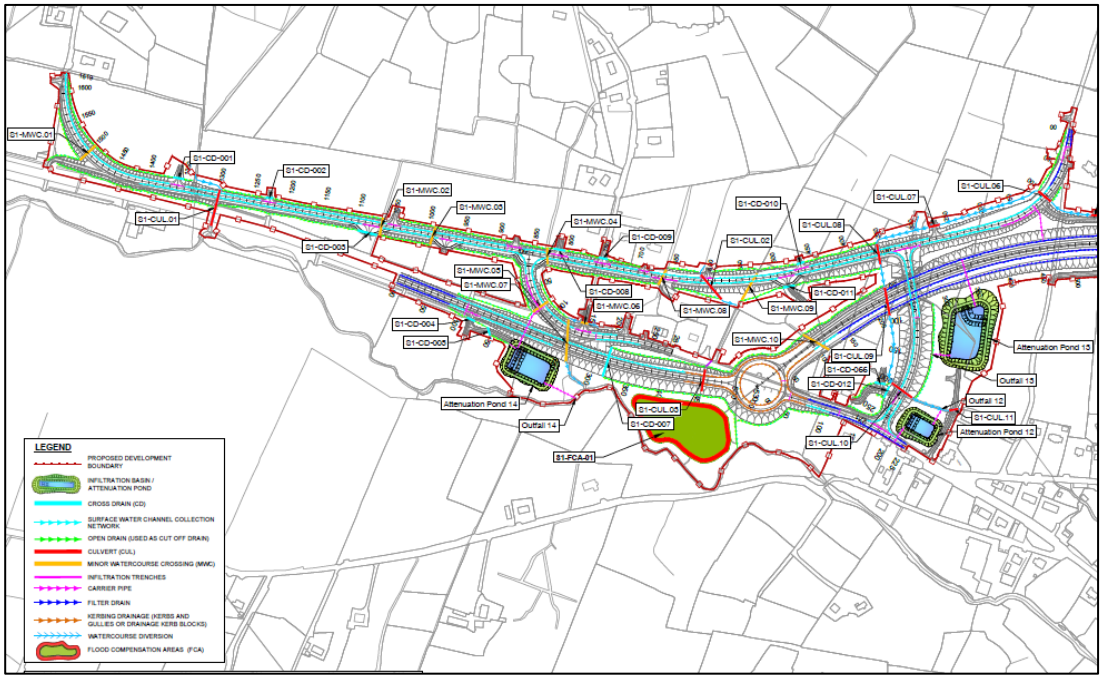

Figure 4.9 Locations of Flood Compensation/Attenuation Areas (FCAs) – 1 of 3

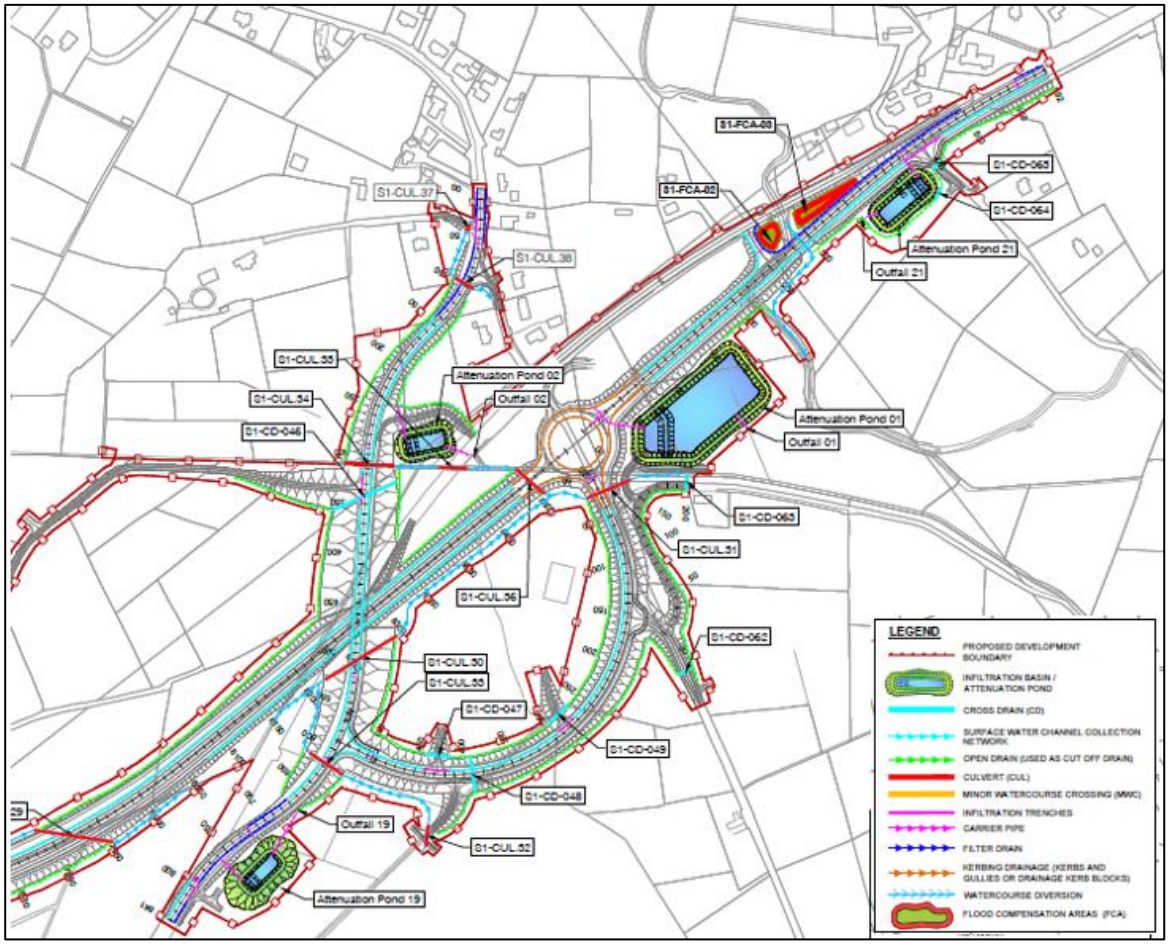

Figure 4.10 Locations of Flood Compensation/Attenuation Areas (FCAs)- 2 of 3

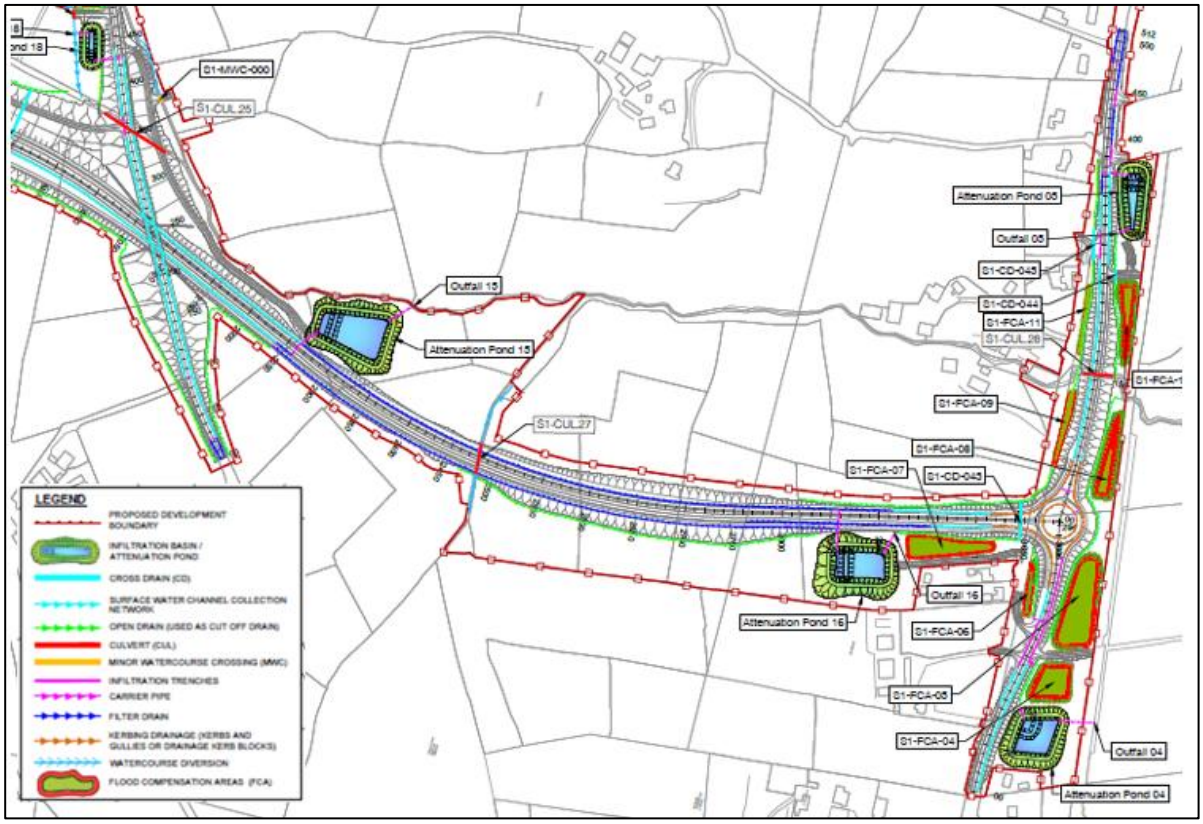

Figure 4.11 Locations of Flood Compensation/Attenuation Areas (FCAs)- 3 of 3

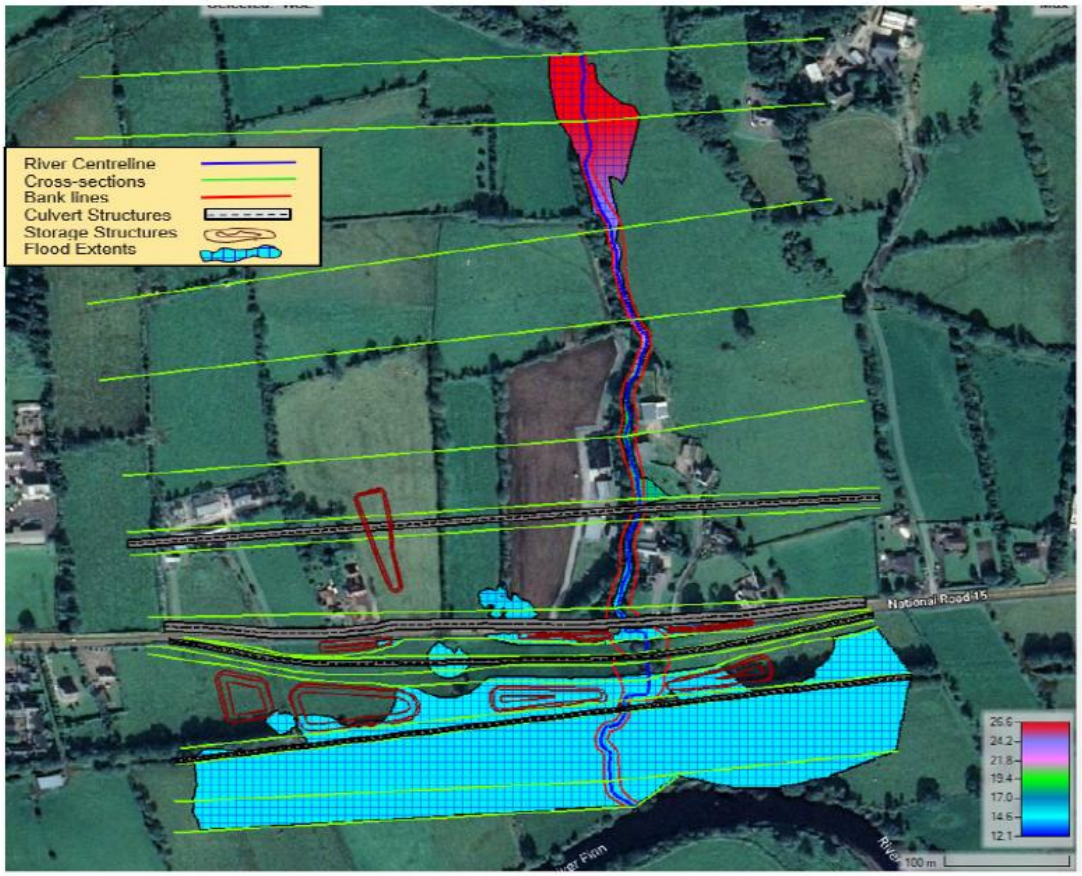

Figure 4.12 HEC-RAS model extent and 1%AEP flood extent for the proposed development condition

4.5.5 Culvert Crossings along Proposed Road

A Section 50 Application for all 39 culverts was submitted to OPW in accordance with the Section 50 of the Arterial Drainage Act, 1945, where the proposed road crosses an existing watercourse. This Section 50 Hydrology Report assessed the design flood for theses culverts, the existing and proposed flood levels and the potential impact on flooding by the proposed culverts and the proposed road. This report is included in Appendix C and a summary of the findings included below.

The design flood flow for each of the culverts is the 100-year return period flood flow with 20% Climate Change allowance. Where relevant the OPW arterial drainage scheme factor of 1.6 was used. In estimating the design flows the UK Institute of Hydrology Report 124 recommended method (IH 124) and the OPW FSU research recommended 3-Variable and 5-Variable methods were used. Refer to the Section 50 report provided in Appendix C for further details of the design flow estimation methods.

Most culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786. Culverts S1-CUL 14 and S1-CUL 28 were sized using HEC-RAS modelling software. A summary of the resulting calculation outputs and proposed culvert details are given in Table 2-12. Specific topographical channel surveys were conducted to provide the geometry information for the modelling exercise. Other sources of topographical information were used, including a lidar survey.

A summary of the results for each of the culvert references is presented below in Table 4.4 below.

Table 4.4 Proposed Culvert Sizes & Hydrological Calculation Outputs

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Culvert Diameter (m) / Width (m) x Height (m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:X)	Freeboard (m)	Net Head Loss (m)
S1-CUL.01	0.98	1,704.7	5.89	3.2 x 2	51.8	0.5	162.8	0.474	0.290
S1-CUL.02	0.02	1,704.7	0.254	1.2Ø	34.1	0.3	494.4	0.563	0.064
S1-CUL.03	0.05	1,704.7	0.462	1.2Ø	30.5	0.3	26.7	0.525	0.060
S1-CUL.04	0.14	1,704.7	0.66	1.2Ø	9.0	0.3	204.5	0.390	0.024
S1-CUL.05	0.14	1,704.7	0.66	1.2Ø	9.0	0.3	500	0.345	0.039
S1-CUL.06	0.25	1,704.7	1.13	1.5Ø	21.8	0.3	306.7	0.413	0.006
S1-CUL.07	0.25	1,704.7	1.13	1.5Ø	15.2	0.3	489.7	0.576	0.110
S1-CUL.08	0.52	1,681.5	3.35	2.5 x 2.2	27.9	0.5	20	0.900	0.297
S1-CUL.09	0.52	1,681.5	3.35	1.8Ø	37.4	0.3	23	0.353	0.124
S1-CUL.10	0.77	1,681.5	8.13	2.5 x 2.5	34.8	0.5	324.8	0.393	0.102
S1-CUL.11	0.77	1,681.5	8.13	2.75 x 2.25	6.9	0.5	285.8	0.319	0.297
S1-CUL.12	0.83	1,347.6	2.91	1.8 x 1.8	18.3	0.5	51.3	0.353	0.239
S1-CUL.13	0.83	1,347.6	2.91	2.5 x 1.8	26.7	0.5	177.8	0.515	0.284
S1-CUL.14	4.98	1,372.1	20.77	6.0 x 2.5	8.5	0.5	21.3	0.450	0.240
S1-CUL.15	0.21	1,704.7	0.69	1.2Ø	110.5	0.3	85.5	0.391	0.078
S1-CUL.16	0.21	1,704.7	0.69	1.2Ø	81.9	0.3	15.4	0.415	0.170
S1-CUL.17	0.21	1,704.7	0.69	1.2Ø	13.9	0.3	49.1	0.395	0.277

Culvert Ref	Catchment Area (km^2)	SAAR (mm)	Design Flow (Q_{100} + 20% CCA)	Culvert Diameter (m) / Width (m) x Height (m)	Length (m)	Depth of Embedment (m)	Culvert Gradient (1:X)	Freeboard (m)	Net Head Loss (m)
S1-CUL.18	0.32	1,704.7	1.1	1.5Ø	33.1	0.3	465.7	0.556	0.216
S1-CUL.19	1.52	1,289.4	7.02	2.8 x 2.1	25.1	0.5	62.3	0.320	0.158
S1-CUL.20	1.52	1,289.4	7.02	2.8 x 2.1	12.3	0.5	81.6	0.320	0.284
S1-CUL.21	1.74	1,289.4	7.95	3.5 x 2.1	56.7	0.5	99.5	0.410	0.270
S1-CUL.22	2.41	1,289.4	10.73	4.5 x 2.2	56.5	0.5	29.7	0.475	0.281
S1-CUL.23	0.17	1,704.7	0.47	1.2Ø	84.4	0.3	15.3	0.531	0.079
S1-CUL.23A	0.04	1,704.7	0.15	1.2Ø	78.9	0.3	42.3	0.722	0.042
S1-CUL.24	0.04	1,704.7	0.15	1.2Ø	86.9	0.3	28.2	0.618	0.042
S1-CUL.25	5.32	1,251.9	18.76	5.0 x 4.5	76.6	0.5	1,298.3	1.818	0.256
S1-CUL.26	0.23	1,704.7	0.83	1.5Ø	7.8	0.3	489.2	0.484	0.013
S1-CUL.27	0.26	1,704.7	0.85	1.5Ø	32.0	0.3	53.5	0.693	0.003
S1-CUL.28	5.88	1243	15.41	Twin culverts 2.3 x 2.7 each	34.0	0.3	10	0.300	
S1-CUL.29	0.5	1,260.3	1.76	1.5Ø	73.5	0.3	87.4	0.355	0.171
S1-CUL.30	1.64	1,260.3	5.27	2.4 x 2.1	87.2	0.5	76.4	0.440	0.139
S1-CUL.31	2.84	1,312.4	11.48	4.5 x 2.2	45.4	0.5	458.1	0.412	0.216
S1-CUL.32	0.92	1,260.3	3.09	1.8Ø	22.5	0.3	499.2	0.301	0.113
S1-CUL.33	0.92	1,260.3	3.09	2.0 x 2.0	46.2	0.5	502.6	0.346	0.068
S1-CUL.34	1.04	1,360.2	5.42	3.5 x 2	42.2	0.5	502.4	0.505	0.148
S1-CUL.35	1.04	1,360.2	5.42	3.5 x 2	26.9	0.5	498.2	0.485	0.078
S1-CUL.36	1.04	1,360.2	5.42	3.5 x 2	30.7	0.5	479.2	0.507	0.101
S1-CUL.37	0.21	1,704.7	1.39	1.5Ø	6.9	0.3	33.6	0.496	0.073
S1-CUL.38	0.21	1,704.7	1.39	1.5Ø	20.0	0.3	33.6	0.365	0.066

It can be seen from the above table that net headlosses are less than the OPW Section 50 Guidelines specified headloss of 300mm in all cases, and the available freeboards above the design flood levels are greater than the OPW Section 50 Guidelines specified freeboard of 300mm in all cases.

At all crossings encroachments within the watercourses floodplains have been minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss will be minimal. Furthermore, rock armours have been proposed at the inlets/outlets of all culverts in order to reduce any risk of scouring in the channel beds.

4.5.6 Road Drainage Outfalls and Attenuation Ponds

The proposed road development drainage solution involves the collection of pavement runoff and the discharge of this storm water to watercourses. For the mainline carriageway a total of 7 no. drainage networks have been proposed, while for the side roads 16no. separate drainage network have been proposed. Road runoff from the drainage network will initially be discharged into 22no. attenuation ponds and then into the existing natural watercourses via 22no. outfalls. One drainage work for a side road will discharge into the infiltration pond in the absence of any surface watercourse in its vicinity.

Attenuation features are sized for the 1 in 100year design storm event, and a controlled discharge not exceeding the existing greenfield flood runoff rate is achieved through use of a flow control such as a hydrobrake device or orifice plate on the outfall. They will be designed as hybrid wetlands, so they provide both an attenuation function and a water treatment function. Flood compensatory measures will be provided where the provision of the attenuation pond reduces the area available to flood in the current scenario.

The details of the 22-no. attenuation are provided in Table 4.5 below.

The drainage system as designed will mitigate the flood risk due to the proposed development. However, any residual flood risk associated with the attenuation pond and potential blockage of the flow control will be mitigated by providing pond overflow. Regular inspection of the ponds and their flow control outfall device is proposed, and such inspections will significantly reduce the potential residual risk.

Table 4.5 Section 1 – Proposed Attenuation Pond details and outfall locations

Ref. No.	Attenuation Pond Details							Outfall locations	
	Easting	Northing	Total Catchment Drainage Area (ha)	Greenfield Runoff Rate (l/s)	Pavement Area (ha)	Attenuation Pond – Volume of Storage (m3)	Invert Level of Attenuation Pond (m)	Easting	Northing
1	616,085.76	899,846.10	12.65	90.51	5.73	8,051.00	74.15	616,290.71	899,943.80
2	615,945.45	899,605.90	0.55	3.92	0.44	313.00	76.35	616,008.33	899,645.63
3	615,964.13	897,049.48	8.06	57.63	4.22	5,072.00	65.03	616,025.54	897,050.45
4	616,268.74	895,137.81	1.02	7.29	0.79	590.00	13.45	616,334.30	895,098.87
5	616,788.55	895,188.94	0.37	2.68	0.28	210.00	12.84	616,610.79	895,150.89
6	614,177.73	896,142.51	10.10	72.28	3.08	6,418.00	65.56	614,288.09	896,093.34
7	613,823.67	895,992.82	0.42	3.02	0.42	239.00	64.87	613,868.95	896,024.06
8	613,194.63	895,527.92	7.61	54.47	2.56	4,806.00	35.87	613,059.73	895,468.45
9	612,772.26	895,281.69	2.48	17.75	2.02	1,541.00	22.50	612,742.79	895,053.33
10	612,375.01	894,958.57	2.36	16.84	1.44	1,462.00	25.72	612,442.55	894,995.98
11	611,903.76	895,155.84	6.47	46.26	2.98	3,998.00	24.29	611,887.78	895,216.90
12	611,175.74	893,412.23	0.65	4.61	0.41	370.00	71.34	611,208.69	893,488.44
13	611,113.58	893,541.17	5.79	41.40	2.80	3,804.00	72.09	611,208.69	893,488.44
14	610,774.54	893,029.67	2.37	16.93	1.63	1,487.00	75.29	610,847.52	893,052.81
15	616,454.01	895,931.08	3.20	22.91	1.93	2,027.00	32.87	616,496.32	895,900.87
16	616,353.85	895,361.73	2.72	19.43	0.93	1,689.00	18.41	616,578.64	895,221.80
17	614,734.51	898,155.91	0.35	2.49	0.22	196.00	138.19	614,728.39	898,128.23
18	616,678.53	896,266.77	0.17	1.20	0.16	92.50	34.80	616,711.71	896,278.44
19	616,184.46	899,208.96	0.39	2.80	0.20	221.00	79.29	616,266.95	899,331.62
20	611,554.07	893,849.49	0.35	4.50	0.27	751.00	68.50	611,566.04	893,776.56
21	616,053.70	900,126.27	1.37	9.83	0.45	773.00	76.14	616,312.63	900,190.26
22	616,059.84	897,889.37	0.89	6.34	0.66	513.00	76.04	615,989.78	897,849.88

4.5.7 Material Extraction and Deposition (MED) Areas

A number of Material Extraction and Deposition (MED) areas have been highlighted for permanent placement of non-structural engineering fill material across the Proposed Development. Any material resulting from the earthworks operations that cannot be re-used as engineering fill will be placed into the MED areas for filling and landscaping purposes. The placement of the material could potentially impact on the flood risk in certain areas if it is placed within existing flood risk areas. A number of MED areas have been identified along the proposed route and generally these sites have avoided floodplain areas and flood risk areas. A drainage system for these deposit sites will be designed that achieves a SuDS response allowing these areas to discharge at natural greenfield runoff rates.

5 CONCLUSIONS AND SUMMARY

A Flood Risk Assessment of Section 1 of the Proposed Development was carried out and the findings are summarised in Table 5.1 below:

Table 5.1 Proposed Road Development FRA Summary

SECTION 1	FRA Summary
Site Description	Section 1 route corridor is approximately 9.7 km long and runs to the north and west of Ballybofey / Stranorlar. Additionally, there are two link roads located to the south and the north of the towns providing connections from the scheme to the existing N15 (east of Ballybofey), N13 (north of Stranorlar) and N15 (to Lifford) respectively. The Mainline consists of Mainline Section 1.1 which is 0.5 km of type 1 Single Carriageway cross section between the existing N15 and Mainline Section 1.2 to the south of the proposed development, Mainline Section 1.2 which is 8.6 km of Type 2 Divided Road bypassing Ballybofey/ Stranorlar, Mainline Section 1.3 which is 0.6 km of Type 1 Single Carriageway cross section between Mainline Section 1.2 and the existing N13 to the north of the proposed development, 3.1 km of Type 3 Divided Road connecting the proposed bypass to the N15 Lifford Road, and 2.1 km Type 2 Single Carriageway connecting the proposed bypass to the local road network at Ballybofey. The alignment of the proposed road development and its associated link roads cross several fluvial floodplain areas as a result of the nature of transport infrastructure which in some cases it is unavoidable. The proposed route for Section 1 lies within the River Foyle Catchment and forms part of the National Hydrometric Area -01. The major sub-catchments within this area are the River Finn and River Deele catchments. There are three bridge structures proposed along the mainline carriageway of Section 1 road, namely, River Finn Crossing, Backlees River Crossing and Cloghroe River Crossing
Vulnerability Category	The proposed road development is essential infrastructure and is therefore considered to be highly vulnerable development in accordance with the FRMPG.
Flooding Mechanisms	Fluvial flooding from the River Finn, Backlees Steram, Cloghroe River (a tributary of River Deele), Mullaghgarry River, and other smaller tributary drains.
Benefitting from flood defences or flood relief scheme	No arterial drainage scheme was carried out within the River Finn catchment area. However, the Ballybofey/Stranorlar Flood Relief scheme is currently being implemented by Donegal County Council.
Historical Flooding	There were several instances of flooding reported in the Ballybofey-Stranorlar area but none of these events coincide with the proposed road extent. It is apparent from the recorded flood history that the River Finn frequently floods its banks. The proposed road will pass over River Finn and through the flood extent for this waterbody. The low-lying floodplains of the River Finn and Mullaghgarry River, particularly at their confluence, generally floods every year during the winter months. The causes of flooding are due to high water levels in River Finn and the flow-backup caused in the Mullaghgarry River as a result of this.
Flood Risk	CFRAM mapping identified encroachment into the 10 %, 1 % and 0.1 % AEP flood extents around the River Finn/Drumboe Lower, so a steady 1D HEC-RAS model was built for the 1 % AEP plus 20 % MRFS climate change scenario using Murphy Surveys' cross-section data, Ballybofey Qmed flows, and Manning's n values of 0.035 (channel) and 0.05 (overbanks). The model predicts design flood levels of 21.68 mOD upstream and 21.47 mOD downstream, providing approximately 7.14 m of freeboard, and shows that the proposed multi-span bridge produces imperceptible changes to existing flood levels. Because the structure fully spans the channel with no adverse hydraulic impacts, no further mitigation is required. CFRAM mapping indicates that the 45 m single-span Backlees River bridge and its approach embankments at CH4+150 encroach slightly on the 1 % and 0.1 % AEP flood extents. A steady-flow HEC-RAS model using a 4.98 km² catchment, a FSU-derived 1 % AEP peak flow of 20.77 m³/s (inclusive of 20 % climate change), and surveyed channel sections predicts a maximum upstream flood level of 63.35 mOD beneath a bridge soffit set at 67.10 mOD, providing 3.75 m of freeboard and a net head loss of approximately 0.20 m. The modelling confirms that all design flows are fully conveyed with no increase in flood risk or alteration of the river's hydraulic characteristics. NIFM mapping indicates the proposed southern tie-in embankment to the N15 intersects the 1% AEP flood extent of Burn Daurnett River. A flood compensatory area is proposed adjacent to the N15 to offset the loss of floodplain storage associated with the road embankment. The compensatory area is connected to the river via a drainage pipe. NIFM mapping shows that the 18 m single-span Cloghroe River bridge at CH 0+300 on the N13 tie-in road encroaches the 1 % AEP flood extent and places the approach embankment within the 0.1 % AEP zone. A steady-flow HEC-RAS model was developed for the 10.75 km² catchment using FSU-derived 1 % AEP peak flows of 51.08 m³/s (inclusive of a 20 % climate-change uplift) and surveyed channel sections. Model results predict a maximum upstream flood level of 78.37 mOD beneath a bridge soffit set at 78.72 mOD providing 0.35 m of freeboard and confirm that the structure fully conveys the design flood with no increase in flood risk or alteration of existing hydraulic conditions. Flood compensatory storage areas is provided within the embankment adjacent to the Cloghroe River to fully offset any loss of floodplain storage at the relevant flood

SECTION 1	FRA Summary
	levels. An underground storage is also provided for flood compensation storage. The proposed N15 link road crosses the Mullaghgarry River approximately 50 m downstream of the existing N15 crossing at Treanamullin, over a low-lying floodplain that routinely inundates four to five times each winter (worst recorded event December 2015). An unsteady 1D HEC-RAS model was built using survey cross-sections and an FSU-derived 1 % AEP peak flow of 15.41 m³/s (inclusive of a 20 % climate-change uplift) for the ungauged catchment; this demonstrated that the existing channel and culvert arrangement cannot convey the design flood. Under the proposed design, two box-culvert vents each 2.3 m × 2.7 m plus compensatory storage within the embankment, the model shows a substantially improved flood profile with about 0.3 m freeboard at the upstream face. Any effect on downstream Finn water levels is imperceptible owing to the extensive floodplain south of the confluence. A total of 39 culverts will be required where the proposed road development crosses existing watercourses. Design flows for each culvert were set as the 100-year return period flood plus a 20 % climate-change allowance (and a 1.6 arterial-drainage factor where applicable), with flows estimated using IH 124 and OPW FSU 3- and 5-variable methods. Culverts were sized mainly in accordance with CIRIA C786, with two critical crossings modelled in HEC-RAS, and all achieve net head losses below the 300 mm OPW limit and freeboards above the 300 mm requirement. Embankment encroachments into floodplains have been minimised to avoid any appreciable rise in upstream or downstream levels, and rock armour is proposed at all inlets and outlets to prevent scour. Section 50 approval concerning flooding and flood capacity of all culverts and the River Bridges is subject to OPW Consent. Other localised sections where the proposed road crosses and encroaches on flood areas were identified. There are some attenuation ponds and sections of the road embankment that encroaches on fluvial and/or coastal flood extents for different AEP. They have been assessed to analyse the impact on flood areas and determine the minimum level of the road and attenuation ponds. The impact is generally minor or imperceptible. Road drainage outfalls discharging to receiving surface and groundwaters without flood flow attenuation could increase downstream and local flooding at the discharge points. This has been mitigated in the drainage design through suitably sized attenuation ponds and outlet flow controls for the mainline and large side roads.
Climate Change	The predicted increases in fluvial flood flows of 20% is generally considered and catered for in the design.
Mitigation Measures	• At all crossings, encroachments within the watercourse's floodplains have been minimised such that any increase in flood levels in the upstream or downstream vicinity due to flood volume storage loss would be minimal. • All bridge/culverts are sized for 1% AEP design flows such that net headlosses are less than the OPW section 50 Guidelines specified headloss of 300 mm, and also the available freeboards above the design flood levels are greater than the OPW section 50 Guidelines specified freeboard of 300 mm in all cases. Any deviations from this will be subject to approval by the OPW and subsequent Section 50 Consent. • Increased road runoff is proposed to be attenuated to greenfield runoff rates through attenuation ponds before discharging into the natural watercourses or infiltration trenches when discharging into the groundwater for small sections of side roads. • Rock armour has been proposed at the inlets/outlets of all culverts in order to reduce any risk of scouring in the channel beds. • Sustainable road drainage systems, e.g., filter drain, grass surface water channels are generally proposed in areas where the groundwater vulnerability risks are not high. • Provision of surface water collector drains parallel, and adjacent to, the toe of earth embankments. • Provision of granular drainage blankets (starter layers) at the base of earth embankments over sloping ground to minimise confinement of overland and/or near-surface flow on the upslope side of the embankment. Attenuation ponds within flood plains are to be bunded 500 mm above the flood level.
Residual Risk	Mitigation measures have been implemented as specified above and through the report for the flood risk areas but also for the impact that the proposed road involves in terms of causing flood risk. There is still a residual risk in some of the areas and elements of the proposed road: • Potential blockages to culverts and bridges on streams and the lack of maintenance could present a localised residual flood risk. • The construction of attenuation ponds and infiltration trenches along the proposed scheme development represent a potential source of flood risk should these ponds/infiltration trenches be overtopped or fail. • Residual risk of localised flooding on proposed road carriageway due to blockages/failure within drainage network. • The disposal of storm water via engineered infiltration trenches represents a potential source of flood risk should the discharge exceed the infiltration capacity of the trench or the reduction over time of the performance of the trench as a result of silt deposition etc.

APPENDIX A:

HYDROLOGICAL IMPACT STUDY RIVER FINN CROSSING, DRUMBOE LOWER

Co-financed by the Connecting Europe Facility of the European Union

HYDROLOGICAL IMPACT STUDY
RIVER FINN CROSSING, DRUMBOE LOWER

TEN-T Priority Route Improvement Project, Donegal

Section 1 N15/N13 Ballybofey / Stranorlar Urban Region

TT_MGT0337-RPS-P3-S1-RP-D-DR0002 S3 P02

Hydrological Impact Study
River Finn Crossing, Drumboe Lower
S3 P02

December 2021

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HYDROLOGICAL IMPACT STUDY
RIVER FINN CROSSING, DRUMBOE LOWER

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December 2021

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1 INTRODUCTION

In January 2017, Donegal County Council appointed joint venture RPS/Barry Transportation as design consultants for the Trans-European Network - Transportation (TEN-T) Priority Route Improvement Project, Donegal. The project is divided into three sections as illustrated in **Figure 1.1**.

- Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region
- Section 2 – N56/N13 Letterkenny to Manorcunningham
- Section 3 – N14 Manorcunningham to Lifford / Strabane / A5 Link.

The study areas were developed based on the Sections above and allowing for areas to sufficiently consider constraints, options development, and future road improvements.

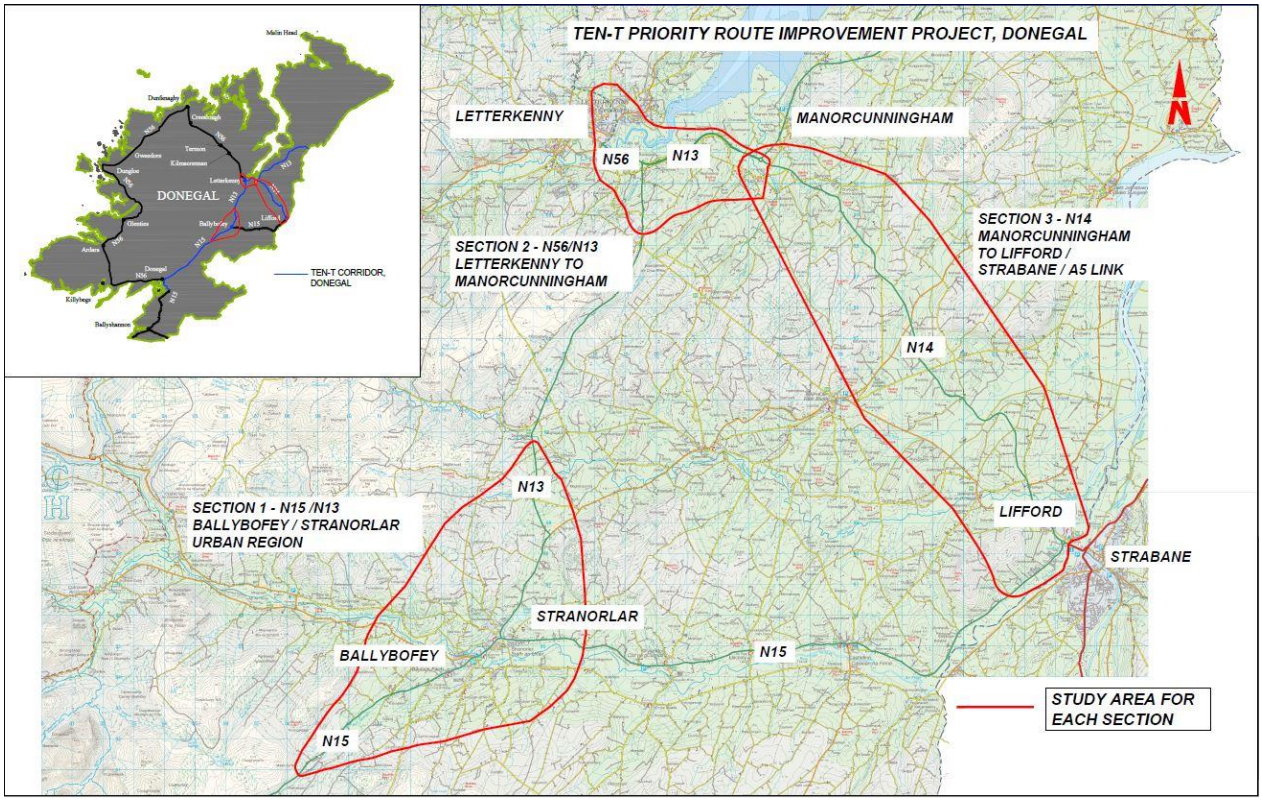


Figure 1.1 Study Areas for the TEN-T Priority Route Improvement Project, Donegal

1.1 Purpose of Report

This report is solely concerned with Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region and the determination of the flood impact (if any) to the River Finn, its tributaries, and their respective floodplains and to outline and evaluate any proposed mitigation measures associated with the River Finn crossing at Drumboe Lower.

1.2 Proposed Route

The proposed route redirects the existing N15 Sligo-Lifford national primary road from the townlands of Meencargagh and Dooish in a north-easterly direction across the River Finn upstream of Ballybofey & Stranorlar to the townlands of Teevickmoy, Meenavoy and Callan where the proposed route joins the existing N13 Stranorlar-Derry national primary road. There is also a second link road from the proposed main alignment to the existing N15. See **Figure 1.2** for a plan of the proposed route.

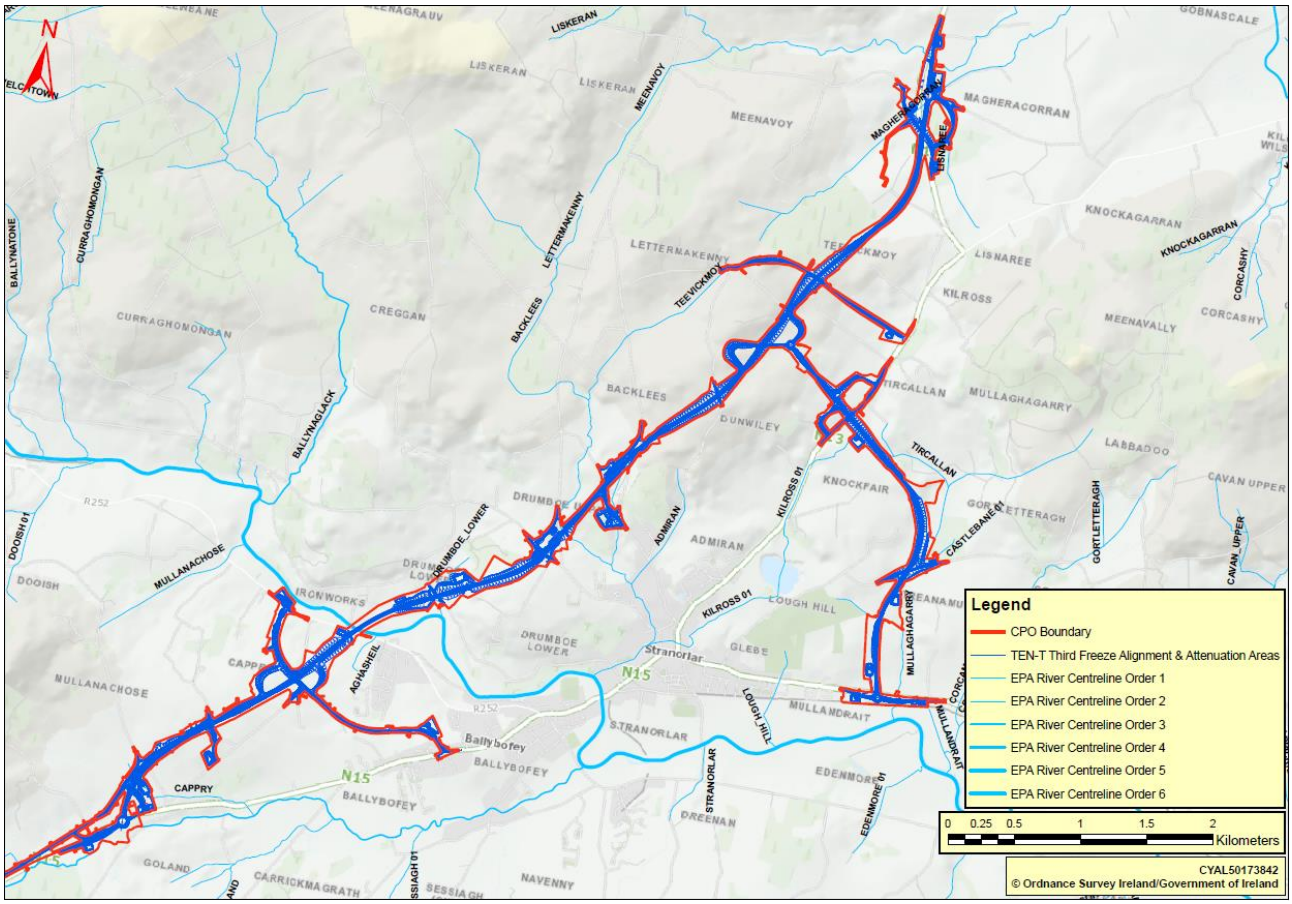


Figure 1.2 Proposed Route Plan

1.3 Report Structure

Chapter 2 of this report gives an overview of the affected watercourses and the proposed route. **Chapter 3** consists of a desk study outlining information on flood history and previous flood studies and identifies flood risk at the site. A flood impact study is detailed in **Chapter 4** establishing the hydrology of the catchment, calculations and hydraulic modelling undertaken to identify and evaluate the flood impact arising from the construction of the proposed route as well as providing information of any necessary mitigation. The Conclusion is provided in **Chapter 5**.

2 SITE BACKGROUND

This chapter describes the potentially impacted site at the proposed River Finn crossing at circa CH2400 on the main N15/N13 alignment from Cappry to Drumboe Lower.

2.1 Site Description

The proposed River Finn river crossing is located at CH2400 on the Section 1 main alignment and stretches from the townland of Cappry to the south of the River Finn to Drumboe Lower to the north of the river. In order to span the flood levels of the River Finn and the River Finn SAC, the approaching routes to the proposed structure are in fill. The proposed route also crosses the Drumboe Lower tributary to the River Finn in this area at CH3050.

The River Finn channel bed level varies from 16.91mOD at the upstream face of the proposed crossing to 16.59mOD at the downstream face. The left channel bank raises to an area of dense woodland with a ground level of 20.60-21.35mOD before sloping downwards to pasture lands of levels varying from 19.60-20.50mOD in the left overbank. The right channel bank raises to a river wall surrounded by some woodland scrub with a top-of-wall level of approximately 22.27-22.68mOD which exists along the northern verge of the existing Glenfin Road. The right overbank consists of agricultural pastures with frequent residential properties along the Glenfin Road that varies from 21.76-23.32mOD. The river at this location is gently meandering and has a main channel width of between 44.5-50.0m.

3 DESK STUDY – EXISTING FLOOD INFORMATION

This chapter identifies existing flooding information known about the subject area. The information referenced as part of this desk study includes historical and predictive sources. This chapter will highlight particular areas of interest with regard to flooding where the proposed works may impact upon flood risk elsewhere or may itself be vulnerable to flooding.

3.1 Historical Flooding

The historical sources interrogated for this chapter include the Ordnance Survey Ireland (OSI) 6inch Cassini historical mapping, Office of Public Works (OPW) website floodmaps.ie and OPW Hydrometric Records.

3.1.1 OSI Historical Mapping

The 6inch Cassini historical maps do not illustrate any evidence of flooding in the past. Lands that have been identified as prone to periodic flooding in these historical maps are typically labelled “Lands liable to floods”. There is evidence of a mill race at the Iron Works and an upstream weir that have since been abandoned. The proposed crossing traverses over this abandoned mill race. From the interpretation of **Figure 3.1** it is not envisaged that the proposed route will be vulnerable to or will impact upon flooding at the site.

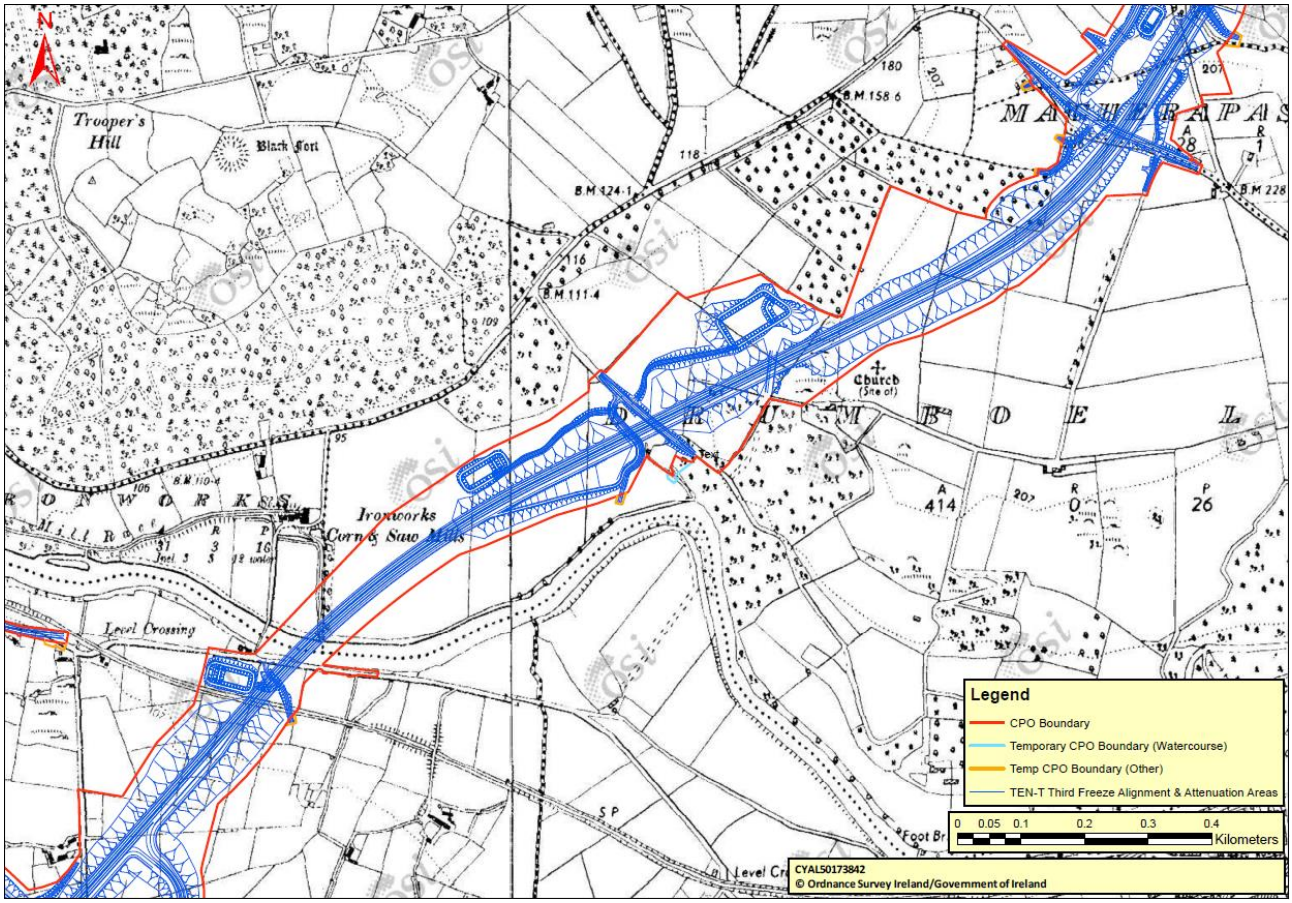


Figure 3.1 River Finn Crossing - OSI 6inch Cassini historical mapping with proposed route overlaid

3.1.2 OPW Flood Hazard Mapping

There are no records of previous flood events in the immediate vicinity of the proposed crossing. There are 4 instances of flooding recorded within a 2km radius (see **Figure 3.2**). These are all located downstream of the proposed crossing and are summarized in **Table 3.1** below.

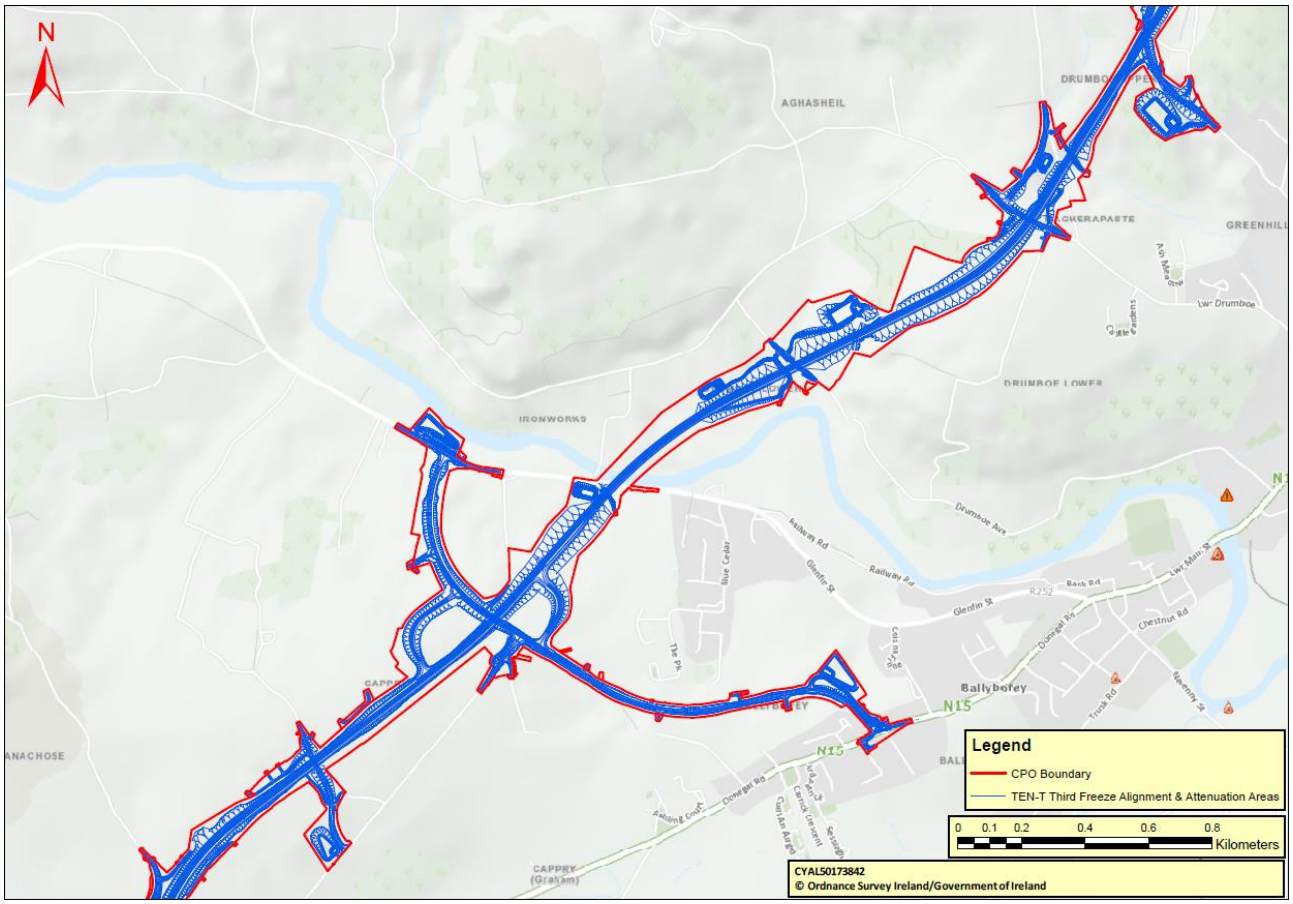


Figure 3.2 River Finn Crossing - OPW Historical Flood Mapping (FloodInfo.ie)

It is apparent from the recorded flood history that the River Finn frequently floods its banks. There are no recorded instances of flooding at the proposed crossing. FloodInfo.ie can be interrogated for further flood reports and press articles. It is important to note that the area of the proposed flood crossing is less densely populated than downstream areas at Ballybofey/Stranorlar and vulnerable receptors may be at a higher level than areas that flood so flood events may have escaped identification and reporting. There is also a detailed assessment of historical flood events included in the North Western - Neagh Bann CFRAM Study UoM 01 Hydraulics Report (RPS, 2017) as part of the hydraulic model calibration and verification.

Table 3.1 River Finn Crossing - Summary of Historical Flood Events provided by FloodInfo.ie

Flood ID	Location	Date(s) of Report(s)	Recorded date of occurrence	Frequency	Description
4188	Trusk Rd / Townview Heights, Ballybofey	13/01/2006	N/A	Annual	Runoff from high ground causes flooding every year after heavy rain. The road is liable to flood, and properties are affected. Surface water system is unable to cope with the volume of water.
4176	Navenny Bridge, Ballybofey	26/09/1985 06/02/1995 13/01/2006 26/11/2006 01/05/2005	20/09/1985- 21/09/1985	Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.
232 2373 2434	Ballybofey Bridge downstream	26/09/1985 06/02/1995		Annual	River Finn overflows its banks every year after heavy rain. The road is liable to flood and can be blocked.

12741	St. Mary's National School, Stranorlar	12/01/2017	05/12/2015-06/12/2015	N/A	Flooding at St Marys NS Stranorlar Co. Donegal 5th-6th Dec 2015. Report prepared by CFRAM consultant

3.1.3 Anecdotal and Photographic Evidence

No flooding was reported by OPW Flood Hazard mapping. As mentioned above, this may be due to the fact that there are no sensitive receptors occupying the lowlands that may have flooded in the past. Anecdotal evidence and photographs were made available to this study and illustrate flooding upstream and downstream of the proposed crossing point. See **Image 3.1** to **Image 3.4** below.

Image 3.1 Flooding at Cappry, Ballybofey (611737E, 895275N) (upstream of proposed crossing)

Image 3.2 Flooding at Cappry, Ballybofey (611737E, 895275N) (upstream of proposed crossing)

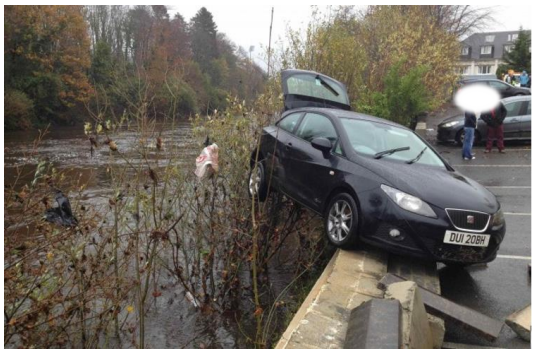


Image 3.3 Flooding at Jackson's Hotel, Ballybofey (downstream of proposed crossing)

Image 3.4 Flooding at Jackson's Hotel, Ballybofey (downstream of proposed crossing)

The flooding in the images above is reported to have occurred on 05 December 2015. The winter of 2015/2016 saw exceptional and widespread flooding due to prolonged intense rainfall in Ireland. The floods recorded across the country during the winter of 2015/2016 are believed to be the worst on record. This holds true for the River Finn catchment where the catchment experienced the highest flow ever recorded at Ballybofey hydrometric station 01043 on 15 November 2015 and the second highest flow ever recorded at the station on 05 December 2015. As seen in the **Hydrometric Data - Flood Event Analysis** chapter, the annual maximum flow recorded in 2015 is an outlier when compared to other annual maxima data fitted to the statistical distribution curves. The return period for the two floods recorded in November (568.75 m^3/s) and December 2015 (555.42 m^3/s) have proven to be in excess of the predicted 100-year flood (see **Chapter 4.1.1** design flow growth factors and flows).

3.1.4 Hydrometric Data - Flood Event Analysis

As part of the desk study, it was necessary to review historical flood events through the statistical analysis of hydrometric records in the catchment. Extreme Value Analysis (EVA) has been carried out in line with the procedures set out in the Flood Studies update (FSU) using the AMAX water level records supplied by the OPW for Ballybofey Hydrometric Station 01043 and the gauge's associated rating. The Ballybofey Hydrometric Station 01043 managed by OPW is located approximately 1.36km downstream from the

proposed crossing at the River Finn. The location of the existing hydrometric gauge 01043 is illustrated in **Figure 3.3** below and has a catchment of 313.37 km^2.

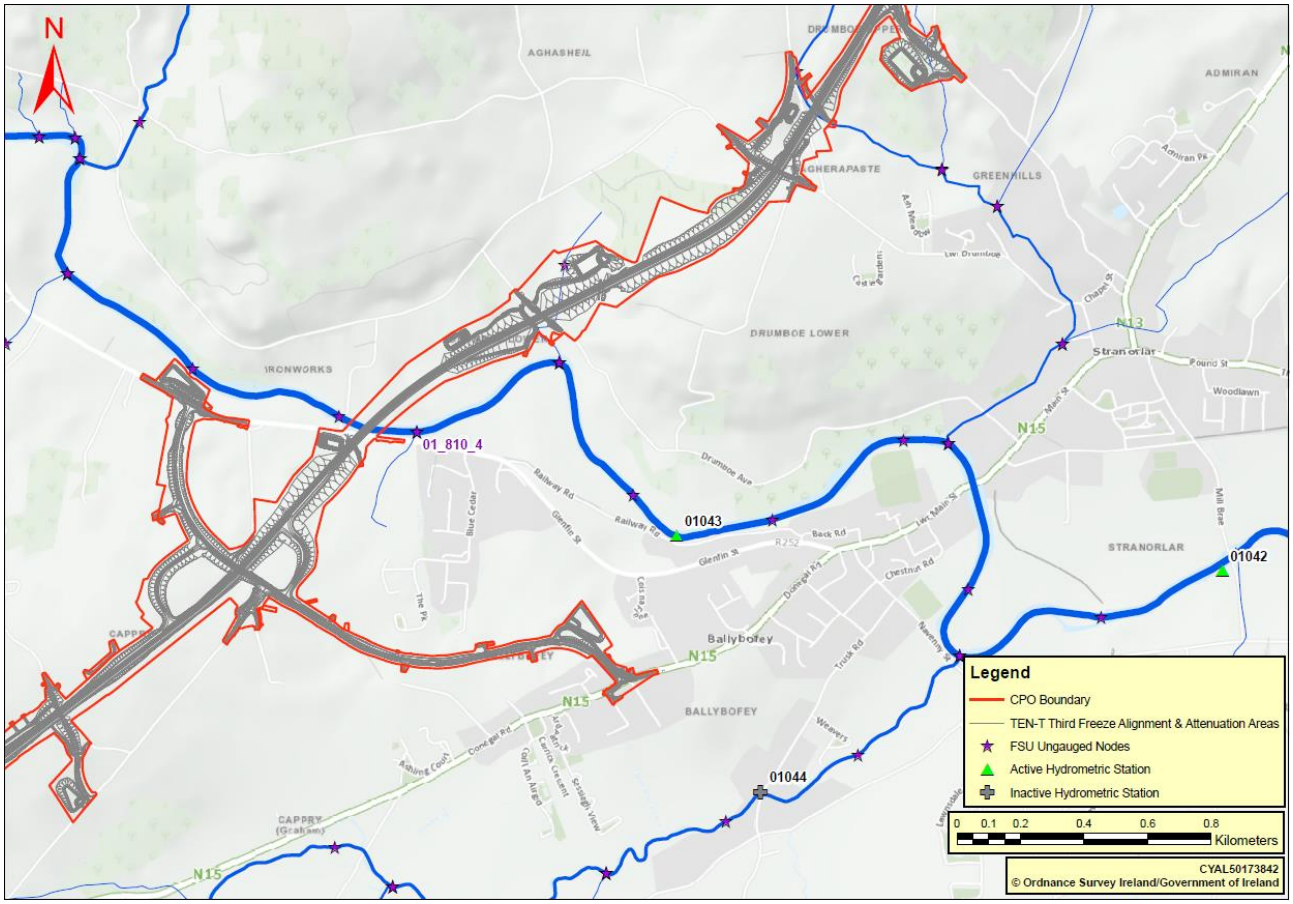


Figure 3.3 Location of Hydrometric Gauges

The hydrometric station 01043 has 49 years of AMAX records (1972-2020) as seen in **Figure 3.4**. The AMAX data was received from OPW in the format of water levels (mOD Poolbeg) and staff gauge reading above a varying datum. The location of the staff gauge and datum elevation changed several times over the period of hydrometric records and is summarised in **Table 3.2** below:

Table 3.2 Ballybofey 01043 Staff Gauge Summary

Valid from	Value (m)	Height system	Comment
01/01/1972	16.791	Poolbeg	
02/10/1972	16.791	Poolbeg	At footbridge
19/07/1985	16.778	Poolbeg	
08/07/1992	15.880	Poolbeg	Station moved to downstream face of bridge

The hydrometric year 1990 has no AMAX data provided, but it is believed that the water level reached the same magnitude as that of the 1984 AMAX flood event. The raw AMAX data received from OPW also highlighted that during the period of 1972-1993 there were no high flow gaugings taken during this period to produce flood flow rating. This means that the confidence in the AMAX data from 1972-1992 is low. Data from July 1992 onwards when the gauge was positioned at its current location can be used for flood event analyses as high flow gaugings have been carried out at the cross-section.

The staff gauge readings were converted to flow values through the use of the gauge rating developed by RPS as part of the CFRAM North Western - Neagh Bann CFRAM Study UoM 01 Hydrology Report. At the time of initiating the CFRAM study, the Ballybofey Gauge 01043 was assigned a 'U' Rating Quality Classification. Stations with ratings of 'U' quality indicate sites where the data is totally unusable for determining high flows. The new rating at this station was developed through the use of hydraulic modelling and is shown to be well calibrated to spot gauged data, is generally in agreement with the downstream

inactive Dreenan gauge 01042 rating review which was derived from a separate model and also results in an observed Qmed value, based on a long term AMAX record, which is in good agreement with catchment descriptor based estimates.

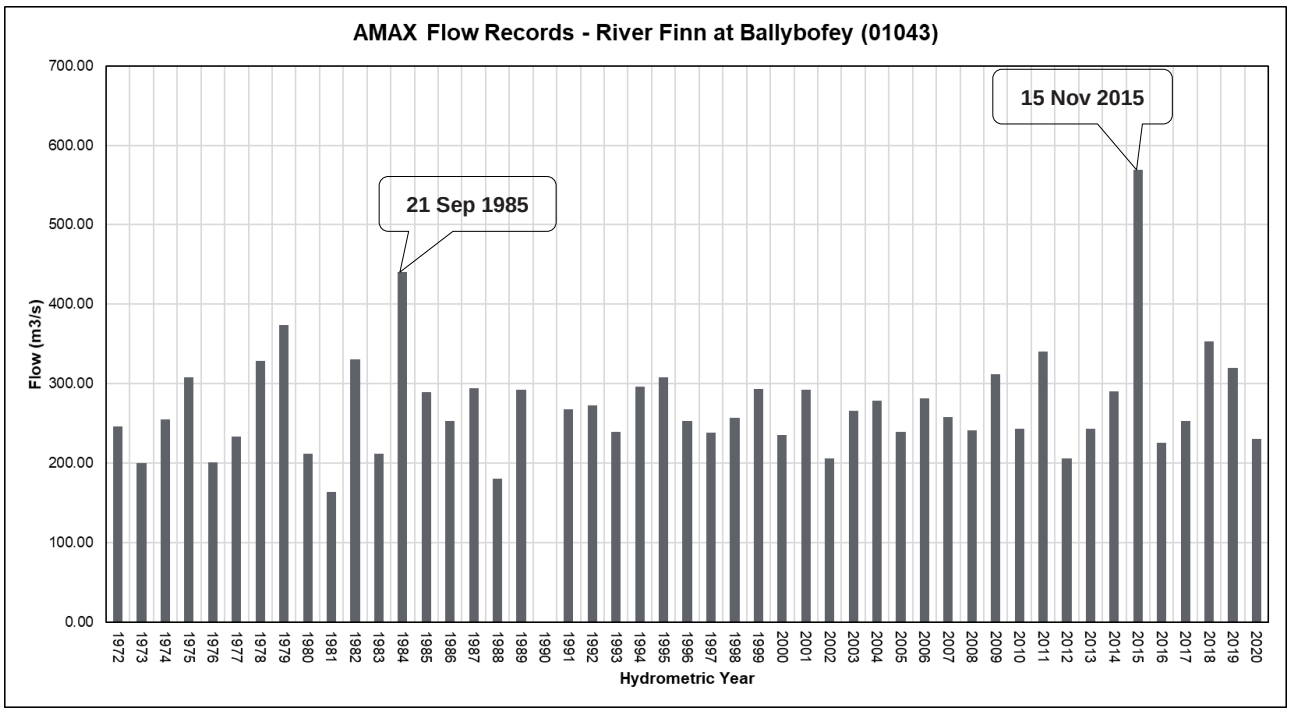


Figure 3.4 River Finn at Ballybofey - AMAX Records

At-site flood frequency analysis was performed on the period of record 1991-2020. A number of flood-like distributions (e.g., EV1, GEV, GLO & LN2) were fitted to the AMAX data as part of the flood frequency analysis and the GLO distribution was found to be the best fit. This at-site flood frequency analysis shows that the flood event from November 2015 is seen to be an outlier when compared with the other AMAX records and has a return period at the site of around 50 years. The pooling group growth curve estimation in **Chapter 4.1.1.2** will illustrate expected flows for given return periods in more detail and with greater confidence. The at-site flood frequency curve is shown in **Figure 3.5**. The frequency analysis has illustrated that the five most extreme flood events at the Ballybofey Gauge have occurred from 2009 to 2019.

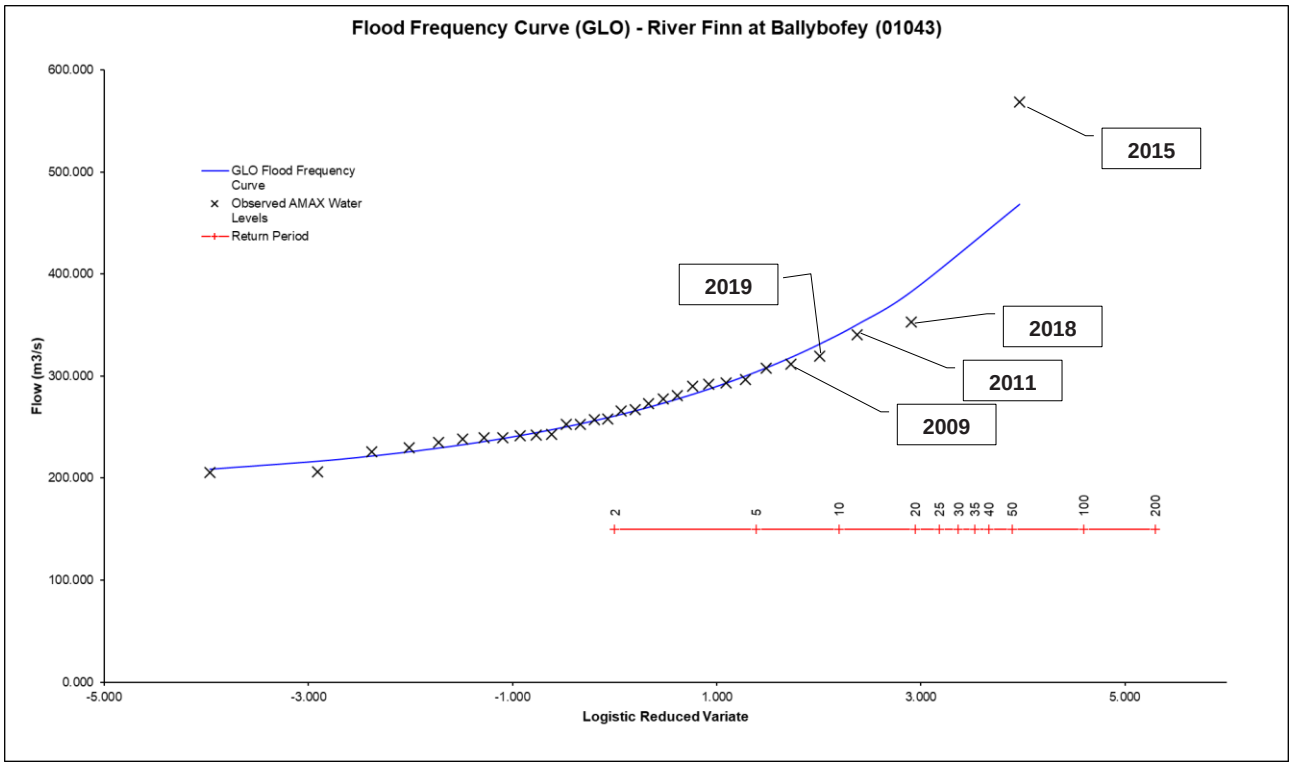


Figure 3.5 Flood Frequency Curve fitted to AMAX data for River Finn at Ballybofey (01043)

3.2 Predictive Flooding

The site has been included in predictive modelling as part of broader OPW studies. These are namely the Preliminary Flood Risk Assessment (PFRA) and the Catchment Flood Risk and Management (CFRAM) programme.

3.2.1 Preliminary Flood Risk Assessment (PFRA)

The PFRA study was undertaken as part of the scoping phase of the CFRAM study to identify areas for further assessment (AFAs) where the flood risk was determined to be potentially significant from one or more sources of flooding. This was undertaken as a requirement of the EU 'Floods' Directive.

It is important to note that the PFRA was not a detailed assessment of flood risk. It was rather a broad assessment, based on available and readily derivable information to identify areas where there was a genuine cause for concern about a risk and impact of flooding that may require further assessment.

The OPW used three sources of information to designate these AFAs:

- Historic information on floods that happened in the past.
- Public consultation to gain local and expert knowledge from Local Authorities and other Government departments and agencies to identify areas prone to flooding and the potential consequences.
- Engineering techniques to analyse potential damage that could be caused by flooding.

The PFRA 100-year flood extents are illustrated in **Figure 3.6** below. The proposed route alignment encroaches upon the 100-year flood extents at the low-lying lands surrounding the River Finn confluence with the Drumboe Lower watercourse. It is important to note that these maps were based on broad-brush datasets and course methodologies in order to flag areas of potential flood risk. The Ballybofey/Stranorlar urban area was highlighted as an AFA as a result of the PFRA process and as such was included in the North Western - Neagh Bann CFRAM Study. The outputs and recommendations from the CFRAM study supersede the information provided by the PFRA and are discussed in **Chapter 3.2.2**.

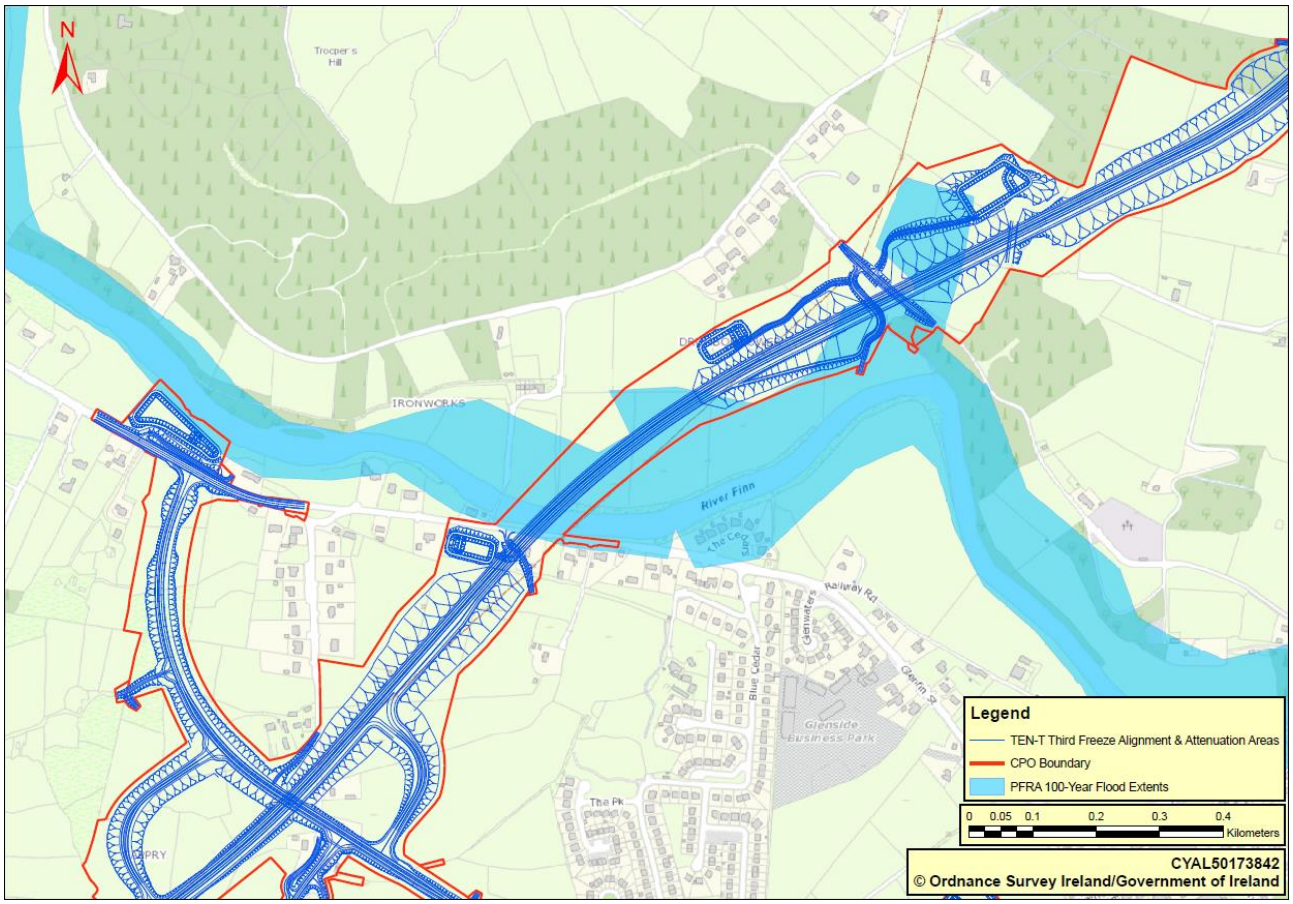


Figure 3.6 River Finn Crossing - PFRA 100-Year flood Extents

3.2.2 Catchment Flood Risk and Management (CFRAM) Study

The OPW commissioned RPS to undertake the North Western – Neagh Bann CFRAM Study in March 2012 and final flood maps were issued in July 2017. The Ballybofey & Stranorlar AFA is located in east Donegal and is affected by the middle reaches of the River Finn and its adjoining tributaries.

The CFRAM study consisted of detailed hydrological analyses including the rating review of existing hydrometric gauging stations within the catchment, catchment boundary review, index flow estimation, flood frequency analysis and growth curve development and hydrograph development.

The North Western - Neagh Bann CFRAM Study UoM 01 Hydrology Report (RPS, 2016) describes the River Finn catchment to the downstream HEP of the model is a medium to large sized catchment (384km^2) with a mixture of peat (43%), pasture (26%) and forest (24%) coverage. The largest tributary to the River Finn is the Daurnett Burn with a catchment of 26km^2, a more upland catchment with a fair degree of peat land coverage (24%). See **Figure 3.7** for the AFA catchment boundaries and Hydrological Estimations Point (HEP) locations.

3.2.2.1 Estimation of Index Flood, Qmed

The report describes that the two hydrometric stations (Ballybofey 01043, Dreenan 01042) on the modelled reaches of the River Finn were given a C rating classification under FSU indicating that there is no confidence in the gauge rating for flows of a magnitude of median flow, Qmed, or higher. The rating review for these two gauges revealed that due to the poor spot flow data for higher flows, the extrapolated C rating curve overestimated $Qmed_{gauged}$ by approximately 288% (Dreenan 01042) and 192% (Ballybofey 01043) when compared with Qmed derived from the FSU 7-variable physical catchment descriptor (PCD) equation.

A new rating was developed for the two hydrometric stations through the construction of a hydraulic model from sufficient distance upstream to a sufficient distance downstream of each gauge station. The model was calibrated to the full range of spot level gauged data and then a Q-h relationship established for flows in

excess of 0.1%AEP through utilization of modelled water level outputs for those flow inputs. The new ratings at each station showed that the new Qmed values showed good agreement between the two stations and also good agreement with Qmed values derived from catchment descriptors. **Table 3.3** summarizes the differences between Qmed estimates at the two hydrometric stations before and after the rating review. The Qmed value from the Ballybofey station was bought forward as a pivotal site for index flood adjustment for flows along the main channel of the River Finn.

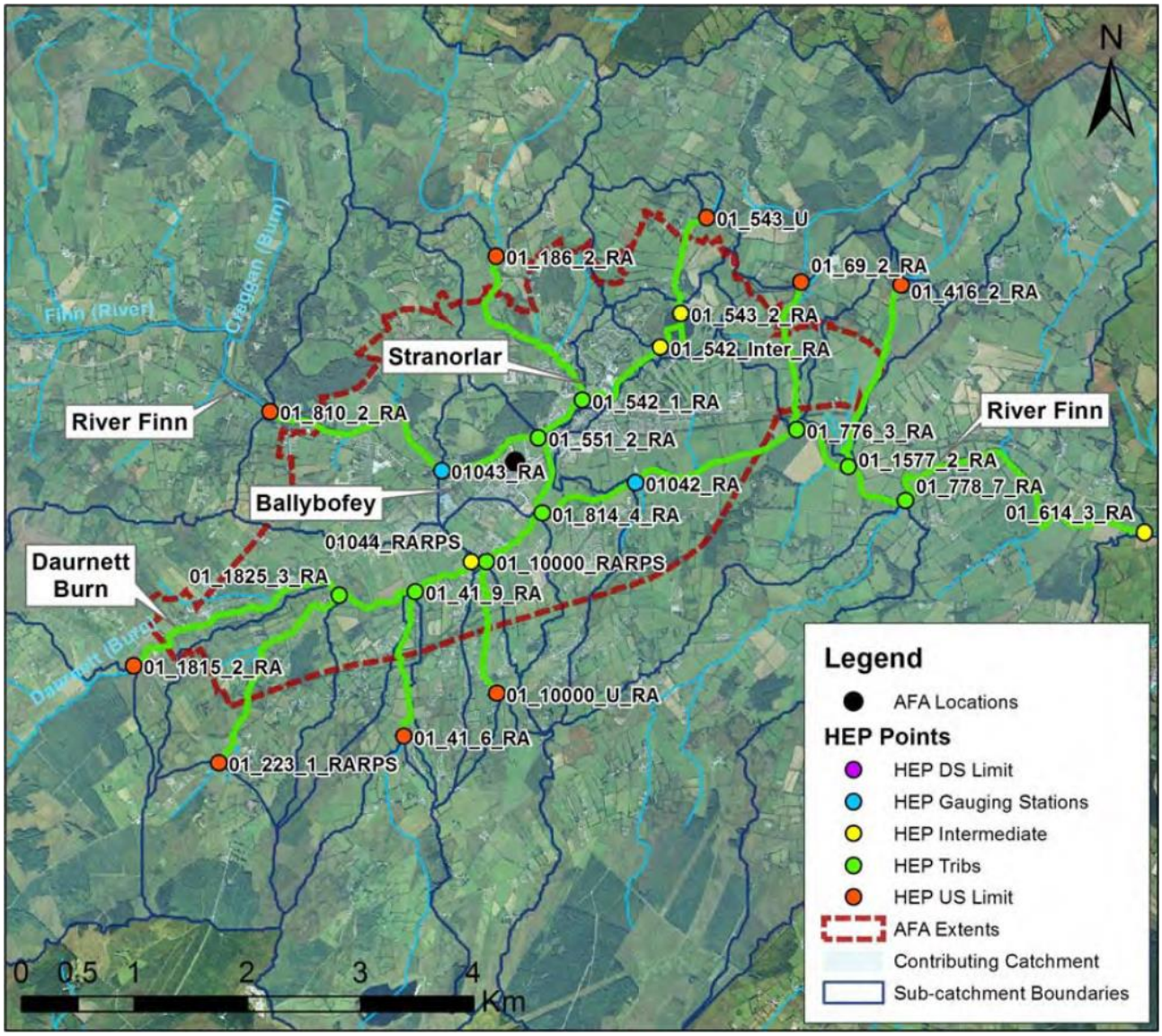


Figure 3.7 Ballybofey and Stranorlar AFA Catchment Boundaries and HEPs

Table 3.3 CFRAM Qmed estimates before and after Rating Review

01042 Dreenan			01043 Ballybofey		
Existing (m^3/s)	Rating Review (m^3/s)	FSU PCD 7-v (m^3/s)	Existing (m^3/s)	Rating Review (m^3/s)	FSU PCD 7-v (m^3/s)
778.00	275.20	270.00	490.50	257.90	256.00

3.2.2.2 Flood Frequency Analysis and Growth Curve Development

Once the Qmed was established with good confidence at the hydrometric stations on the River Finn, a flood frequency analysis was undertaken to develop the growth curves for the design floods of varying magnitude. Growth curves have been developed based on single site and pooled analysis of gauged hydrometric data based on the FSU methodology. It was recommended to adopt the GLO distribution derived concave upward shape growth curve for UoM 01.

Growth curves were derived for 125 HEPs in UoM01 and were analysed to determine the relationship between flood growth factors and the physical catchment descriptors AREA (catchment area), SAAR (Standard Annual Average Rainfall) and BFI (Baseflow Index). A good relationship was determined between flood growth factors and catchment area for the 125 HEPs in UoM01.

As a result of this, the growth curves in UoM01 were generalised based on ranges of catchment size. As all HEPs located on the River Finn have a catchment that lies in the range of 300-400km^2, the median growth curves for the "300 < AREA ≤ 400km^2" range for design floods of varying extremity were used. The growth curves for this catchment size range are summarized in **Table 3.4** below.

Table 3.4 CFRAM Flood Growth Factors for HEPs for catchments 300 < AREA ≤ 400km^2 in UoM01

Catchment Size Range		Growth Factors			
	AEP (%)	50.0%	10.0%	1.0%	0.1%
	Return Period (Years)	2	10	100	1000
300 < AREA ≤ 400km^2		1.000	1.432	2.147	3.201

3.2.2.3 Design Flow Peaks

The design flood flows for HEPs along the River Finn were calculated by multiplying the Index Flood, Qmed (derived from Rating Review at Ballybofey 01043), by the above relevant growth factors. These design flows calculations are outlined in **Table 3.5** below.

Table 3.5 CFRAM Design Flows

Return Period (Years)	2	10	100	1000
Flood Growth Factor	1.000	1.432	2.147	3.201
Design Flood (m^3/s)	257.900	369.313	553.711	825.538

3.2.2.4 Hydrograph Development

Once the design flows were calculated, the temporal distribution of the flood events were determined. At HEPs representing larger catchments (generally 10km^2 or larger) within UoM 01 hydrographs were generated using the Hydrograph Shape Generator (version 5) developed by OPW. The Hydrograph Shape Generator centres around FSU Work Package 3.1 'Hydrograph Width Analysis' and contains a library of parametric, semi dimensionless hydrograph shapes derived from gauge records of pivotal sites using the HWA software previously discussed. Based on hydrological similarity, a pivotal site hydrograph is 'borrowed' and applied at the subject site (in this case the CFRAMS HEP) based on catchment descriptors.

Hydrographs for catchments less than 10km^2 in the study were generated through Flood Studies Supplementary Report (FSSR) 16 Unit Hydrograph Method.

3.2.2.5 Hydraulic Model

The North Western - Neagh Bann CFRAM Study UoM 01 Hydraulics Report (RPS, 2017) states that all watercourses within the Ballybofey & Stranorlar AFA were modelled as 1D-2D using the Infoworks ICM suite of software. This software was selected to achieve compatibility between all Finn and Mourne models in the NWNB CFRAM Study (Killygordon, Castlefinn and Lifford AFAs). A pre-existing model of the Mourne, Finn and Foyle at Lifford/Strabane undertaken by DARD Rivers Agency in Northern Ireland was used as the starting point for the Finn models. This model was built using Infoworks ICM, and so to ensure a consistent approach within the Foyle catchment ICM was used for all of the CFRAM Study models located upstream on the Finn, including the Ballybofey and Stranorlar model.

The Ballybofey and Stranorlar model is one of four CFRAM Study models covering the Finn catchment from upstream of Ballybofey to the Foyle at Lifford. Although the models are separate the backwater effect from the Mourne catchment and the tidally influenced Foyle is considered at Ballybofey and Stranorlar through the application at the downstream boundary of the model of the upstream modelled water levels from the next model downstream. Through this methodology the back water effects along the Finn arising from coastal water levels in Lough Foyle and flood flow in the Mourne are passed up through the models.

The 1D domain was built using channel cross-section and structure topographical survey while the 2D mesh was generated using LiDAR survey. The boundary conditions for the upstream extents of the model were entered as flow hydrographs developed as part of the North Western - Neagh Bann CFRAM Study UoM 01 Hydrology Report. Lateral inflows were included along the reaches of the watercourses as a flow top-up between HEPs. The modelled downstream boundary condition is the upstream level from the corresponding node, return period and timestep from the Killygordon model taken from the cross-section where both models meet. This was considered appropriate to apply a water level boundary taken from the downstream model to ensure any backwater effect emanating from the coastal boundary on the Foyle or flood flows on the River Mourne at Lifford is captured through the application of water level boundaries in series from the downstream model.

3.2.2.6 CFRAM Flood Extents Mapping

The outputs from the CFRAM current scenario fluvial modelling for the predictive 0.1%, 1% and 10% AEP events can be seen in **Figure 3.8**. The proposed route alignment has been overlaid to illustrate the foreseeable impacts on flooding and will be discussed in **Chapter 3.3**.

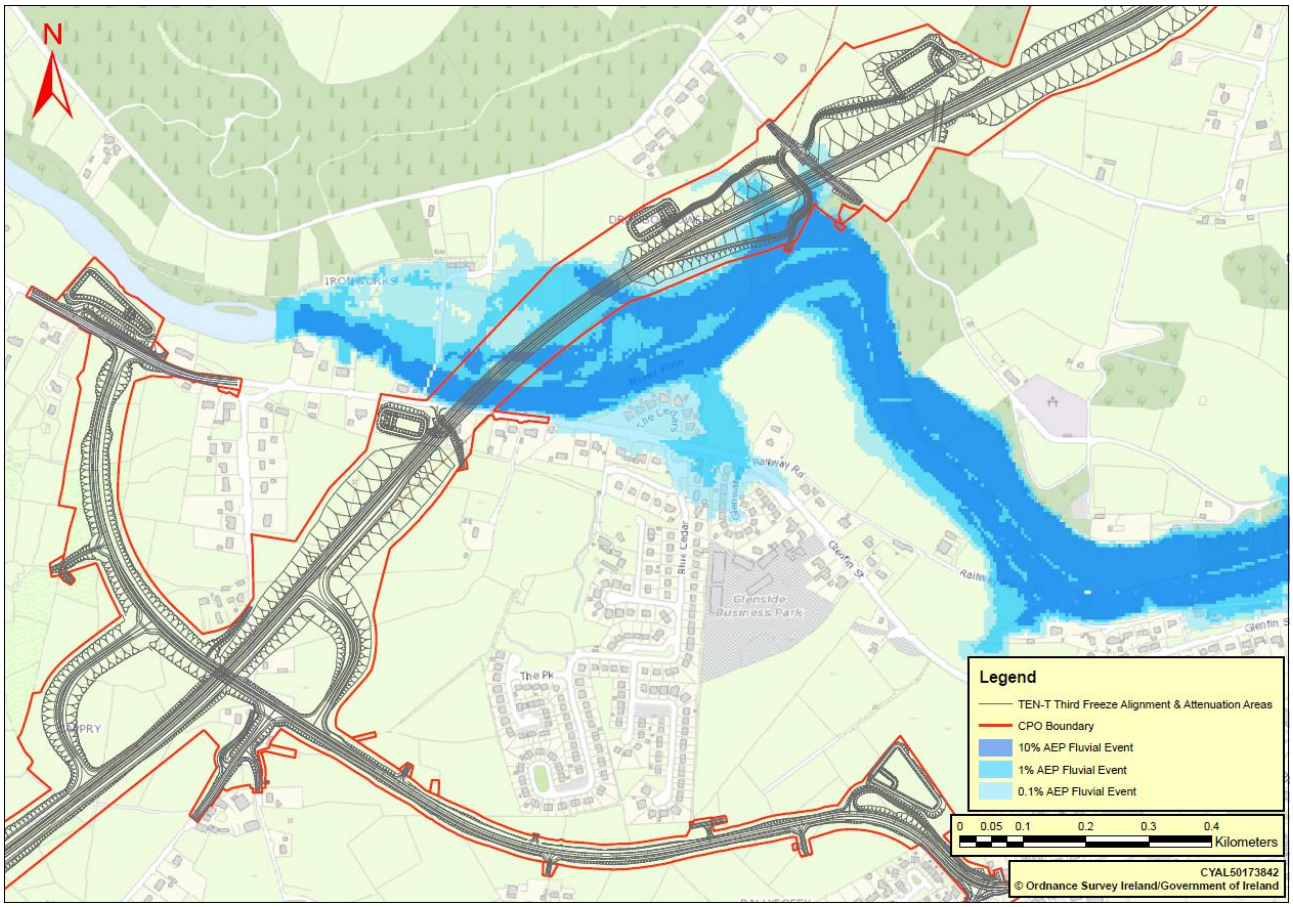


Figure 3.8 River Finn Crossing - CFRAM current fluvial flood extents with proposed route alignment

3.2.2.7 CFRAM Proposed Flood Relief Measures

The North Western - Neagh Bann CFRAM Study UoM 01 Preliminary Options Report (RPS, 2016) outlines three flood defence option schemes for the Ballybofey & Stranorlar AFA. The three options were subject to a Multi Criteria Analysis (MCA) and preliminary costing to calculate the Benefit Cost Ratio (BCR). Option 3 scored more favourably in the MCA and BCR and has been brought forward to the North Western Flood Risk Management Plan (FRMP) and more recently the Ballybofey-Stranorlar Flood Relief Scheme (FRS) which is still in the early planning phase having appointed Engineering and Environmental Consultants in Spring 2021.

Figure 3.9 outlines the Option 3 proposed flood relief measures to be considered under the planning and detailed design of the Ballybofey-Stranorlar FRS. It is not yet known if these proposed flood defences will

increase flood levels elsewhere in the River Finn. It is assumed that any flood defence measures that increase flood levels will not pass through the planning phase and so will not be considered for inclusion in the implementation of the Ballybofey-Stranorlar FRS.

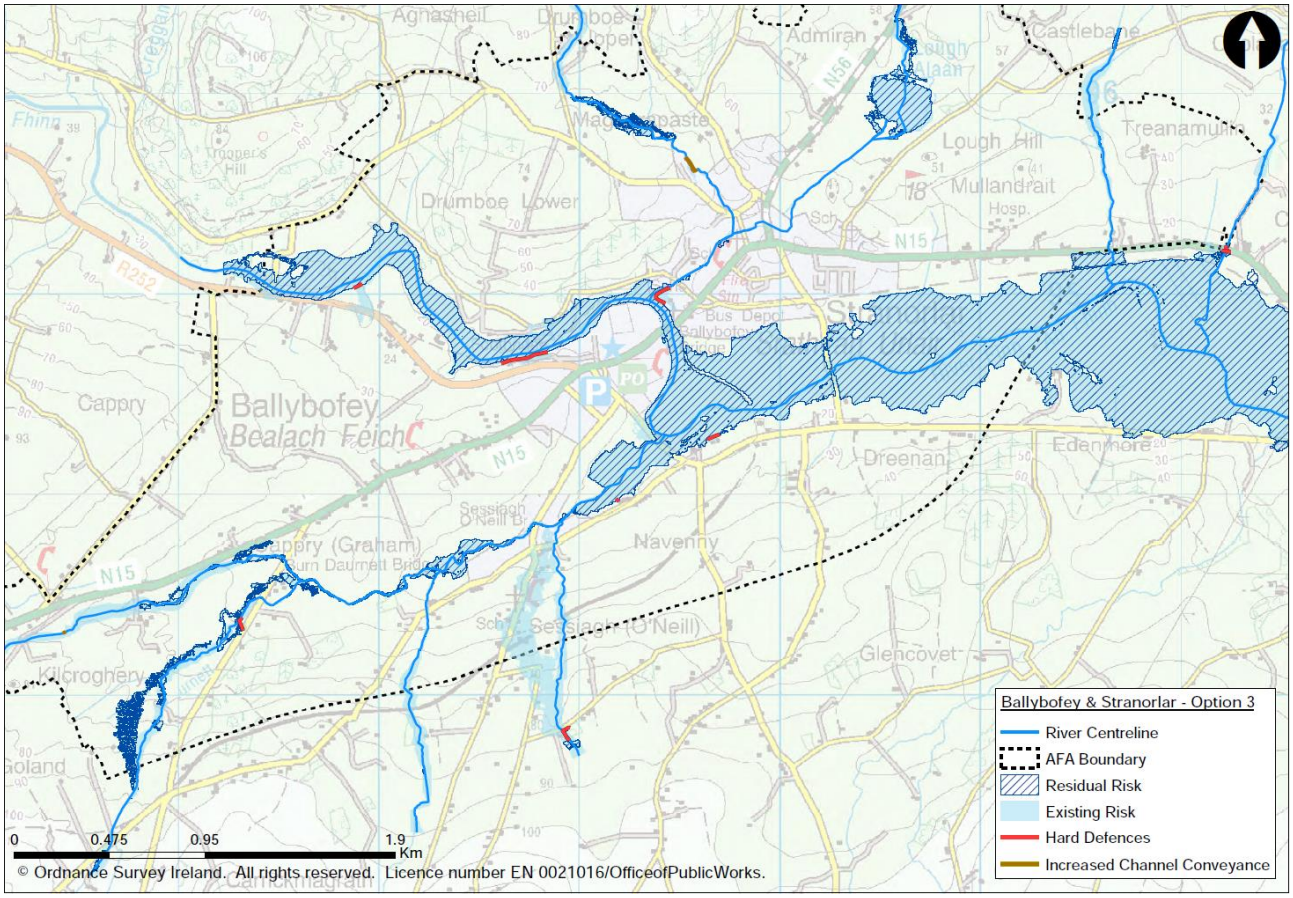


Figure 3.9 Ballybofey-Stranorlar FRS Proposed Flood Relief Measures

3.2.3 Geological Survey Ireland (GSI) GWFlood Groundwater Flooding

Historical and predictive maps prepared by GSI as part of the GWFlood Project indicate that there is no potential flooding from groundwater sources at the proposed crossing of the River Finn. This is consistent with the geology of the area and hydrological catchment.

3.3 Sources of Flooding to Development & Potential Impacts

3.3.1 Fluvial

The most reliable indicators of flooding at the proposed crossing are the CFRAM flood extent outputs illustrated in **Figure 3.8**. The proposed crossing effectively traverses the flood extents from the south banks of the River Finn and across the main river channel. There are works proposed that encroach upon a portion of the 0.1%, 1% and 10% AEP flood extents predominantly at the low-lying lands surrounding the River Finn confluence with the Drumboe Lower watercourse. **Figure 3.10** illustrates the depths of flood waters impacted by the proposed works.

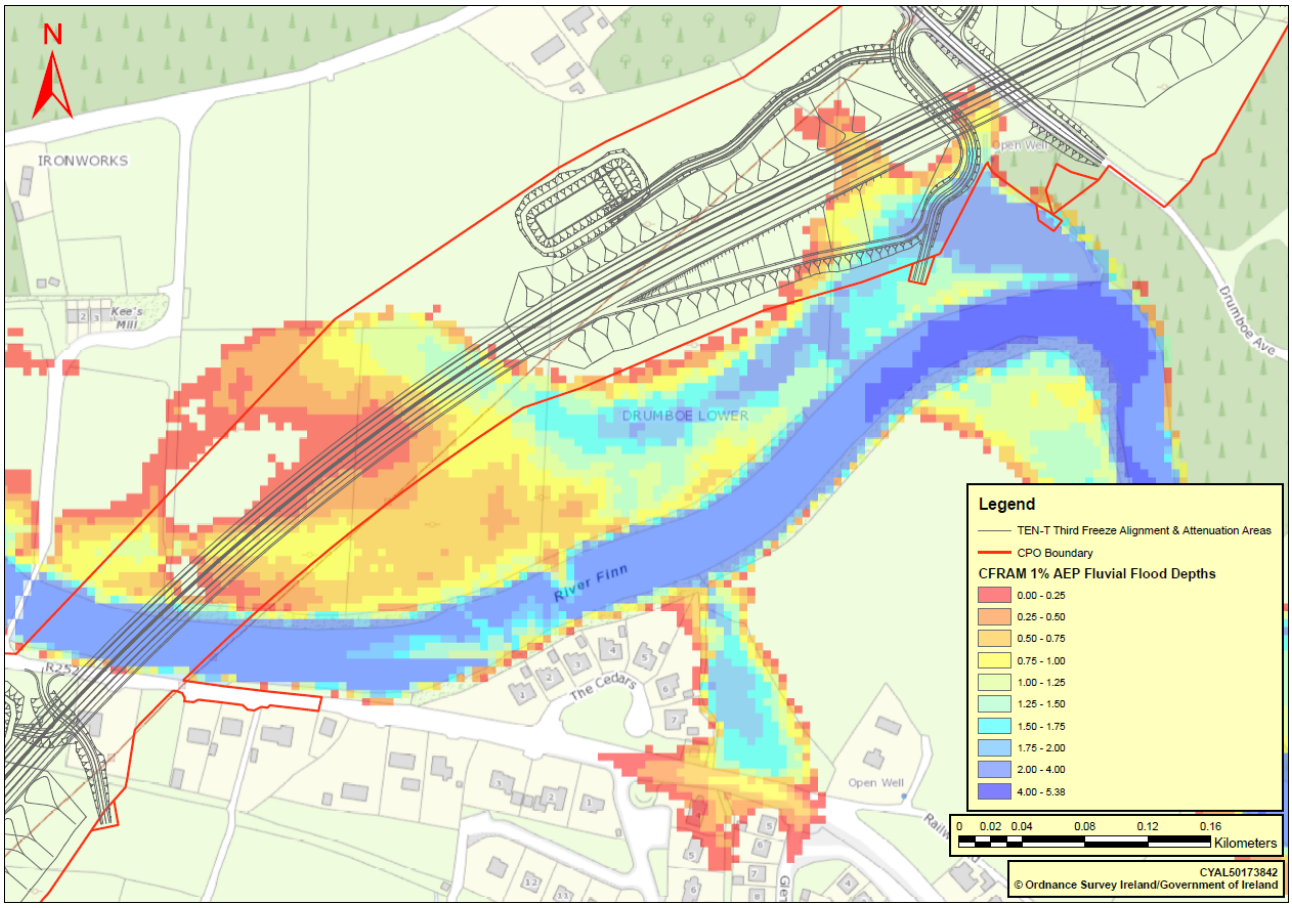


Figure 3.10 CFRAM 1%AEP Current Scenario Flood Depths

3.3.2 Coastal

N/A

3.3.3 Groundwater

Historical and predictive maps prepared by GSI as part of the GWFlood Project indicate that there is no potential flooding from groundwater sources at the proposed crossing of the River Finn.

4 HYDROLOGICAL IMPACT STUDY

A predictive hydrological assessment was undertaken, and a hydraulic model was developed at the proposed River Finn crossing to assess the impact of the proposed works upon flood risk in the study area.

4.1 Hydrology

The hydrology of the area has been examined through the use of hydrometric records and the Physical Catchment Descriptors (PCDs) prepared as part of the Flood Studies Update (FSU) programme. The closest active hydrometric station to the crossing is Ballybofey (01043). Analysis of this station's hydrometric records and flood event analysis can be seen in **Chapter 3.1.3**. **Figure 4.1** illustrates that the River Finn rises at Lough Finn approximately 27.3km upstream from the proposed road crossing.

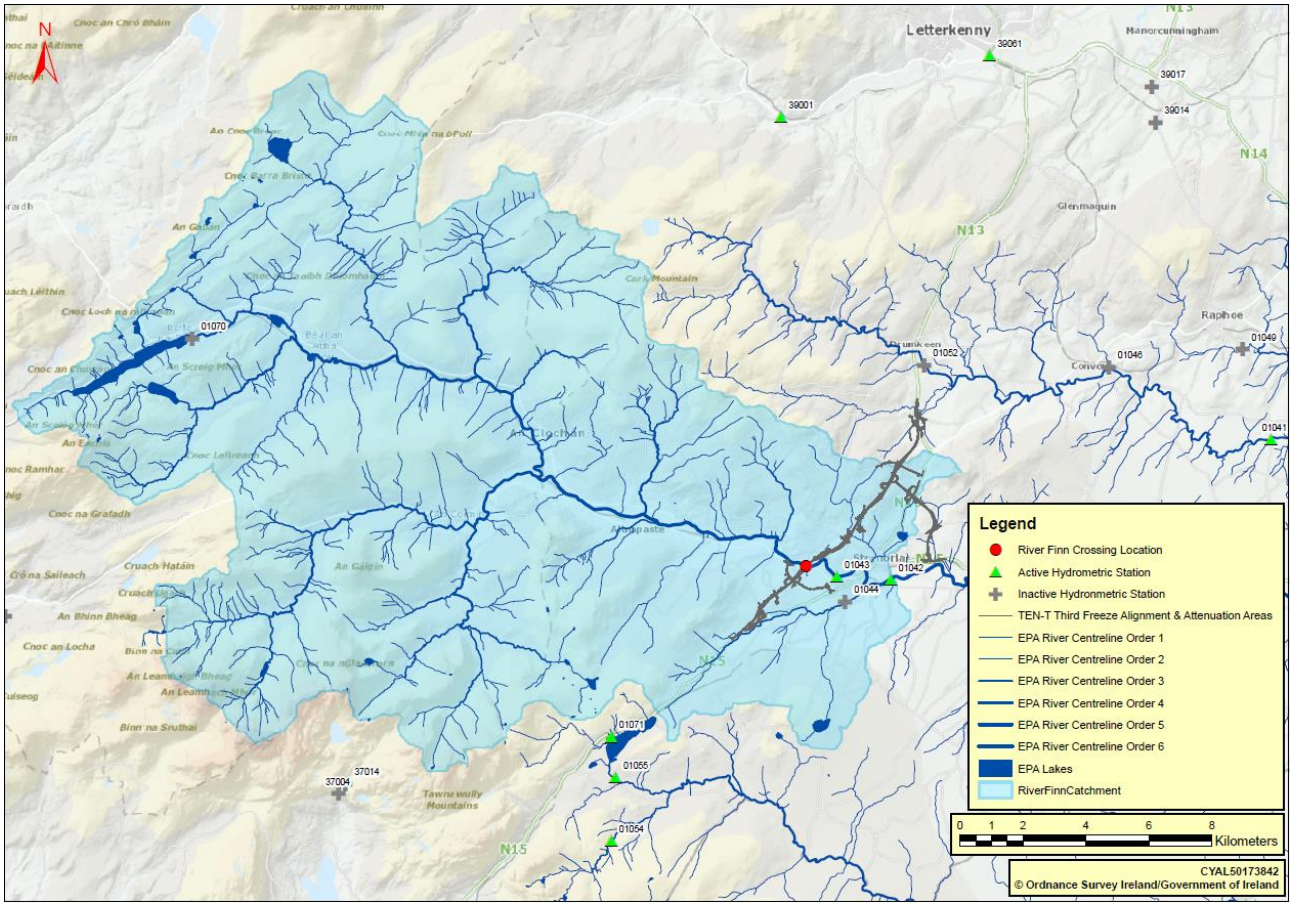


Figure 4.1 River Finn Catchment Map at Ballybofey

The PCDs have been prepared as part of the FSU programme and are readily available for ungauged nodes located at 500-metre intervals along each river/stream in Ireland for which the catchment drainage area is greater than 1km^2. The PCDs for the catchment at the proposed crossing have been extracted from FSU Ungauged Node 01_810_4 approximately 140m downstream of the proposed crossing (see **Figure 4.2** for location). The FSU PCDs for the FSU ungauged node 01_810_4 is outlined in **Table 4.1** below.

Table 4.1 FSU PCDs for River Finn ungauged node 01_810_4

Location Number	01_810_4
Contributing Catchment Area (km^2)	309.961
BFISOIL (unitless)	0.2968
SAAR (mm)	1995.1
FARL (unitless)	0.963
DRAIND (km/km^2)	1.694
S1085 (m/km)	6.2179
ARTDRAIN2 (unitless)	0
URBEXT (unitless)	0.0004

The baseflow index (BFI) value, indicative of catchment permeability, for the catchment is 0.2968, indicating an almost immediate reaction to rainfall, i.e., a flashy catchment. This BFI value is consistent with the geology of the catchment as it is predominantly peat land coverage. The Standard Annual Average Rainfall (SAAR) value is 1995.11mm and is consistent with the climate of the north-west of Ireland. The Flood Attenuation by Reservoirs and Lakes (FARL) value is 0.963, indicating negligible storage in the catchment. The PCD values show very little influence from urbanisation and arterial drainage in the catchment. The slope of the catchment (S1085) is relatively flat which is representative in the meandering in the River Finn at its middle course.

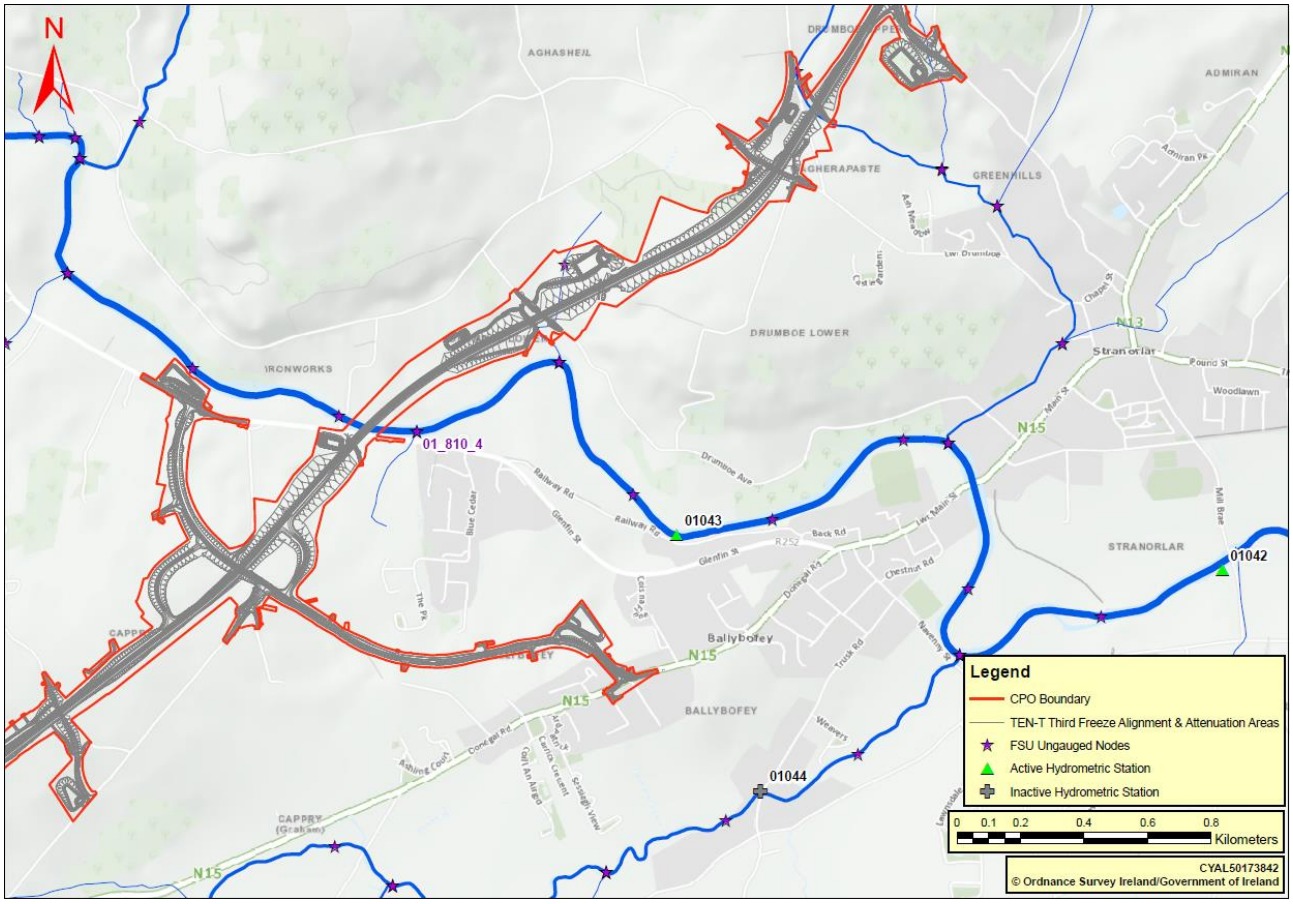


Figure 4.2 Location of FSU Ungauged Nodes and Existing Hydrometric Stations

4.1.1 Design Flow Estimation

The estimation of design flows is based on the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). Design flow estimation began with the estimation of the index flood, or median flow, Qmed. In a set of hydrometric records, Qmed represents the median of the observed annual maximum flood flows and has an annual exceedance probability (AEP) of 50%, i.e., a 2-year return period.

4.1.1.1 Estimation of Index Flood, Qmed

The Qmed for the River Finn crossing was estimated using the FSU methodology for ungauged catchments at the closest FSU ungauged node 01_810_4 approximately 140m downstream of the proposed crossing (see **Figure 4.2**).

The FSU methodology for Qmed estimation in ungauged catchments involves the use of a 7-variable catchment descriptor equation:

$$Q_{medrural} = 1.237.10^{-5}.\text{Area}^{0.937}.\text{BFI}^{-0.922}.\text{SAAR}^{1.306}.\text{FARL}^{2.217}.\text{DRAIND}^{0.341}.\text{S1085}^{0.185}.(1+\text{ARTDRAIN2})^{0.408}$$

The above PCDs were input into the 7-variable equation to calculate Qmed. The Qmed output was adjusted for the effect of urbanisation within the catchment:

$$Q_{med} = Q_{medrural} \times (1 + URBEXT)^{1.482}$$

The Qmed estimate was then adjusted to account for the discrepancy between gauged Qmed and 7-variable Qmed in the catchment. The pivotal station chosen was Ballybofey gauging station (01043) downstream on the River Swilly. The adjustment factor was calculated through the use of the gauged Qmed provided in the FSU. A second gauged Qmed value was also determined for Ballybofey 01043 to examine the sensitivity of Qmed at the gauge utilizing up to date hydrometric records. The calculations for Qmed at the catchment are tabulated in **Table 4.2** below.

Table 4.2 TEN-T Qmed calculations

Ballybofey Stn 01043 (FSU)			Ballybofey Stn 01043 (TEN-T)			FSU Ungauged Node 01_810_4		
$Qmed_{PCD}$	$Qmed_{gauged}$	Adj Factor	$Qmed_{PCD}$	$Qmed_{gauged}$	Adj Factor	$Qmed_{PCD}$	$Qmed_{adjustedFSU}$	$Qmed_{adjustedTEN-T}$
256.00	257.90	1.01	256.00	261.91	1.02	258.03	259.95	263.99

The Ballybofey Station 01043 is located approximately 1.2km downstream of the FSU ungauged node 01_810_4 and so it would be expected that the $Qmed_{PCD}$ estimate would grow with increase in catchment size. This is not the case in this scenario and is most likely due to the decrease in catchment slope S1085 from upstream to downstream and the sensitivity of the 7-variable equation to this parameter. As a result, the $Qmed_{gauged}$ at Ballybofey Stn 01043 (TEN-T) will be brought forward for the estimation of the extreme flood flows at the proposed River Finn crossing. This estimate is still considered a conservative estimate as the gauge is located 1.36km downstream of the proposed river crossing. The similarity between all values calculated is seen to be quite high so there is good confidence in this estimate.

4.1.1.2 Flood Frequency Analysis and Growth Curve Development

The growth curves required to generate the design floods were developed using the FSU methodology for pooling group analysis utilising a Region-Of-Influence (ROI) approach. A pooled flood frequency analysis was undertaken using gauged records at stations with hydrologically similar catchments using up to date records as of 2019 hydrometric year. The 2 Parameter Log Normal (LN2), Extreme Value Type 1 (EV1), Generalized Extreme Value (GEV) and Generalized Logistic Distribution (GLO) were used to fit the pooled data.

The growth curves produced by the pooling group for each distribution is tabulated in **Table 4.3** below. The growth curves are seen to be quite agreeable for the 100-year flood event. The GEV distribution and GLO distribution fit the pooling group data well and both their L-Skewness and L-Kurtosis pass centrally through the observed L-Moment ratios. It was decided to take the GLO flood growth factor forward to the 100-year

design event estimate as it has a more conservative concave up increasing shape with increase in return period while the GEV distribution appears to flatten out.

Table 4.3 TEN-T Growth Curves

Return Period (Years)	2	5	10	20	30	50	100	200	500	1000
EV1 Growth Factors	1.00	1.25	1.41	1.56	1.65	1.77	1.92	2.07	2.27	2.42
GEV Growth Factors	1.00	1.24	1.40	1.54	1.62	1.72	1.85	1.98	2.14	2.26
GLO Growth Factors	1.00	1.22	1.37	1.53	1.62	1.75	1.93	2.14	2.44	2.70
LN2 Growth Factors	1.00	1.24	1.39	1.52	1.60	1.69	1.81	1.93	2.09	2.21

The discrepancies between the CFRAM developed growth curves in **Table 3.4** and the TEN-T developed growth curves in **Table 4.3** can be explained by the utilisation of up to date hydrometric records and AMAX data across all catchments in the pooling group analysis during this study. It is also important to note that the growth curves generated during CFRAM took a more generalized Unit of Management (UoM) catchment approach and applied similar growth factors to Hydrological Estimation Points (HEPs) with similar catchment sizes while this TEN-T study takes a more site-specific approach.

4.1.1.3 Design Flow Peaks

The peak flow calculations are outlined in **Table 4.4**. A Climate Change consideration of 20% in line with Mid-Range Future Scenario (MRFS) climate projections was included in the design peak flow as recommended in OPW Section 50 guidance documents.

Table 4.4 TEN-T Design peak flow estimates

Qmed (m^3/s)	100-year growth factor	Q100 (m^3/s)	Q100+CC (20%) (m^3/s)
261.91	1.93	505.49	606.58

4.2 Hydraulic Modelling

The hydraulic modelling for this analysis was undertaken using HEC-RAS 1D. The River Finn was modelled as a steady state model in order to produce peak water levels for the 100-year flood inclusive of climate change.

4.2.1 Existing

The model geometry for the existing scenario was modelled using topographical cross-section survey data provided by Murphy Surveys in September 2020. The survey files imported into HEC-RAS were namely MSL36919_S1_R56_HECRAS_V0 and MSL36919_S1_R55_HECRAS_V0. The survey covers a reach of the River Finn approximately 930m long that includes the Mill Cottage bridge. The cross-sections do not extend to the confluence with the Drumboe Lower where CFRAM has indicated flooding in the vicinity of a proposed attenuation area. The cross-sections also don't extend as far as the hydrometric gauge 01043 and so calibration of the model wasn't achievable.

The cross-sections were imported into HEC-RAS and suitable manning coefficients were applied for the main channel (0.035) and the overbanks (0.05). The existing bridge at Mill Cottage was built into the model using the bridge data editor.

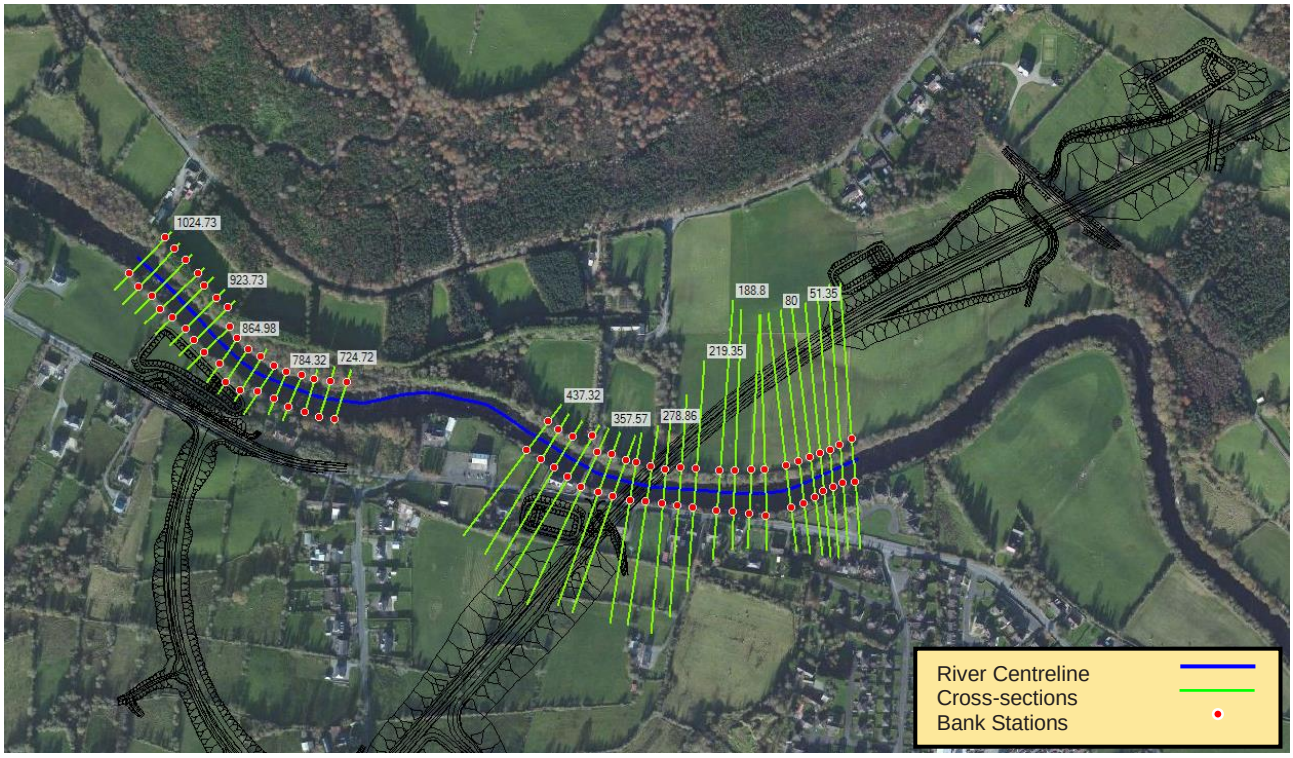


Figure 4.3 HEC-RAS Model Existing Geometry with proposed alignment overlaid

The model was run as steady state with a downstream boundary condition that calculates the water level at normal depth for the design peak flow when given the downstream slope of the channel. The flow inputs are as described in **Table 4.4**.

The model output water levels for the 100-year flood inclusive of climate change and are summarized for the proposed river crossing below.

Table 4.5 Modelled Water Levels at Proposed River Finn Crossing

Modelled Flood Level (mOD)	
U/S Face Proposed Bridge Main Channel	**D/S Face Proposed Bridge Main Channel**
21.68	21.47

4.2.2 Proposed

The proposed scenario was modelled in order to assess the impacts of the proposed bridge on the flood levels in the River Finn. The proposed bridge was incorporated into the model and the increase in flood level in the River Finn for the proposed scenario was imperceptible.

4.2.3 Mitigation

No mitigation proposed as crossing completely spans the River Finn.

5 CONCLUSION

- In January 2017, Donegal County Council appointed joint venture RPS/Barry Transportation as design consultants for the Trans-European Network - Transportation (TEN-T) Priority Route Improvement Project, Donegal. The project is divided into three sections:
  - Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region
  - Section 2 – N56/N13 Letterkenny to Manorcunningham
  - Section 3 – N14 Manorcunningham to Lifford / Strabane / A5 Link.
- This report is solely concerned with Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region and the determination of the flood impact (if any) to the River Finn, its tributaries, and their respective floodplains and to outline and evaluate any proposed mitigation measures associated with the River Finn crossing at Drumboe Lower River Finn Crossing
- The proposed River Finn river crossing is located at CH2400 on the Section 1 main alignment and stretches from the townland of Cappry to the south of the River Finn to Drumboe Lower to the north of the river. In order to span the flood levels of the River Finn and the River Finn SAC, the approaching routes to the proposed structure are in fill. The proposed route also crosses the Drumboe Lower tributary to the River Finn in this area at CH3050.
- The 6inch Cassini historical maps do not illustrate any evidence of flooding in the past. There are no records of previous flood events in the immediate vicinity of the proposed crossing according to OPW Flood Hazard Mapping. However, there were instances of flooding further downstream and upstream on the River Finn.
- The Preliminary Flood Risk Assessment (PFRA) 100-year flood extents illustrate that a short section of the proposed route and a proposed attenuation pond encroach upon flood extents at the low-lying lands surrounding the River Finn confluence with the Drumboe Lower watercourse.
- The North Western – Neagh Bann CFRAM study consisted of hydrological analyses that involved the rating of existing hydrometric gauging stations, catchment boundary review, index flow estimation, flood frequency analysis and growth curve development, hydrograph development, coastal hydrology, and joint probability analysis. Flood inundation mapping was prepared for the Ballybofey & Stranorlar AFA for flood events of varying magnitude.
- The CFRAM flood maps indicate that there are works proposed that encroach upon a portion of the 0.1%, 1% and 10% AEP flood extents predominantly at the low-lying lands surrounding the River Finn confluence with the Drumboe Lower watercourse.
- A steady 1D model was built using HEC-RAS software in order to produce flood water levels for the 100-year design flood event inclusive of climate change at the proposed crossing. The model geometry for the existing scenario was modelled using topographical cross-section survey data provided by Murphy Surveys in September 2020. The cross-sections were imported into HEC-RAS and suitable manning coefficients were applied for the main channel (0.035) and the overbanks (0.05). The existing bridge at Mill Cottage was built into the model using the bridge data editor.
- The hydrological inputs to the model were determined using the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). The $Qmed_{gauged}$ value at Ballybofey hydrometric stn 01043 was brought forward for design flow estimates due to lack in confidence in the $Qmed_{PCD}$ calculated at the FSU ungauged node at the proposed crossing. The flood growth factors were developed using pooling group analysis and a GLO distribution was selected. A Climate Change consideration of 20% in line with Mid-Range Future Scenario (MRFS) climate projections was included in the design peak flow as recommended in OPW Section 50 guidance documents.
- The model output design water levels at the upstream and downstream face of the proposed river crossing:

Modelled Flood Level (mOD)	
U/S Face Proposed Bridge	**D/S Face Proposed Bridge**
21.68	21.47

- The proposed scenario was modelled in order to assess the impacts of the proposed bridge on the flood levels in the River Finn. The proposed bridge was incorporated into the model and the increase in flood level in the River Finn for the proposed scenario was imperceptible.
- No mitigation proposed as the crossing completely spans the River Finn.
- The hydraulic model has been constructed using topographical survey and hydrological inputs were determined using the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). The model could not be calibrated to the downstream hydrometric gauge as the topographical survey did not extend to that reach of the River Finn. Manning 'n' channel and floodplain roughness parameters were estimated using survey photographs.

Appendix A - Section 50 Application Form

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region**	Structure Ref No.	**River Finn Crossing**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	River Finn			Catchment:	Finn
Address (Townland – County):		Drumboe Lower, Ballybofey, Co. Donegal			
Grid Reference	X:	212533	Y:	395012	
Hydrometric Station(s) utilized (including reference number):		Ballybofey Stn 01043			
Area of Contributing Catchment:		309.96	Km^2	Road Reference:	N15
Design Flood Flow:	606.58 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	9th December 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☒	Qmed =261.91
Unit Hydrograph	☐	
ADAS	☐	
Other	☐	

FSR ☐ FSU ☒ Qmed = 256.00 m3/s Other ☐

Comments

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	
Irish Growth Curve (ADAS)	
Factor for Standard Error (IH 124)	
Factor for Standard Error (3 - Variable Catchment Characteristics)	

Tidal ☐

Comments
Pooled Frequency Analysis undertaken to develop growth curves using hydrologically similar catchments utilising records up to 2019 and GLO Distribution – Q100 growth factor = 1.93

Hydraulic/Structure Details

Description of Structure*3 Construction of a new 370m long, seven span bridge. The 6nr piers have a width of 2m

Effective Conveyance Area *4	3734.87m^2
Upstream Invert Level **16.91** mOD	Downstream Invert Level **16.59** mOD
Upstream Soffit Level **27.84** mOD (minimum)	Downstream Soffit Level **27.84** mOD (minimum)
Upstream Design Flood Level **21.68** mOD	Downstream Design Flood Level **21.47** mOD

NOTES :

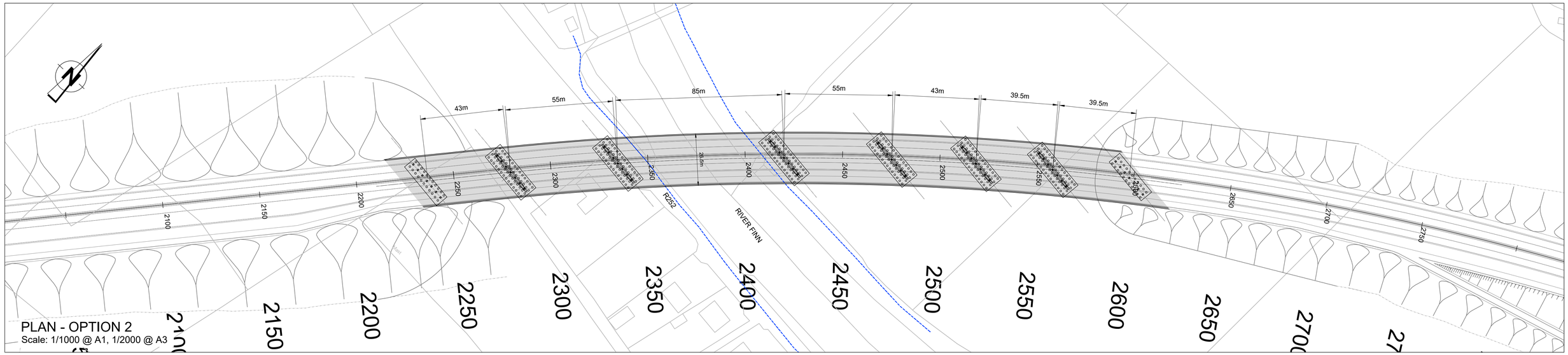
1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

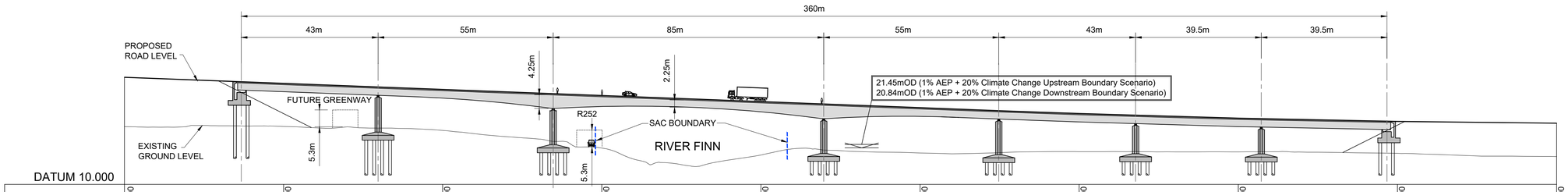
3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Appendix B - Drawings

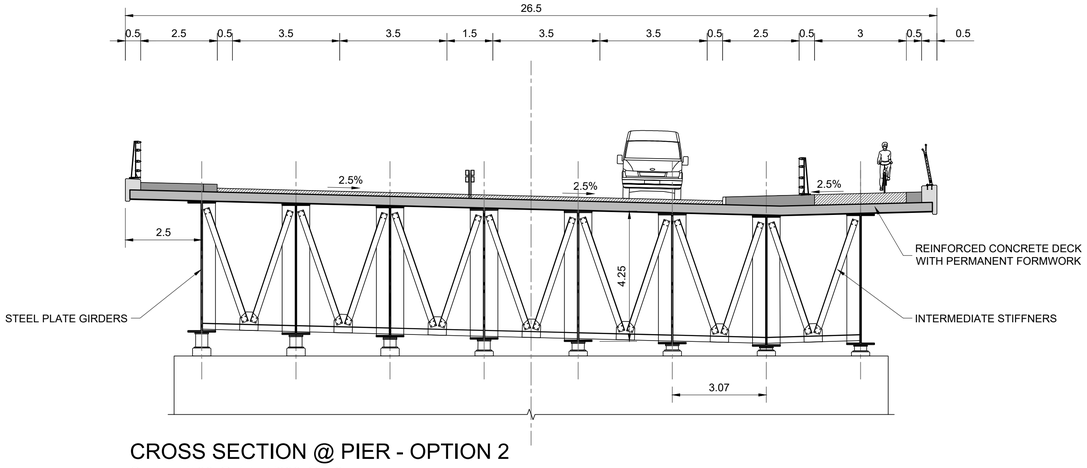


PLAN - OPTION 2
Scale: 1/1000 @ A1, 1/2000 @ A3

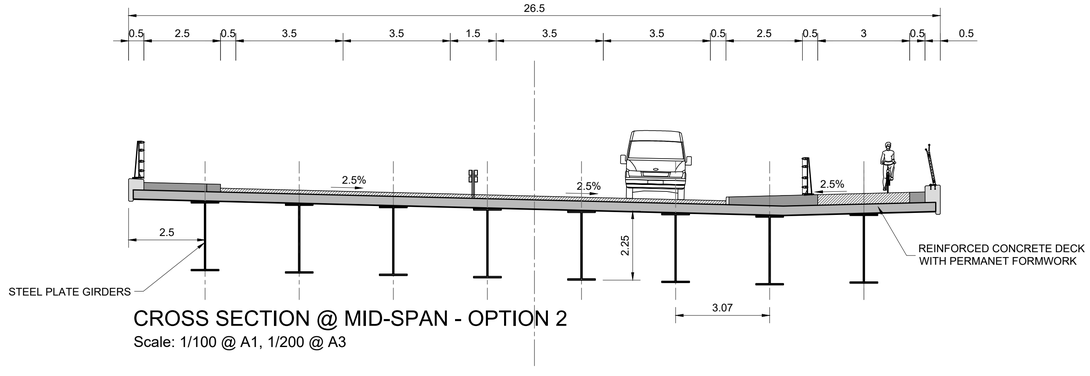


CHAINAGE	2200.000	2250.000	2300.000	2350.000	2400.000	2450.000	2500.000	2550.000	2600.000	2650.000
PROPOSED LEVEL	43.641	41.738	39.834	37.930	36.027	34.123	32.271	30.811	29.805	29.254
EXISTING LEVEL	28.102	28.168	26.914	21.411	19.220	19.834	20.254	20.206	19.735	18.745

LONG SECTION - OPTION 2
Scale: 1/750 @ A1, 1/1500 @ A3



CROSS SECTION @ PIER - OPTION 2
Scale: 1/100 @ A1, 1/200 @ A3



CROSS SECTION @ MID-SPAN - OPTION 2
Scale: 1/100 @ A1, 1/200 @ A3

NOTES

DO NOT SCALE, use figured dimensions only.

All levels are referred to Ordnance Survey Datum, Malin Head.
This drawing is the property of the Donegal County Council. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent. This document should not be relied on or used in circumstances other than those for which it was originally prepared. RPS / Barry Transportation accepts no responsibility for this document to any other party other than the party by whom it was commissioned.

Rev.	Date	Drawn	Description	Chk'd	Appr.
S3 P02	Oct.'21	DC	ISSUE FOR REVIEW & COMMENT	JM	EC
P01	09.09.21	PH	ISSUE FOR REVIEW & COMMENT	JM	EC

Project Title: TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13

Drawing Title: RIVER FINN CROSSING BRIDGE OPTION - 2 (STEEL MULTI-GIRDERS)

Status: S3

Designed: JM	Date: FEB 2021	Model File Identifier: N/A	Rev: P02
Drawn: PH	Scale @ A1: AS		
Approved: EC	@ A3: AS	File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-BR0122	
Checked: JM	Sheet: 1 of 1		

Bonneagar Iompair Éireann Transport Infrastructure Ireland
Co-financed by the Connecting Europe Facility of the European Union
Rialtas na hÉireann Government of Ireland
Tionscadal Éireann Project Ireland 2040
Donegal NRO Oifig Boiseo Naisiunta Dhun na nGall
Comhairle Contae Dhún na nGall Donegal County Council
RPS BARRY TRANSPORTATION

APPENDIX B:
HYDROLOGICAL IMPACT STUDY MULLAGHAGARRY RIVER CROSSING AT STRANORLAR

Co-financed by the Connecting Europe Facility of the European Union

HYDROLOGICAL IMPACT STUDY MULLAGHAGARRY RIVER CROSSING AT STRANORLAR

TEN-T Priority Route Improvement Project, Donegal

Section 1 N15/N13 Ballybofey / Stranorlar Urban Region

TT_MGT0337-RPS-P3-S1-RP-D-DR0003 S3 P01

Hydrological Impact Study
River Mullaghagarry Crossing, Stranorlar
S3 P01

April 2022

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1 INTRODUCTION

In January 2017, Donegal County Council appointed joint venture RPS/Barry Transportation as design consultants for the Trans-European Network - Transportation (TEN-T) Priority Route Improvement Project, Donegal. The project is divided into three sections as illustrated in **Figure 1-1**.

- Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region
- Section 2 – N56/N13 Letterkenny to Manorcunningham
- Section 3 – N14 Manorcunningham to Lifford / Strabane / A5 Link.

The study areas were developed based on the Sections above and allowing for areas to sufficiently consider constraints, options development, and future road improvements.

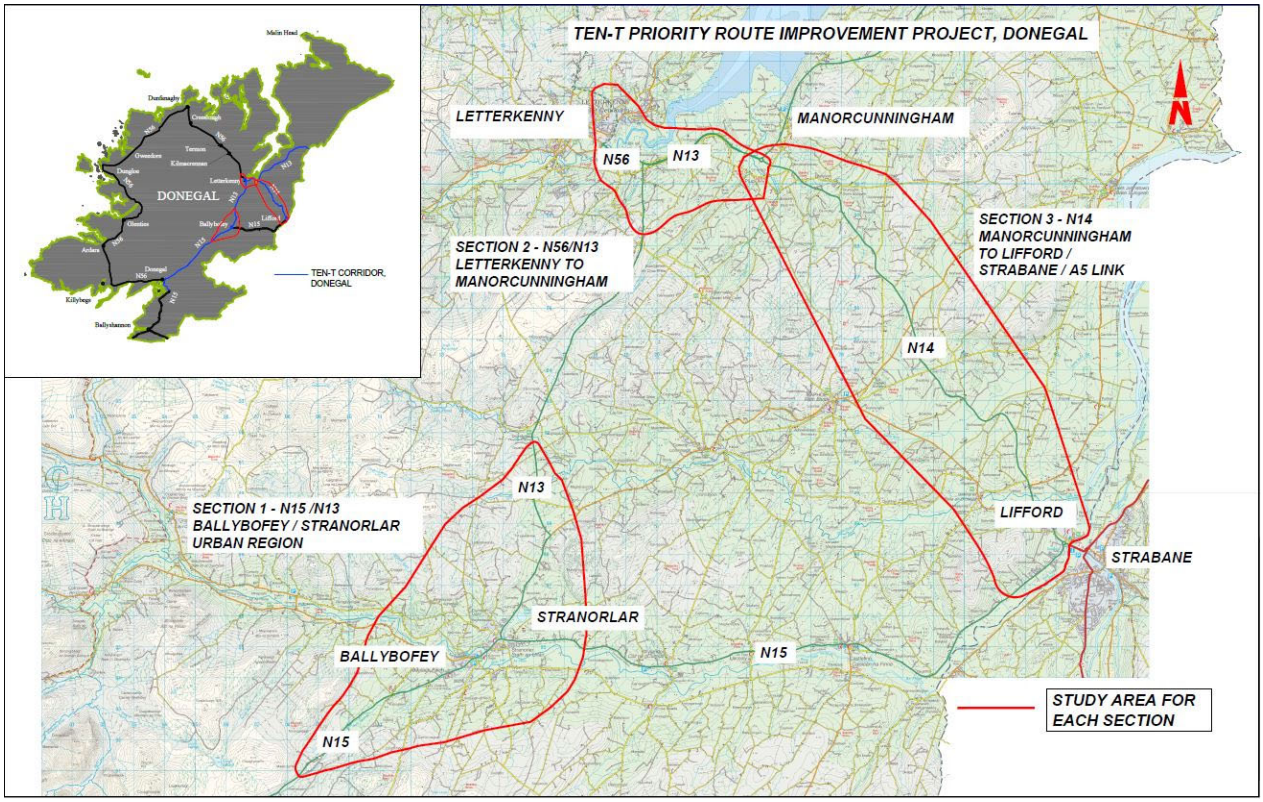


Figure 1-1 Study Areas for the TEN-T Priority Route Improvement Project, Donegal

1.1 Purpose of Report

This report is solely concerned with Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region and the determination of the flood impact (if any) to the Mullaghagarry River and its associated floodplains and to outline and evaluate any proposed mitigation measures associated with the Mullaghagarry River crossing at Treanamullin, Stranorlar.

1.2 Proposed Route

The proposed route redirects the existing N15 Sligo-Lifford national primary road from the townlands of Meencargagh and Dooish in a north-easterly direction across the River Finn upstream of Ballybofey & Stranorlar to the townlands of Teevickmoy, Meenavoy and Callan where the proposed route joins the existing N13 Stranorlar-Derry national primary road. There is also a second link road from the proposed main alignment to the existing N15. See Figure 1.2 for a plan of the proposed route.

As seen in **Figure 1-2,** the proposed route crosses the River Mullaghagarry approximately 50m downstream /south side of the Existing N15 crossing at Treanamullin.

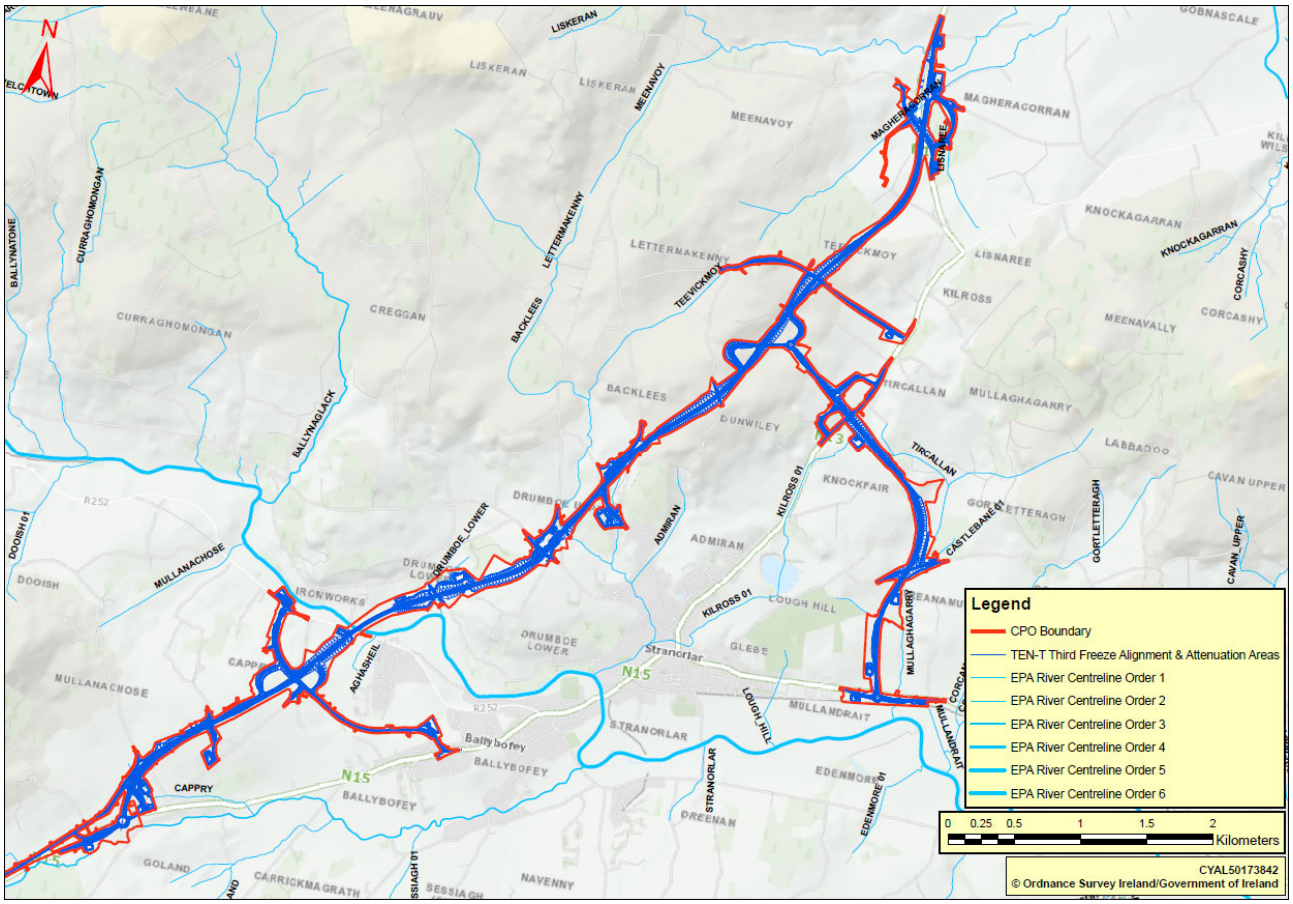


Figure 1-2 Proposed Route Plan

1.3 Report Structure

Chapter 2 of this report gives an overview of the affected watercourses and the proposed route. Chapter 3 consists of a desk study outlining information on flood history and previous flood studies and identifies flood risk at the site. A flood impact study is detailed in Chapter 4 establishing the hydrology of the catchment, calculations and hydraulic modelling undertaken to identify and evaluate the flood impact arising from the construction of the proposed route as well as providing information of any necessary mitigation. The conclusion is provided in Chapter 5.

2 SITE BACKGROUND

This chapter describes the potentially impacted site at the proposed Mullaghagarry channel and floodplain crossing at Treanamullin and north of the existing N15 culvert.

2.1 Site Description

The proposed Mullaghagarry River crossing is located at CH150-165 on the main N15 Tie-in East realignment arm where it spans from the townland of Mullandrait to Treanamullin. From CH350 the proposed alignment consists of fill embankment through the Mullaghagarry floodplain as it approaches the proposed roundabout junction with the proposed N15. Within the floodplain area there are also several proposed local access arms and a roundabout that links with the existing N15.

The Mullaghagarry River channel bed level is fairly flat at the proposed bridge crossing (levels vary from 12.69mOD to 12.48mOD upstream to downstream. The riverbank levels vary from 14.53m to 14.73mOD (Malin). The right & left overbanks (floodplain) consist of agricultural pastures and levels rise up to 16mOD in both sides. Refer to **Figure 4-4** for the existing topography in the area in a digital elevation model format.

3 DESK STUDY – EXISTING FLOOD INFORMATION

This chapter identifies existing flooding information known about the subject area. The information referenced as part of this desk study includes historical and predictive sources. This chapter will highlight areas of interest with regard to flooding where the proposed works may impact upon flood risk elsewhere or may itself be vulnerable to flooding.

3.1 Historical Flooding

The historical sources interrogated for this chapter include the Ordnance Survey Ireland (OSI) 6inch Cassini historical mapping, Office of Public Works (OPW) website floodmaps.ie and OPW Hydrometric Records. The subject road development site was visited on 25th June 2021 and 7th March 2022 in order to get an understand on the flood mechanism in the area.

3.1.1 OSI Historical Mapping

The 6inch Cassini historical maps the low-lying floodplains of River Finn and Mullaghagarry River in the vicinity of the proposed development are liable to flooding (see **Figure 3-1**).

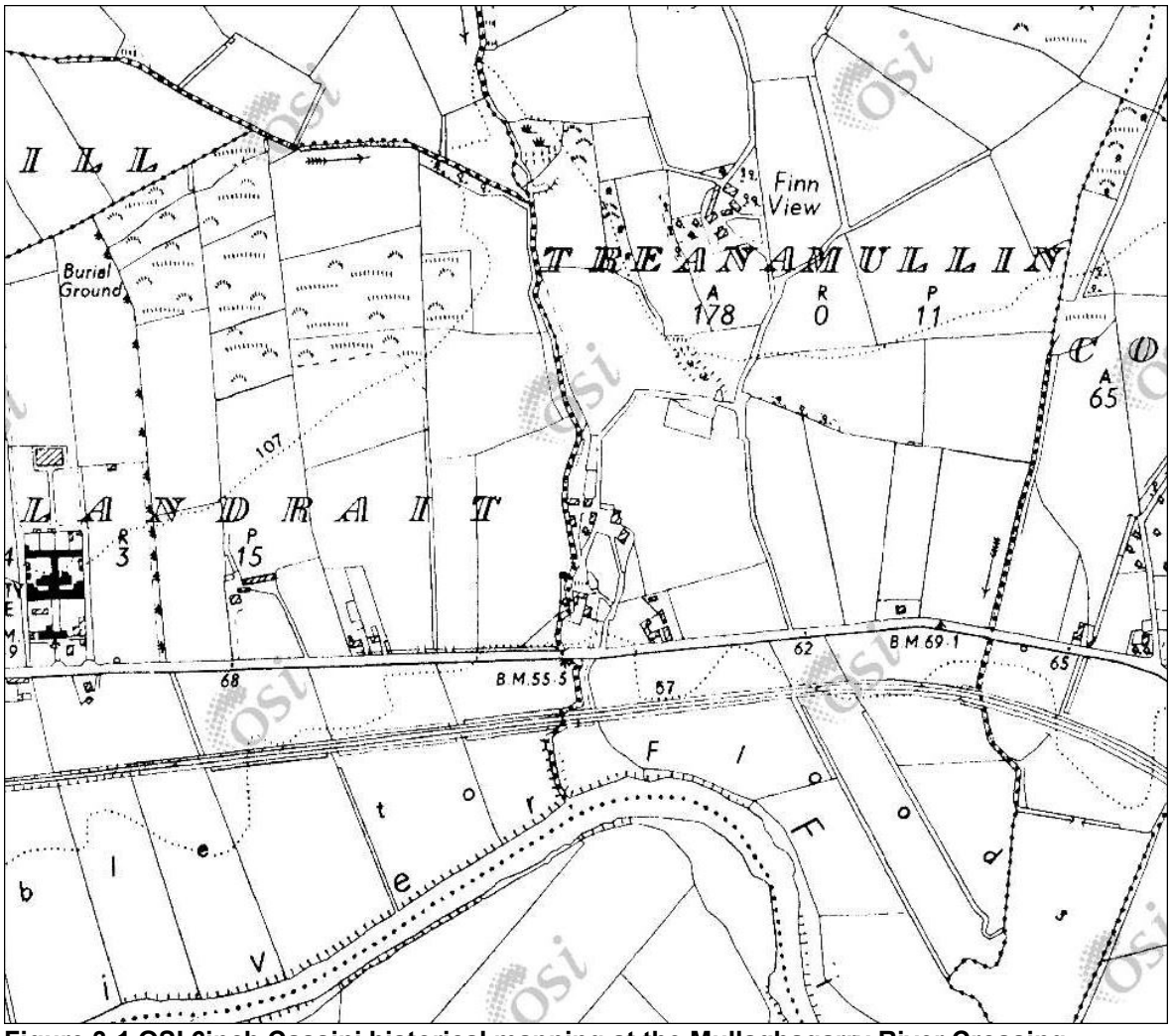


Figure 3-1 OSI 6inch Cassini historical mapping at the Mullaghagarry River Crossing

3.1.2 OPW Flood Hazard Mapping

Figure 3-2 shows an extract of the OPW flood hazard map in the subject area. It can be seen in the map that there are number of recurring flood points located within the 2.5 km radius of the proposed development site.

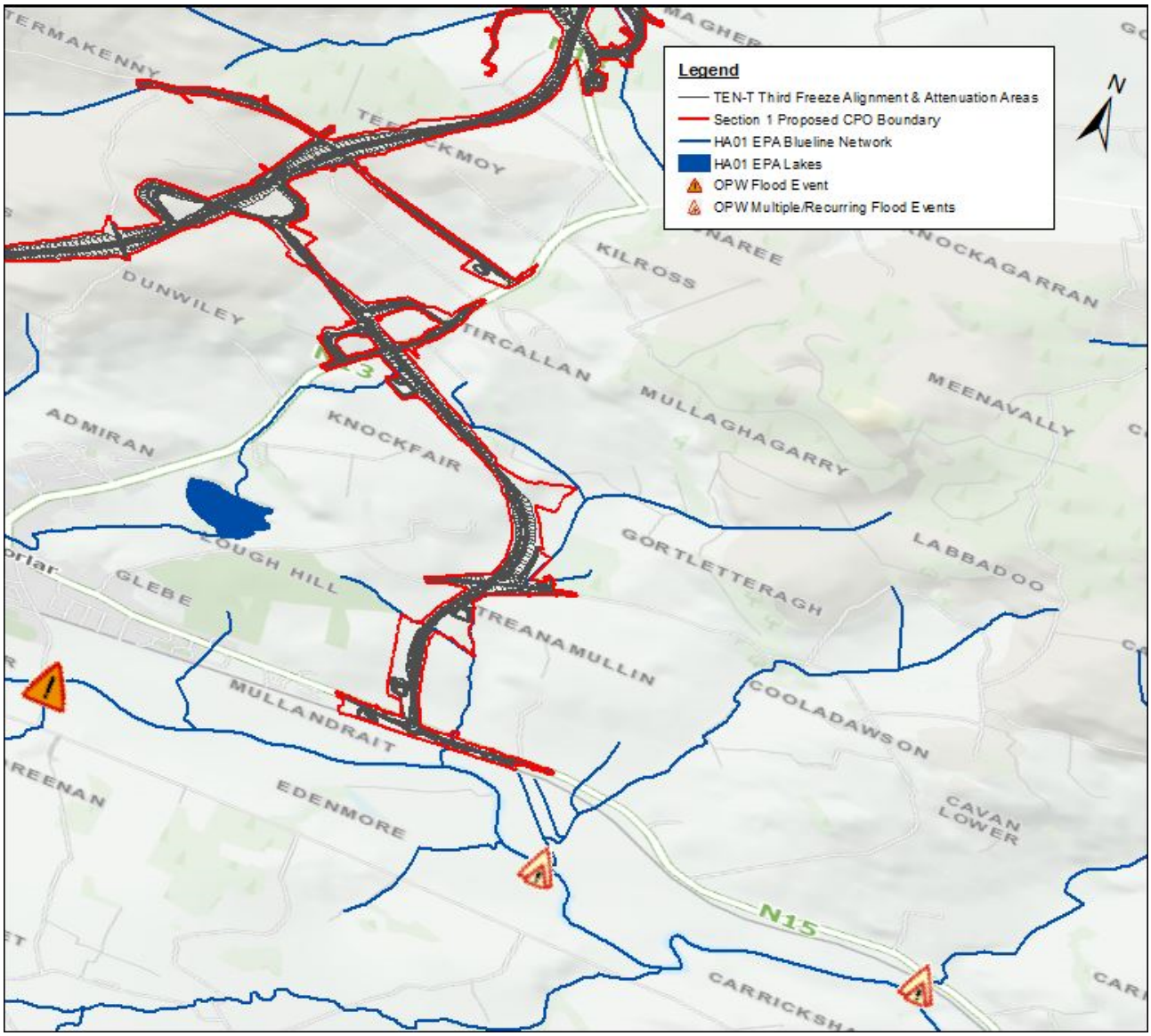


Figure 3-2 OPW Historical Flood Mapping (FloodInfo.ie) at the Mullaghararry River Crossing

It is apparent from the recorded flood history in the OPW floodinfo website (www.floodinfo.ie) and also from local sources that the low-lying floodplains of River Finn and Mullaghagarry River flood every winter (approximately 4 to 5 times). The worst flooding occurred in the area in December 2015. The anecdotal record suggests that flood level at the existing N15 bridge crossing rose to a level of 14.95mOD on 5th December 2015, which caused flooding at some section of N15 road and existing railway embankment. Refer to Figures 3-3 and 3-4, which showing the flooded areas south of the existing railway embankment and the lands between the N15 road and railway embankment. Land areas, north of N15 road drains via a roadside drain and then discharges into the Mullaghagarry River channel at the existing railway arch culvert via a long pipe culvert. Lands located in the upstream vicinity of this pipe culvert generally flood when the flood level in the Mullaghagarry river is high. Other noted flood events occurred in the area were on 26th September 1985, 6th February 1995, 13th January 2013 and 26th November 2006.

Figure 3-3 River Finn Floodplain south of the existing railway embankment during the December 2015 flood event.

Figure 3-4 River Finn Floodplain north of the existing railway embankment/ south of N15 road during the December 2015 flood event.

3.2 Predictive Flooding – CFRAM Study

The site has been included in predictive modelling as part of broader OPW studies. These are namely the Preliminary Flood Risk Assessment (PFRA) and the Catchment Flood Risk and Management (CFRAM) programme.

The PFRA study was undertaken as part of the scoping phase of the CFRAM study to identify areas for further assessment (AFAs) where the flood risk was determined to be potentially significant from one or more sources of flooding. This was undertaken as a requirement of the EU 'Floods' Directive.

It is important to note that the PFRA was not a detailed assessment of flood risk. It was rather a broad assessment, based on available and readily derivable information to identify areas where there was a genuine cause for concern about a risk and impact of flooding that may require further assessment.

The OPW used three sources of information to designate these AFAs:

- Historic information on floods that happened in the past.
- Public consultation to gain local and expert knowledge from Local Authorities and other Government departments and agencies to identify areas prone to flooding and the potential consequences.
- Engineering techniques to analyse potential damage that could be caused by flooding.

The Ballybofey/Stranorlar urban area was highlighted as an AFA as a result of the PFRA process and as such was included in the North Western - Neagh Bann CFRAM Study. Catchment Flood Risk and Management (CFRAM) Study

The OPW commissioned RPS to undertake the North Western – Neagh Bann CFRAM Study in March 2012 and final flood maps were issued in July 2017. The Ballybofey & Stranorlar AFA is located in east Donegal and is affected by the middle reaches of the River Finn and its adjoining tributaries.

The CFRAM study consisted of detailed hydrological analyses including the rating review of existing hydrometric gauging stations within the catchment, catchment boundary review, index flow estimation, flood frequency analysis and growth curve development and hydrograph development.

The outputs from the CFRAM current scenario fluvial modelling for the predictive 0.1%, 1% and 10% AEP events in the vicinity of the proposed development can be seen in **Figure 3-5.** It can be seen from this map that a section of the proposed road is predicted to be liable to flooding if these flood events would occur.

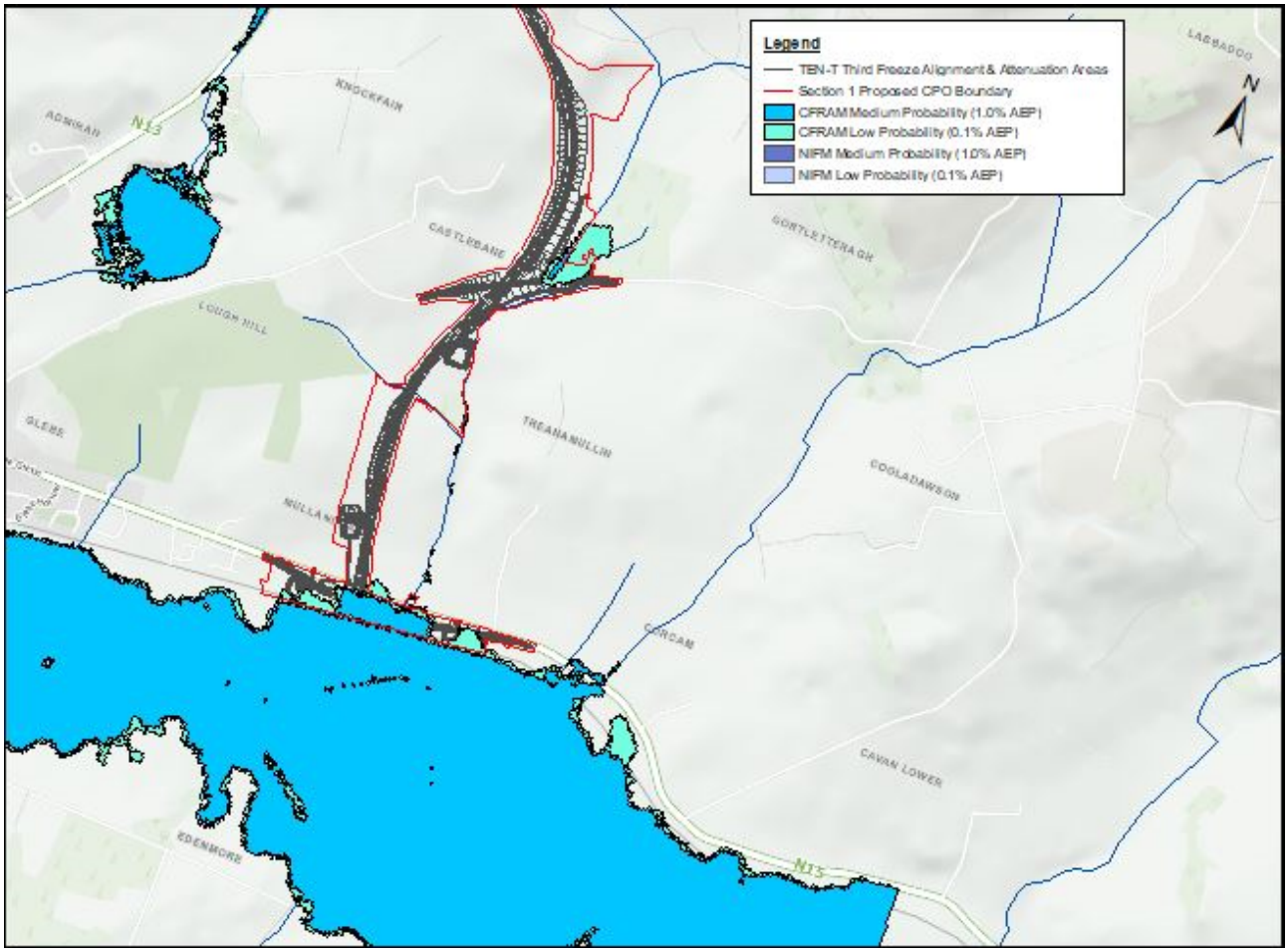


Figure 3-5 CFRAM current fluvial flood extents in the vicinity of the proposed road development

Historical and predictive flood maps prepared by GSI as part of the GWFlood Project indicate that there is no potential flooding from groundwater sources in the vicinity of the proposed development.

4 HYDROLOGICAL IMPACT STUDY

A predictive hydrological assessment was undertaken, and a hydraulic model was developed at the proposed Mullaghagarry River crossing to assess the impact of the proposed works upon flood risk in the study area.

4.1 Hydrology

The hydrology of the area has been examined through the use of hydrometric records and the Physical Catchment Descriptors (PCDs) prepared as part of the Flood Studies Update (FSU) programme.

Mullaghagarry River is a small tributary of River Finn rises in the high grounds at the townlands of Mullaghagarry and Tircallan (approximately at a ground elevation of 200mOD) and flows in the southerly direction approximately 3 km before it discharges into River Finn at the townland of Treanamullin. Mullaghagarry River has an approximate upstream catchment of 5.90km2 at the proposed road crossing at Treanamullin (see **Figure 4.1**). The River Finn is one of the major tributaries of the greater Foyle catchment (HA 01) and emanates from the Bluestack and Glendowan Mountains in the interior of Donegal. The River Finn flows into the River Mourne to form the River Foyle at Lifford/Strabane. The Finn has an approximate upstream catchment area of 319 km2 at Ballybofey (see **Figure 4-2**).

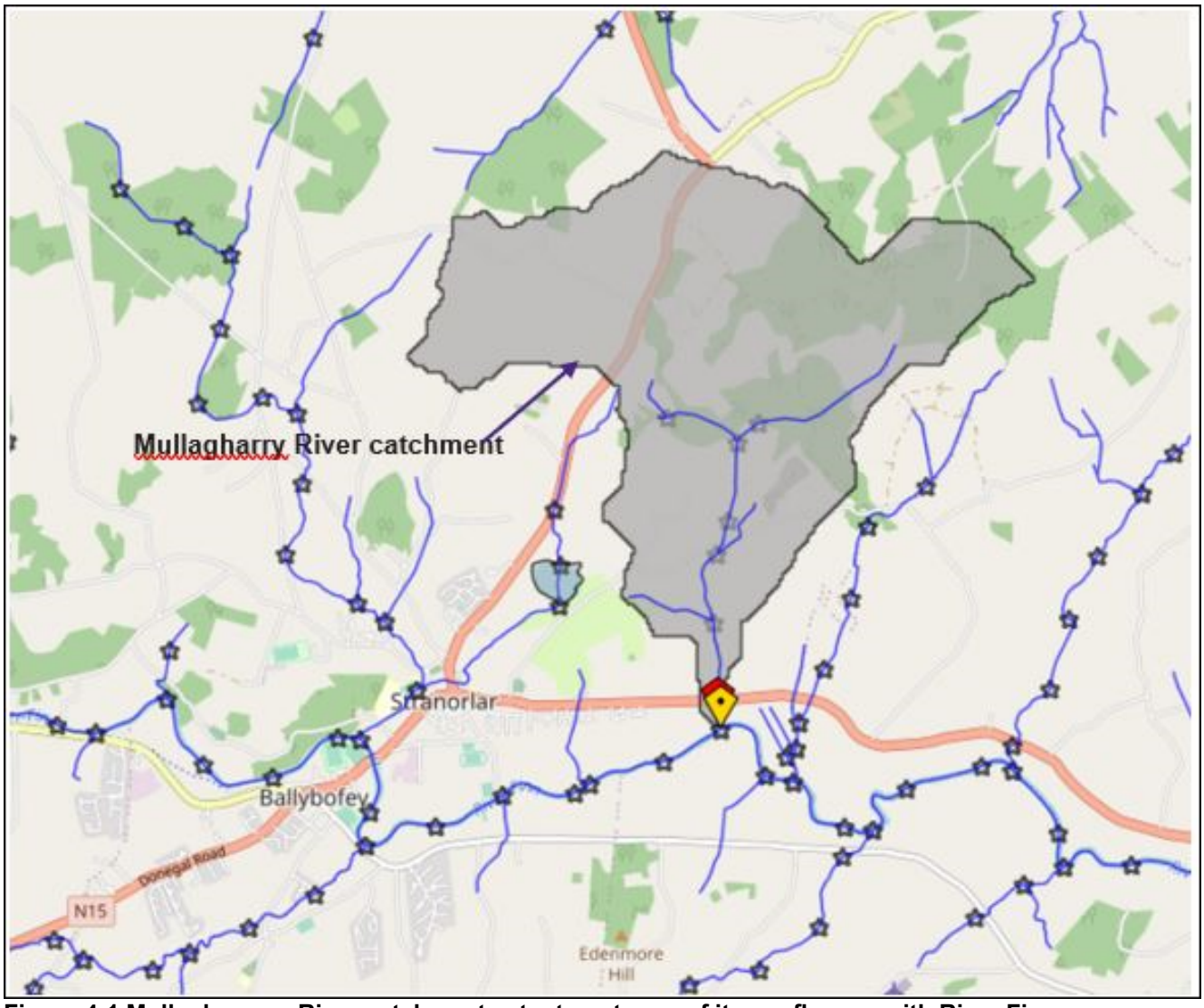


Figure 4-1 Mullaghagarry River catchment extent upstream of its confluence with River Finn (extracted from OPW FSU Portal)

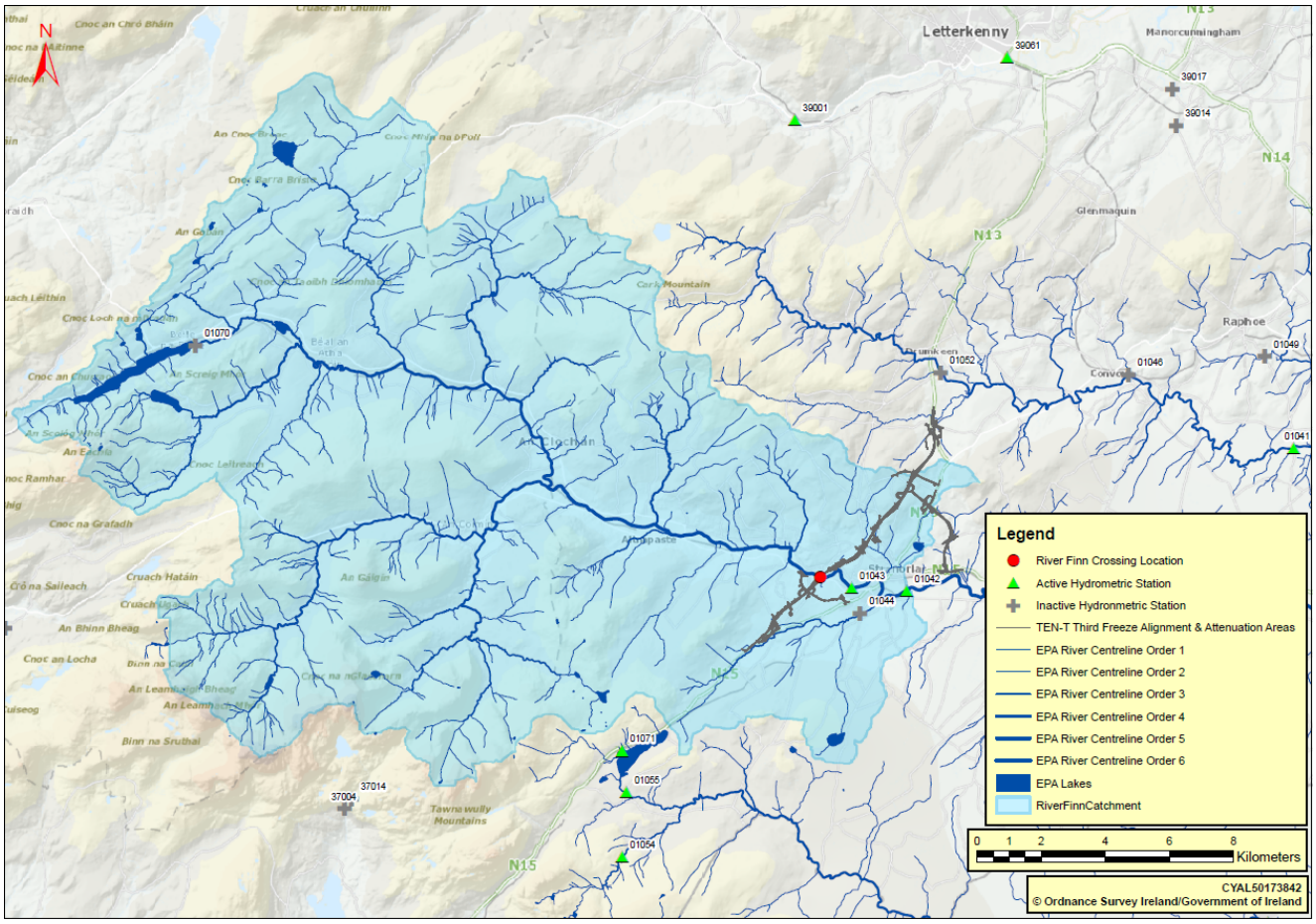


Figure 4-2 River Finn Catchment Map at Ballybofey

The Physical Catchment Descriptros values for both the River Finn and Mullaghagarry River catchments were obtained from the OPW FSU database. **Table 4-1** presents these PCD values. The Mullaghagarry River catchment is predominantly rural with 65% pasture cover. The entire catchment area has the 1975 Flood Studies Report classified soil type 2, suggesting that it has a low runoff potential. The catchment is fairly steep with the mainstream slope (S1085) of 41.56m/km. The Standard Annual Average Rainfall (SAAR) value is 1243.14 mm. The Flood Attenuation by Reservoirs and Lakes (FARL) value is 1, indicating negligible storage in the catchment.

Table 4-1 PCD values for River Mullaghagarry (at the railway crossing) and Finn River (source Flood Studies Update PCD values)

Watercourse	River Finn at Ballybofey (01043)	River Finn at Dreenan (01042)	Mullaghagarry River (FSU location Id. 01_776_2)
Contributing Catchment Area (km^2), AREA	319.0	353.0	5.88
BFISOIL (unitless)	0.297	0.298	0.396
SAAR (mm)	1989	1936	1243.14
FARL (unitless)	0.964	0.965	1
DRAIND (km/km^2)	1.684	1.622	0.824
S1085 (m/km)	5.854	5.706	41.56
ARTDRAIN2 (unitless)	0.0	0.0	0.0
URBEXT (unitless)	0.001	0.006	0.0
ARTDRAIN (unitless)	0.0	0.0	0.0
ALLUV (unitless)	0.013	0.014	0.0
FOREST (unitless)	0.251	0.251	0.281

River Finn is a medium to large sized catchment (502 km^2) with a mixture of peat, pasture and forest coverage. The Standard Annual Average Rainfall (SAAR) value is 1989mm and is consistent with the climate of the north-west of Ireland. The FARL values of 0.964 indicating negligible storage in the catchment. The PCD values for the river catchments show very little influence from urbanisation and arterial drainage in the catchment. The slope of the catchment (S1085) is relatively flat.

The subject Mullaghagarry River catchment is not gauged. However, River Finn is gauged at Ballybofey (hydrometric station no. 01043) and at Dreenan (hydrometric station no. 01402). The Ballybofey and Dreenan gauging stations are located approximately 4.20 km and 1.5km upstream of the Mullaghagarry River confluence. Ballybofey station has water level records from 1972 to 2020 while the Dreenan station has water level records from 1972 to 2017. The observed maximum water levels at these gauge locations are 19.039mOD-Malin and 16.335mOD-Malin observed on 15th November 2015 and 5th December 2015 respectively. The highest maximum observed flood level in River Finn at the confluence of Mullaghagarry River was approximately 14.95mOD-Mallin observed on 5th December 2015 (local source).

4.1.1 Design Flow Estimation

The estimation of design flows is based on the best practice guidance for Irish catchments generally as outlined in the Flood Studies Update (FSU). Design flow estimation began with the estimation of the index flood, or median flow, Qmed. In a set of hydrometric records, Qmed represents the median of the observed annual maximum flood flows and has an annual exceedance probability (AEP) of 50%, i.e., a 2-year return period.

4.1.1.1 Estimation of Index Flood, Qmed

The Qmed value for the River Mullaghagarry study area was estimated using the FSU methodology for the ungauged catchments. The following PCD based regression equations derived from the FSU Work Packages 2.3 and 4.2 have been used in estimating the index-flood for the ungauged catchments in their rural form referred to henceforth as Qmed-rural.

FSU 7-variable: $Q_{med\ rural} = 1.237*I0^{-5}*AREA^{0.937}*BFI_{SOIL}^{-0.922}*SAAR^{1.306}*FARL^{2.217}*DRAIND^{0.341}*S1085^{0.185}*(1+ ARTDRAIN2)^{0.408}$

FSU 5-variable: $\mathbf{Q_{med\ rural}} = (\mathbf{2.0951 * 10^{-5}})\mathbf{AREA^{0.9245}SAAR^{1.2695}BFI^{-0.9030}FARL^{2.3163}S1085^{0.2513}}$

FSU 3-variable: $\mathbf{Q_{med\ rural}} = \mathbf{0.000302 * AREA^{0.829}SAAR^{0.898}BFI^{-1.539}}$

It should be mentioned here that the 7-variable Qmed equation has been derived through regression analysis of the observed records and associated various PCDs from 190 stations in Ireland. This has a Factorial Standard Error (FSE) of 1.37. This method is recommended for use only for catchment areas larger than 25 km^2. In developing the FSU 5-variable and 3-variable equations 35 stations with catchment areas ranging from 2.8 km^2 to 28.6 km^2 were used. The FSE values associated with these equations are 1.686 and 2.059 respectively.

The Qmed-rural estimate was then adjusted for the effect of urbanisation within the catchment area using the following equation:

$$Q_{med} = Q_{medrural} \times (1 + URBEXT)^{1.482}$$

The accuracy of the above Qmed estimates has been assessed by using a number of similar characteristics gauging sites (pivotal sites). **Table 4-2** presents the PCD details and observed Qmed for a number of pivotal catchments, hydrologically similar to the subject ungauged catchment. The hydrological similarity between the subject site and the pivotal sites has been determined based on the similarity in PCD parameters of Catchment Area (AREA), SAAR and BFISOIL for both the subject and pivotal sites.

Table 4-2 PCD values for the Pivotal Sites for Mullaghagarry River

Pivotal Sites	Area (km^2)	SAAR (mm)	BFI	FARL	DRAIND (km/km^2)	S1085 (m/km)	ART-DRAIN2	URBEXT	Obs. Qmed (m^3/s)
6030 (Big River @ Ballyygoly)	10.400	1156.770	0.447	0.972	2.224	20.091	0.000	0.000	9.42
36021 (Yellow River @ Kiltybardan)	23.406	1569.640	0.330	0.995	1.473	19.110	0.000	0.000	23.91
14033 (Owenass River @ Mountmellick)	78.892	1145.220	0.454	1.000	1.119	11.379	0.000	0.009	20.95
35002 (Owenbeg River @ Billa Bridge)	88.820	1380.560	0.422	0.986	1.701	13.263	0.000	0.000	49.74
10004 (Figile River @ Clonbulloge)	30.567	1700.390	0.436	0.986	0.938	25.037	0.000	0.000	33.90

Table 4-3 presents the observed and FSU method predicted Qmed values along with the estimated adjustment factors for all of the above-mentioned pivotal sites. It can be seen from Table 4.3 that the FSU 5-variable equation outperforms the observed Qmed at most of the five pivotal sites selected for the smaller river catchments, with an average adjustment factor of 1.065 (under-estimation by 6.5%) using the more conservative arithmetic mean.

Table 4-3 Mullaghagarry River Catchment - Qmed Adjustment Factors

Pivotal Sites	Obs. Qmed (m3/s)	FSU PCD -Qmed-urban			Adjustment Factor (Qmed_obs/Qmed_est)			Performance
		7-Var	5-var	3 Var	7-Var	5-var	3 Var	
6030 (Big River @ Ballyygoly)	9.42	5.017	5.82	4.09	1.88	1.62	2.301	
36021 (Yellow River @ Kiltybardan)	23.91	19.187	24.91	16.85	1.25	0.96	1.419	
14033 (Owenass River @ Mountmellick)	20.95	25.030	34.58	21.52	0.84	0.61	0.974	5-variable equation performs better
35002 (Owenbeg River @ Billa Bridge)	49.74	43.389	51.91	31.04	1.15	0.96	1.603	
10004 (Figile River @ Clonbulloge)	33.90	18.673	28.73	14.69	1.82	1.18	2.307	
				Arithmetic Mean=	**1.385**	**1.065**	**1.56**	Average under-estimation by 6.5%
				Geometric Mean=	**1.251**	**0.980**	**1.47**	Average over-estimation by 2 %

Based on the above assessments, It was considered prudent to use the 5-variable equation in estimating the Qmed value for the Mullaghagarry River catchment. The estimated Qmed value for the Mullaghagarry River catchment is 5.73 m3/s. Based on a FSE of 1.686 for the 5-variable equation the 68% upper confidence limit of the Qmed estimate is 9.66 m3/s.

4.1.1.2 Flood Frequency Analysis and Growth Curve Development

The growth curves required to generate the design floods were developed using the FSU methodology for pooling group analysis utilising a Region-Of-Influence (ROI) approach. A pooled flood frequency analysis was undertaken using gauged records at stations with hydrologically similar catchments using up to date records as of 2020 hydrometric year. The 2 Parameter Log Normal (LN2), Extreme Value Type 1 (EV1), Generalized Extreme Value (GEV) and Generalized Logistic Distribution (GLO) were used to fit the pooled data.

The growth curves produced by the pooling group for each distribution is tabulated in **Table 4-4**Error! Reference source not found. below. The growth curves are seen to be quite agreeable for the 100-year flood event. The GEV distribution and GLO distribution fit the pooling group data well and both their L-Skewness and L-Kurtosis pass centrally through the observed L-Moment ratios. It was decided to take the GLO flood growth factor forward to the 100-year design event estimate as it has a more conservative concave up

increasing shape with increase in return period while the GEV distribution appears to flatten out. The estimated 1%AEP growth factor for the Mullaghagarry River catchment is 2.241 (**Table 4-4**).

Table 4-4 Mullaghgarry River Catchments-Growth Factors

AEP (%)	50%	20%	10%	5%	2%	1%	0.5%	0.2%	0.1%
EV1 Growth Factors	1.000	1.291	1.483	1.668	1.907	2.086	2.265	2.500	2.678
GEV Growth Factors	1.000	1.293	1.493	1.691	1.955	2.159	2.368	2.651	2.872
GLO Growth Factors	1.000	1.266	1.458	1.664	1.972	2.241	2.546	3.016	3.431
LN2 Growth Factors	1.000	1.289	1.471	1.641	1.857	2.015	2.173	2.380	2.537

4.1.1.3 Design Flow Peaks

The design flood flow is calculated by multiplying the Qmed flow by growth curve derived from a pooling group of recorded data. The estimated 1%AEP peak flood flow for the Mullaghagarry River catchment inclusive of 20% climate change allowance is 15.41 m^3/s (**Table 4-5**).

Table 4-5 Mullaghagarry River catchment- estimated design peak flows

AEP (%)	50%	20%	10%	5%	2%	1%	0.5%	0.2%	0.1%
Peak Flows (m^3/s)	5.73	7.25	8.35	9.53	11.30	12.84	14.59	17.28	19.66
Peak Flows with 20% CCA	6.88	8.71	10.03	11.44	13.56	15.41	17.51	20.74	23.59
68%ile Peak Flows with 20% CCC	11.59	14.68	16.90	19.29	22.86	25.98	29.52	34.96	39.78

4.1.2 Hydrograph Development

The flood hydrographs for the Mullaghagarry River were generated using Flood Studies Updates recommended Hydrograph Width Analysis method. The HWA method uses the catchment descriptors to arrive at an initial estimate of the hydrograph shape, defined in three parameters (see below), and then uses a pivotal site to adjust the shape based on observed data. This method uses a parametric UPO-ERR-Gamma model (2 parameter) to approximate the hydrograph shape up to the inflection point, while the recession limb of the hydrograph is proposed to be represented by a 1- parameter exponential recession curve (Exponential Recession Replacement – ERR model). The proposed parameters of this UPO-ERR-Gamma model are:

n – Shape parameter of Gamma distribution
T_r – Rise time (=translation parameter)

C - Recession parameter (hours)

The following catchment descriptors were used in developing the above-mentioned hydrograph parameter

- BFISOIL – the baseflow index estimated from soil characteristics
- FARL – a measure of flood attenuation due to reservoirs and lakes
- ALLUV – the proportion of the catchment covered in alluvial soils
- ARTDRAIN – the proportion of the catchment that benefits from arterial drainage schemes
- S1085 – the slope of the main channel.
- DRAIND – drainage density (km/km^2)
- FOREST - proportion of forest cover within the catchment area

Table 4-6 FSU recommended equations for the characteristic hydrograph (n, Tr and C)

Parameters	When BFI values are unavailable
n	$n = 1 + 4.78DRAIND^{0.63}FARL^{5.46}(1 + FOREST)^{2.46}$
T_r	$T_r = 13.85DRAIND^{-0.48}FARL^{-2.54}(1 + ARTDRAIN)^{-3.16}(1 + ALLUV)^{-8.83}(S1085/1000)^{-0.25}$
C	$C = 11.78DRAIND^{-0.97}FARL^{-7.65}(1 + FOREST)^{-3.70}AREA^{0.26}$

Refer to the FSU Technical Research Report Volume III for further details of the HWA method.

The estimated hydrograph shape parameters n, Tr and C for the Mullagharry River catchment are 33.66, 8.79 and 9.0 respectively. Based on similarity in PCD values of S1085, BFISOIL and FARL, a gauged catchment (36021_Yellow River at Kilybarden) was identified as a pivotal site for the subject Mullaghagarry river catchment. The above mentioned hydrograph shape parameters are then adjusted using this pivotal site. Further to this it was found that the FSU HWA estimated Tr parameters (hydrograph *time-to-rise* parameter) is unrealistic (very prolonged), even after adjusting with the pivotal site. In this case the FSSR16 method estimated critical storm duration / time to hydrograph peak (equivalent to the HWA Tr value) appeared to be more realistic, and therefore adopted as the Tr value for the Mullaghagarry River catchment. The final estimates of the hydrograph shape parameters n, Tr and C for the Mullaghagarry River catchment are 6.0, 6.88 and 0.0 respectively. **Figure 4-3** presents estimated 1%AEP flood hydrograph for Mullaghgarry river catchment inclusive of 20% Climate change allowance.

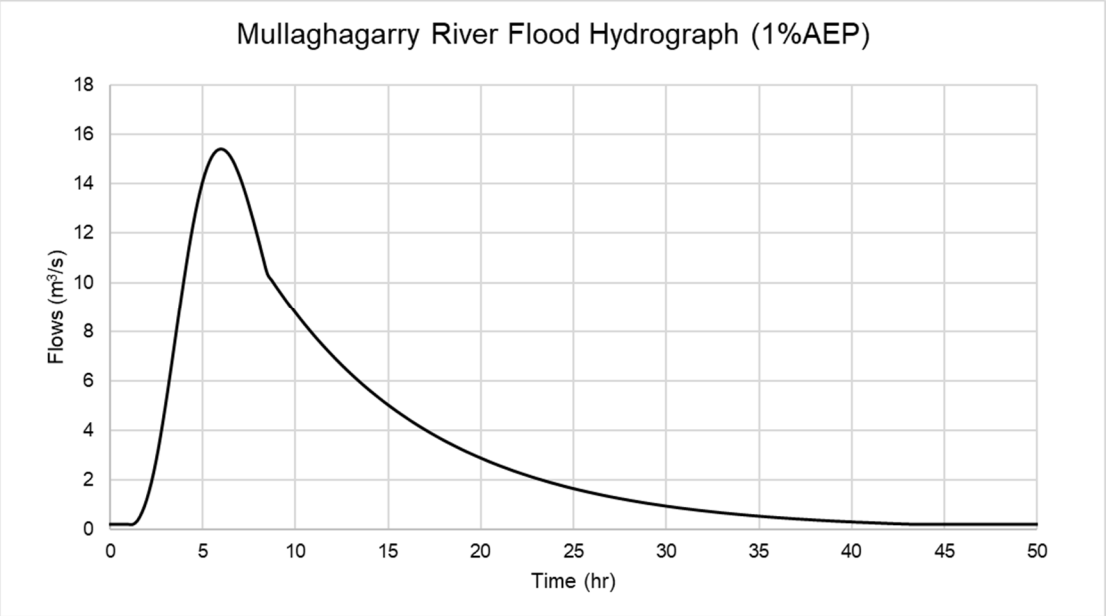


Figure 4-3 Mullaghagarry River 1% AEP Flood hydrograph (inclusive of 20% climate change allowance)

4.2 Hydraulic Modelling

The hydraulic modelling for this FRA was undertaken using the US Army Corps of Engineers developed HEC-RAS software. The River Mullaghagarry was modelled as a 1D unsteady state model in order to produce peak water levels for the 100-year flood inclusive of climate change.

4.2.1 Existing Scenario

4.2.1.1 Geometry

The Mullaghagarry River channel cross sectional information and the LiDAR data for the associated low-lying floodplains were procured through a topographical survey contract under the TEN-T project. **Figure 4-4**

illustrates locations of the channel cross-sections, existing bridge structures and a digital elevation model for the floodplain areas.

The river passes through two existing culverts upstream of the proposed road bridge crossing. It flows under the existing N15 road through a double arch bridge (span 2.4 m and rise 1.2m each) (see Photos 3 & 4 in Appendix A). Upstream of this bridge the river flows through a 3-barrels pipe culvert (pipe diameter 0.95m each) (refer to Photos 1 & 2 in Appendix A). Downstream of the proposed road crossing the river flows under an existing railway embankment through a single arch bridge (span 4.66m and rise 2.55m) (refer to Photos 5 & 6 in Appendix A). The bottom widths of the river channel vary from 4 m to 12m, while the top widths vary from 7m to 14m. The HEC-RAS model was built using these bridge and channel geometric information. Manning's 'n' values of 0.04 and 0.06 were used for the river channel and floodplain respectively.

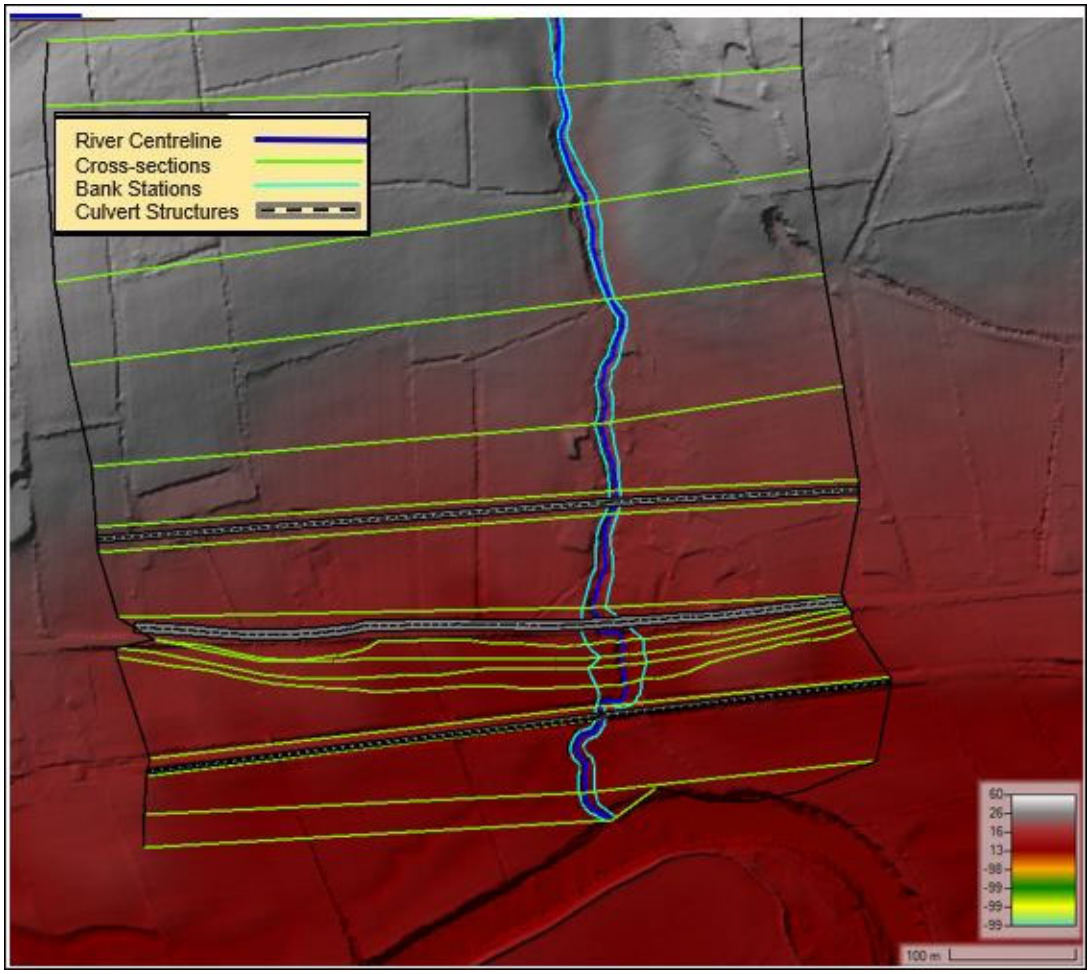


Figure 4-4 Existing geometry plan

The estimated 1%AEP flow hydrograph was input at the upstream boundary of the model while a stage hydrograph was used as downstream boundary condition. **Figure 4-5** shows the stage hydrograph that was used as boundary condition. This was obtained from the observed water levels in River Finn at the Dreenan gauge during the December 2015 flood event. The observed peak water level at Dreenan gauge on 5th December 2015 was 16.335mOD-Malin. As mentioned earlier that this gauge is located approximately 1.5m upstream of the Mullaghagarry River confluence; therefore, a hydraulic gradient based adjustment to the observed water levels at Dreenan was applied to derive the water levels at the Mullaghagarry River confluence. The adjustments factors were derived from the known concurrent water levels in River Finn at the Ballybofey and Breenan gauges. The adjusted peak water level during the December 2015 flood event at the Mullaghagarry River confluence is in the order of 14.95mOD (Malin). The statistical frequency analysis of the observed water levels at Dreenan gauge showed that the December 2015 flood event has an approximate return period of 1 in 100 years.

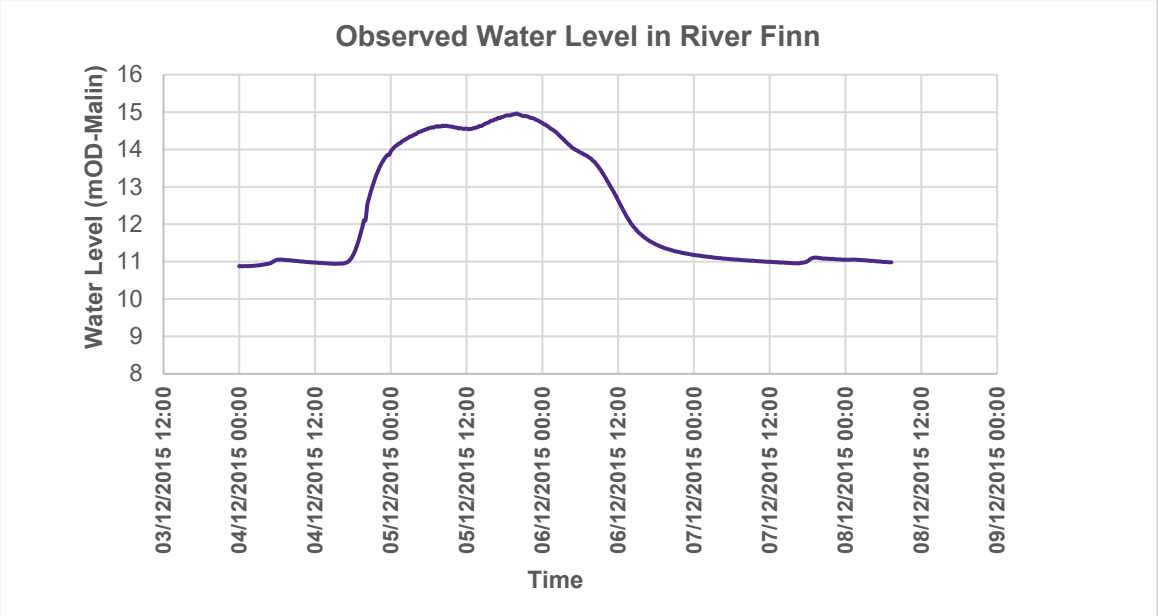


Figure 4-5 Stage hydrograph in River Finn (downstream boundary condition)

The peaks of the flow and stage hydrographs were timed to be coincidental in order to be conservative.

4.2.1.2 Results

The simulated 1%AEP flood profile along the modelled stretch of the Mullaghagarry River channel is shown in **Figure 4-6. Figure 4-7** illustrates the simulated flood extents for this 1%AEP flood flows. **Table 4-7** presents the predicted flood levels at the upstream vicinity of the existing bridges. It can be seen from this flood profile that the existing river channel and the bridge/culverts do not have adequate capacity to convey the 1%AEP flood flow.

Table 4-7 Predicted 1%AEP flood levels for the existing condition

Locations	1% AEP Peak Flood Levels	
	With 20% Climate change (CC)	With 20% CC & FSE
Upstream of railway culvert	14.87	14.86
Upstream of N15 road culvert	15.29	15.45
Upstream of pipe culvert	18.51	18.89

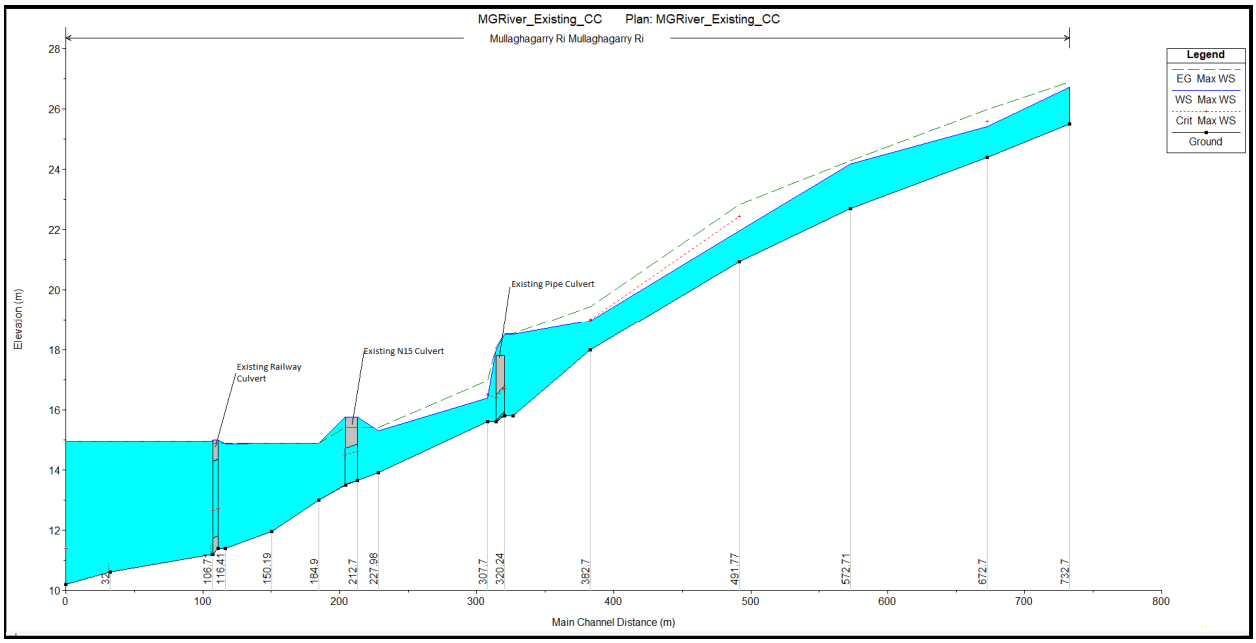


Figure 4-6 1%AEP flood profile for the existing condition (inclusive of 20% climate change)

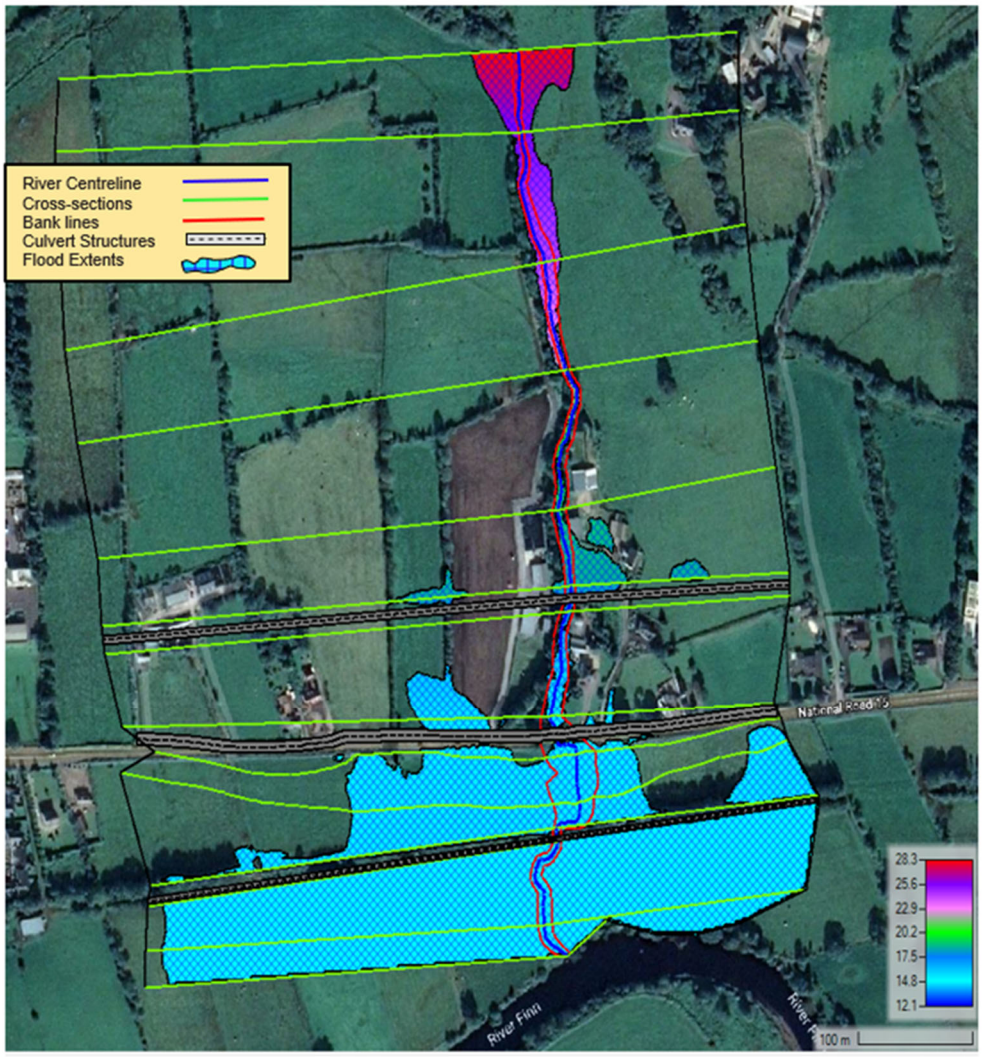


Figure 4-7 Existing Scenario 100-year current scenario flooding extents

4.2.2 Proposed Scenario with Mitigation Measures

4.2.2.1 Geometry

The geometry for the proposed scenario with mitigation measures was prepared by providing flood compensation area ponds within flood plain area and north of the proposed road with a storage volume of 13500m^3. **Figure 4-8** illustrates locations of these compensation storages. A double vent box culvert of 2.5m x 2.5m each was used initially proposed at the proposed road crossing and was included in the model geometry.

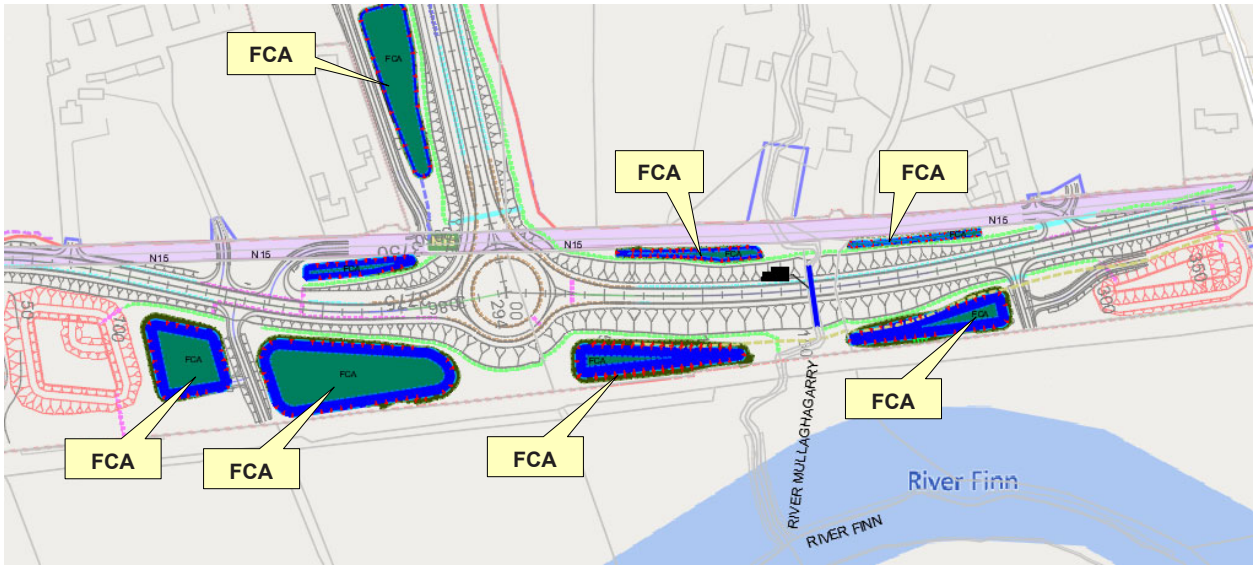


Figure 4-8 Locations of Flood Compensation Areas (FCAs)

4.2.2.2 Results

The HEC-RAS model simulations showed that a double vent box culvert with a vent size of 2.3m (span) x 2.7m(high) each will be required to safely convey the design flood flows with a required minimum freeboard of 300mm. **Figure 4-9** shows the simulated 1%AEP flood profile for the proposed model geometry. **Figure 4-10** illustrates the simulated flood extents for this 1%AEP flood flow with proposed bridge and compensation storage areas as shown in **Figure 4-8**. **Table 4-8** presents the predicted flood levels at the upstream vicinity of the existing bridges.

Table 4-8 Predicted 1% AEP flood levels for the proposed design condition.

Locations	1% AEP Peak Flood Levels	
	With 20% Climate change (CC)	With 20% CC & FSE
Upstream of railway culvert	14.91	14.89
Upstream Proposed TEN-T Culvert	15.06	15.33
Upstream of N15 road culvert	15.05	15.45
Upstream of pipe culvert	17.93	18.89

It can be seen from the above results that under the proposed design conditions with the proposed compensation storage flooding scenario in the area will be improved. Any increase in the flood level in the River Finn, south of the proposed road/existing railway embankment, is expected to be imperceptible due to the presence huge extent of River Finn floodplain in the immediate downstream vicinity of the Mullagharaggy River confluence.

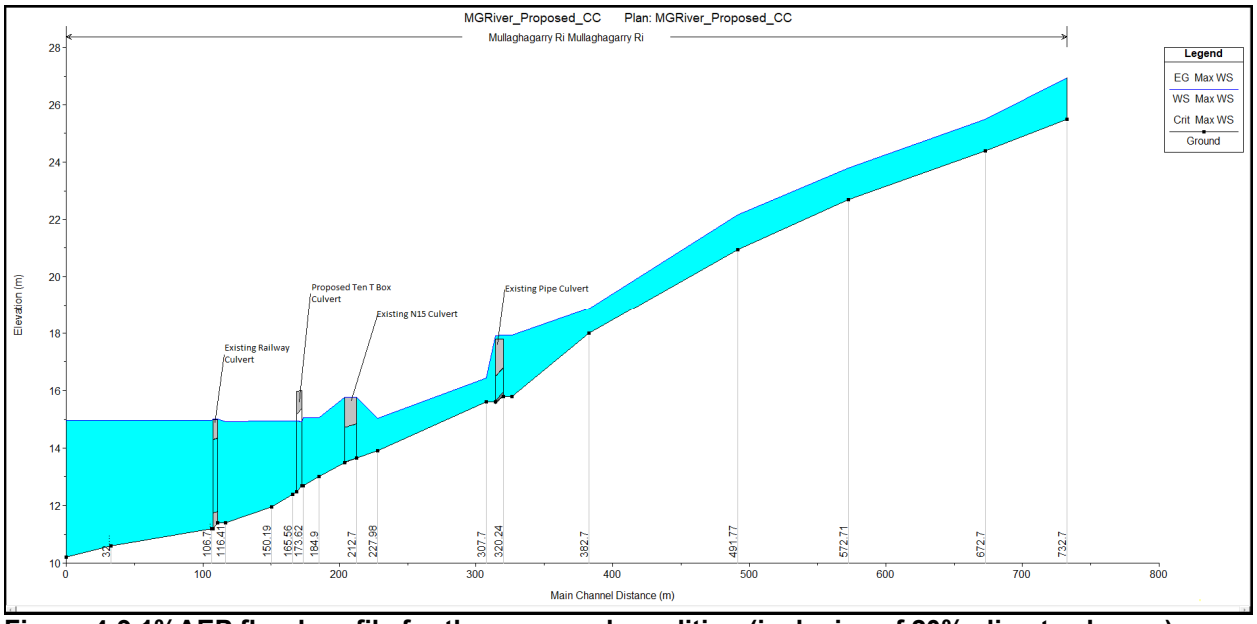


Figure 4-9 1%AEP flood profile for the proposed condition (inclusive of 20% climate change)

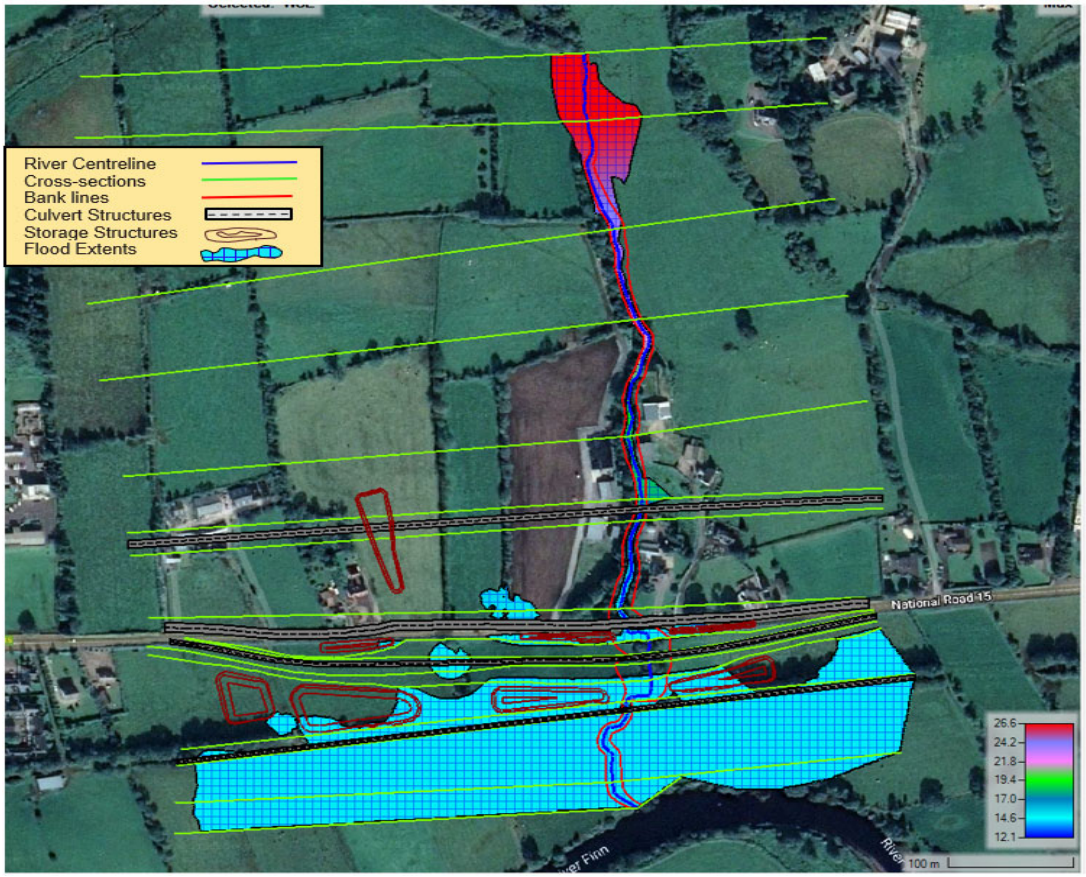


Figure 4-10 Proposed Scenario HEC-RAS simulated flood extents

5 CONCLUSION

- In January 2017, Donegal County Council appointed joint venture RPS/Barry Transportation as design consultants for the Trans-European Network - Transportation (TEN-T) Priority Route Improvement Project, Donegal. The project is divided into three sections:
  - Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region
  - Section 2 – N56/N13 Letterkenny to Manorcunningham
  - Section 3 – N14 Manorcunningham to Lifford / Strabane / A5 Link.

- This report is solely concerned with Section 1 – N15/N13 Ballybofey / Stranorlar Urban Region and the determination of the flood impact (if any) to the Mullaghagarry Riverr and associated floodplains and to outline any proposed mitigation measures.
- The low-lying floodplain of Mullaghagarry River, in the vicinity of the proposed road crossing, is liable to flooding mainly from the high-water level in River Finn. This high water level in River Finn causes significant backwater effect to the upstream catchment flow of Mullaggarry River.
- The Mullaghaghgarry River is ungauged, the design flood flow for this river catchment has been estimated in accordance with FSU recommended methods for ungagged catchments. The estimated 1%AEP peak flow at the proposed road crossing is 15.41 m3/s inclusive of future climate change allowance of 20%.
- The 1%AEP flood level at the subject bridge crossing has been estimated through building an unsteady HEC-RAS hydraulic model (1D). The model geometry has been obtained from the topographical survey info procured under the TEN-T project.
- The HEC-RAS model simulation showed that the existing river channel and the bridge/culverts do not have adequate capacity to convey the 1%AEP flood flow.
- Under the proposed design condition, i.e. with a double vent box culvert with a vent size of 2.3m (span) x 2.7m(high) each at the proposed road crossing along with some compensation storage associated with road embankment, the HEC-RAS model simulation showed an improved flooding scenario in the vicinity. The estimated freeboard above the predicted 1%AEP flood level at the upstream vicinity of the proposed bridge is in the order of 450 mm.
- Any increase in the flood level in the River Finn, south of the proposed road/existing railway embankment, is will be imperceptible due to the presence huge extent of River Finn floodplain in the immediate downstream vicinity of the Mullagharaggy River confluence.

Appendix A – Photos

Photo 1: Upstream of existing Pipe Culvert

Photo 2: Downstream of existing Pipe Culvert

Photo 3: Upstream of existing N15 Culvert

Photo 4: Downstream of existing N15Culvert

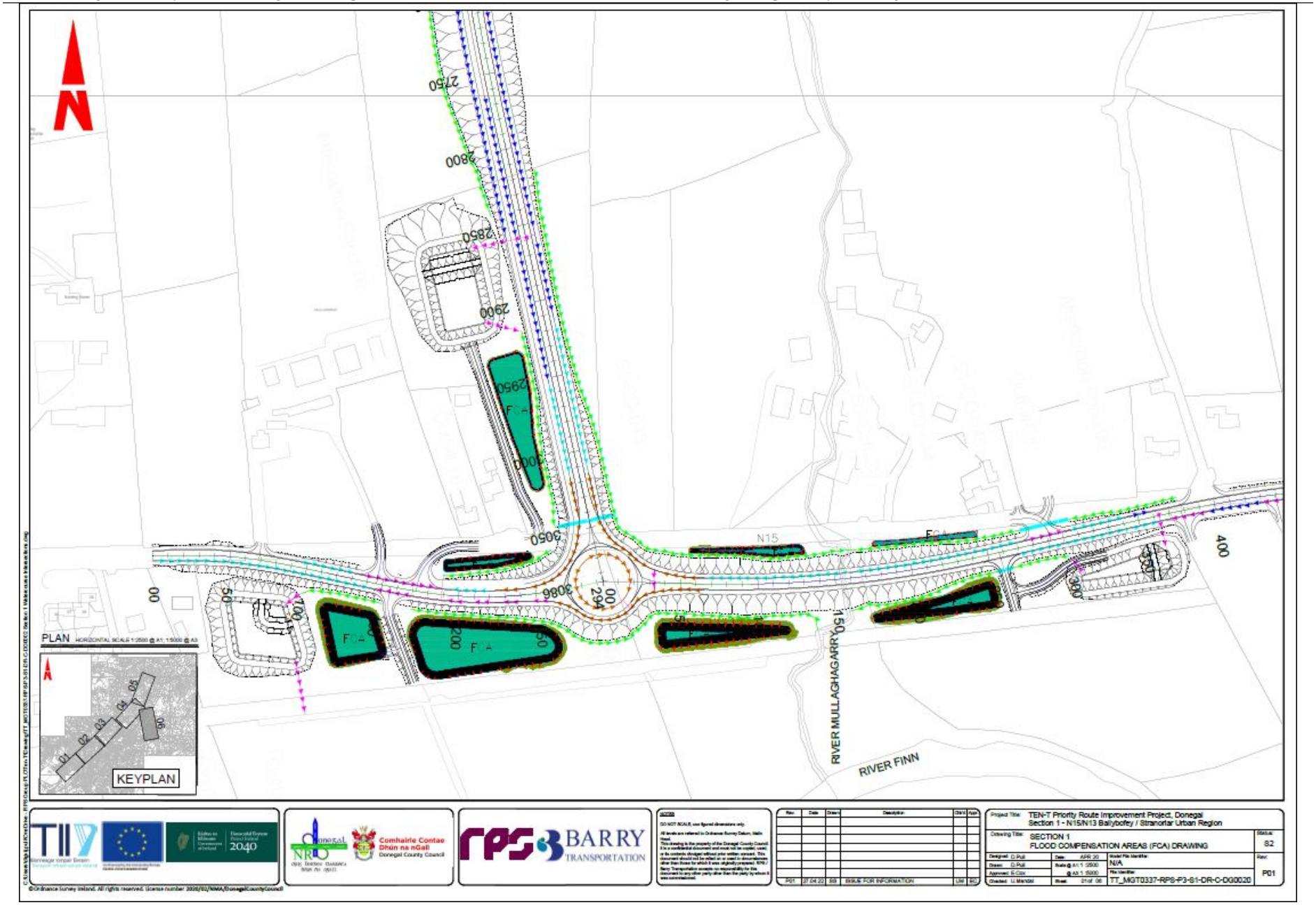
Photo 5: Upstream of existing Railway Culvert

Photo 6: Downstream of existing Railway Culvert

Photo 7: Mullaghagarry River/River Finn Floodplain between existing railway embankment and N15 road (looking east)

Photo 8: Mullaghagarry River/River Finn Floodplain (looking west)

Appendix B – Drawings


N
2750
2800
2850
2900
2950
3000
3050
3086
N15
RIVER MULLAGHAGARRY
RIVER FINN
PLAN HORIZONTAL SCALE 1:2500 @ A1, 1:5000 @ A3
KEYPLAN
TII
Comhairle Contae Dhún na nGall
Donegal County Council
RPS BARRY TRANSPORTATION
TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13 Ballybofey / Stranorlar Urban Region
SECTION 1
FLOOD COMPENSATION AREAS (FCA) DRAWING
TT_MGT0337-RPS-P3-S1-DR-C-DG0020
P01
S2
ISSUE FOR INFORMATION

APPENDIX C:
TECHNICAL REPORT FOR OPW SECTION 50 APPLICATIONS

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Rialtas na hÉireann
Government of Ireland

Tionscadal Éireann
Project Ireland 2040

Co-financed by the Connecting Europe Facility of the European Union

TECHNICAL REPORT FOR OPW SECTION 50 APPLICATIONS

TEN-T Priority Route Improvement Project, Donegal

Section 1 – N15/N13

TT_MGT0337-RPS-P3-S1-RP-D-DR0001 S3 P01

TECHNICAL REPORT FOR OPW SECTION 50 APPLICATIONS S3 P01

26 November 2021

Donegal NRO
Oifig Boichna Naisiunta Dhun na nGall

RPS

BARRY TRANSPORTATION

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Appendices

Appendix A – Section 50 Application Forms

Appendix B - Drawings

1 INTRODUCTION

This report details the preliminary design location, size and associated hydrological calculations for the proposed watercourse crossings required to construct the works as part of the Section 1 – N15/N13 Ballybofey/Stranorlar Urban Region of the TENT-T Priority Route Improvement Project, Donegal.

1.1 Proposed Development

The N13, N14 and N15 form part of the TEN-T Priority Route Improvement Project, Donegal, which is a selection of strategic transport corridors throughout the European Union (EU) that have been identified to play a key role in the mobility of goods and passengers through the EU. EU Regulation Number 1315/2013 sets the requirements for the TEN-T network. Letterkenny is connected to Derry via the N13, to Lifford (the County Town) via the N13-N14 and to Ballybofey/Stranorlar via the N13-N15.

This report is based on **Section 1:** The N15 Ballybofey/Stranorlar Urban Region. Section 1 includes the N15 from approximately Lough Mourne, through the townland of Cappry along the N15, through Ballybofey and Stranorlar and onto the N13 to Drumkeen.

The route is approximately 8.3km long. It commences west of Ballybofey near Blackburn Bridge and heads in a north-easterly direction through Cappry. The option crosses the River Finn and continues north-easterly passing through Drumboe Lower, Backlees where the option aligns in a more northerly direction before terminating at the existing N13, near Callan Bridge.

Two links connect the route to the urban centres of Ballybofey and Stranorlar, one west of the River Finn that connects to the existing N15 in Ballybofey and a second near Backlees that connects with the existing N13 north of Stranorlar and the existing N15 west of Stranorlar.

1.2 Existing Watercourses

The proposed alignments of the mainline, side roads and access roads cross existing watercourses in numerous locations. Where these streams will be crossed by the proposed road and require the consent of the OPW in accordance with Section 50 of the Arterial Drainage Act, 1945 a Section 50, an application will be submitted to the OPW for approval.

This report is prepared in support of a preliminary application for 35No. such culverts and 2No. such river crossings under Section 50 of the Arterial Drainage Act, 1945 and forms the basis for preliminary Section 50 approval of these culverts located along this section of road in Co. Donegal.

There are 36No. culverts and 3No. river crossings in total required to be built as part of the works in Section 1. Culvert S1-CUL.28 is in abeyance and is, therefore, not included in this application; an application for S1-CUL.28 will be submitted to the OPW at a later date. A separate Section 50 application has been submitted to the OPW for the construction of the River Finn Bridge crossing in the townlands of Capry and Drumboe Lower.

The Section 50 application forms for all crossings included in this application are enclosed in Appendix A. The location of all culverts, necessary stream diversions, culvert and stream diversion longitudinal sections and typical construction details are provided in Appendix B.

2 CROSSING CATCHMENTS & DESIGN FLOWS

2.1 Calculation Methods

Most streams are ungauged and so the design flows have been estimated using methods dictated by the catchment size.

The catchment size for the watercourses upstream of the proposed culverts were derived using the EPA contours available on the GSI GIS Data Viewer maps (https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=bc0dba38f3f5477c8fd400f66b5eedcd).

The UK Institute of Hydrology Methodology (IH 124), the 3-variable revision of the original Flood Studies Supplementary Report No. six variable equation, the Agricultural Development and Advisory Service (ADAS) method, OPW FSU 3-Variable, OPW FSU 5-Variable or flood frequencies module of the Flood Studies Update (FSU 7-Variable) online portal were used to estimate flow depending on the catchment size.

Table 1 below outlines the applicable calculation method based on the catchment size.

Table 1: Design Flow Calculation Methods

Catchment Size (km2)	Calculation Method	Method Reference
< 0.4	ADAS	DN-DNG-03064 (TII)
0.4 to 25.0	IH 124	DN-DNG-03064 (TII)
0.4 to 25.0	FSU 3 Variable	opw.hydronet.com
0.4 to 25.0	FSU 5 Variable	opw.hydronet.com
0.5 to 25.0	FSSR 6, 3-Variable	FSR
> 25.0	FSU Web Portal (FSU 7 Variable)	opw.hydronet.com

As indicated by the table, the flows from catchments between 0.4km^2 and 25km^2 were calculated by the UK Institute of Hydrology Methodology (IH 124), the OPW FSU 3-Variable method, OPW FSU 5-Variable method. Additionally, for catchments between 0.5km^2 and 25km^2, the 3-variable revision of the original Flood Studies Supplementary Report No. Six variable equation was also calculated. Once all methods were estimated, the most conservative flow (i.e. the largest flow) adopted as the design flow.

2.2 Design Flows

If the watercourse forms part of an OPW arterial drainage scheme, a drainage district factor of 1.6 was applied to all methods as required by the OPW. A factorial standard error (FSE) of 1.651 was applied to the IH 124 method and a factor of 1.58 was applied to the FSSR 3-variable method. FSEs of 2.059 and 1.686 were applied to the FSU 3-Variable method and FSU 5-variable methods respectively.

A growth factor of 1.96 was applied to IH124 and FSSR 3 variable methods to account for the 100-year flood flows while growth factors of between 1.95 and 2.21 were applied to the FSU methods. After reviewing the results from each method with relevant factors applied, the most conservative (i.e. the highest) estimated flow was adopted as the design flow for the culvert sizing calculations. As the ADAS method calculates the Q75 flow, a growth factor of 1.05 was applied to account for the 100-year flood flows in accordance with FSR growth curves. All design flows are subject to a 20% climate change allowance.

The Standard Average Annual Rainfall (SAAR) was obtained from the Flood Studies Update (FSU website) and the SOIL index value was calculated from the winter rain acceptance potential (WRAP) map and associated formulae. For the ADAS calculation, the largest site-wide SAAR value was applied to all catchments as a conservative measure.

A summary of flow calculations is given in **Table 2** with catchment descriptors in **Table 3**.

Table 2: Catchment Design Flows

Culvert/ Crossing	Catchment	Q_{75}	Q_{bar}/Q_{med}*				Design Flow Q100 + SFE + 20% (CC)
		ADAS Method	IH 124 Method	FSU 3-Var Method	FSU 5-Var Method	FSSR 6, 3-Var Method	
-	*(km^2)*	*(m^3/s)*	*(m^3/s)*	*(m^3/s)*	*(m^3/s)*	*(m^3/s)*	*(m^3/s)*
S1-CUL.01	0.98	-	0.877	1.283	**1.442**	0.908	5.89
S1-CUL.02	0.02	**0.101**	-	-	-	-	0.13
S1-CUL.03	0.05	**0.366**	-	-	-	-	0.46
S1-CUL.04	0.14	**0.520**	-	-	-	-	0.66
S1-CUL.05							
S1-CUL.06	0.25	**0.894**	-	-	-	-	1.13
S1-CUL.07							
S1-CUL.08	0.52	-	0.491	0.729	**0.820**	0.499	3.35
S1-CUL.09							
S1-CUL.10	0.77	-	0.697	1.009	**1.179**	0.715	4.82
S1-CUL.11							
S1-CUL.12	0.83	-	0.308	0.471	**0.689**	0.329	2.91
S1-CUL.13							
S1-CUL.14	4.98	-	1.549	4.121	**5.158**	1.749	20.77
Blacklees River							
S1-CUL.15	0.21	**0.544**	-	-	-	-	0.69
S1-CUL.16							
S1-CUL.17							
S1-CUL.18	0.32	**0.874**	-	-	-	-	1.10
S1-CUL.19	1.52	-	0.501	1.218	**1.760**	0.544	7.02
S1-CUL.20							
S1-CUL.21	1.74	-	0.565	1.363	**1.995**	0.616	7.95
S1-CUL.22	1.87	-	0.602	1.446	**2.132**	0.658	8.50
S1-CUL.23	0.17	**0.376**	-	-	-	-	0.47
S1-CUL.24	0.08	**0.243**	-	-	-	-	0.31
S1-CUL.25	4.68	-	1.316	2.707	**4.683**	1.477	18.76
S1-CUL.26	0.23	**0.660**	-	-	-	-	0.83
S1-CUL.27	0.26	**0.674**	-	-	-	-	0.85
S1-CUL.28	tbc						
S1-CUL.29	0.5	-	0.181	0.337	**0.393**	0.190	1.76
S1-CUL.30	1.64	-	0.522	0.903	**1.179**	0.568	5.27
S1-CUL.31	2.84	-	0.892	2.113	**2.851**	0.988	11.48
S1-CUL.32	0.92	-	0.312	0.559	**0.691**	0.333	3.09
S1-CUL.33							
S1-CUL.34	1.04	-	0.380	1.072	**1.375**	0.410	5.42
S1-CUL.35							
S1-CUL.36							
Cloghroe River	10.75	-	6.717	8.914	**12.751**	7.396	51.08

*Values in bold indicate the adopted method

Table 3: Catchment Design Flows

Culvert/ Crossing	All methods								IH124, FSSR and FSU methods				FSU Method	ADAS Method	
	Catch't Area	Soil Factor Calculation						SAAR	BFI SOIL	FARL	DRAIND	S1085	OPW FSU GF	Max. Catch't Width	Avg. Height of Catch't Divide
		WRAP 1	WRAP 2	WRAP 3	WRAP 4	WRAP 5	Soil Factor								
	(km^2)	*(%)*	*(%)*	*(%)*	*(%)*	*(%)*	*-*	*(mm)*	*-*	*-*	*(km/km^2)*	*(m/km^2)*	*-*	*(W)m*	*(Z)m*
S1-CUL.01	0.98	0	0	100	0	0	0.40	1704.7	0.334	1	0.924	17.60	2.02	-	-
S1-CUL.02	0.02	0	0	100	0	0	0.40	1704.7	-	-	-	-	-	144	2
S1-CUL.03	0.05	0	0	100	0	0	0.40	1704.7	-	-	-	-	-	180	12
S1-CUL.04	0.14	0	0	100	0	0	0.40	1704.7	-	-	-	-	-	1077	37
S1-CUL.05															
S1-CUL.06	0.25	0	0	100	0	0	0.40	1704.7	-	-	-	-	-	1120	35
S1-CUL.07															
S1-CUL.08	0.52	0	0	100	0	0	0.40	1681.5	0.340	1	1.024	21.94	2.02	-	-
S1-CUL.09															
S1-CUL.10	0.77	0	0	100	0	0	0.40	1681.5	0.340	1	1.024	21.94	2.02	-	-
S1-CUL.11															
S1-CUL.12	0.83	0	100	0	0	0	0.30	1347.6	0.510	1	0.35	25.86	2.09	-	-
S1-CUL.13															
S1-CUL.14 Backlees River	4.98	0	100	0	0	0	0.30	1372.1	0.331	1	1.301	20.54	1.99	-	-
S1-CUL.15	0.21	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	710	35
S1-CUL.16															
S1-CUL.17															
S1-CUL.18	0.32	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	780	51
S1-CUL.19	1.52	0	100	0	0	0	0.30	1289.4	0.372	1	0.145	46.64	1.97	-	-
S1-CUL.20															
S1-CUL.21	1.74	0	100	0	0	0	0.30	1289.4	0.372	1	0.145	46.64	1.97	-	-
S1-CUL.22	1.87	0	100	0	0	0	0.30	1289.4	0.372	1	0.145	46.64	1.97	-	-

Culvert/ Crossing	All methods								IH124, FSSR and FSU methods				FSU Method	ADAS Method	
	Catch't Area	Soil Factor Calculation						SAAR	BFI SOIL	FARL	DRAIND	S1085	OPW FSU GF	Max. Catch't Width	Avg. Height of Catch't Divide
		WRAP 1	WRAP 2	WRAP 3	WRAP 4	WRAP 5	Soil Factor								
	(km^2)	*(%)*	*(%)*	*(%)*	*(%)*	*(%)*	*-*	*(mm)*	*-*	*-*	*(km/km^2)*	*(m/km^2)*	*-*	*(W)m*	*(Z)m*
S1-CUL.23	0.17	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	620	15
S1-CUL.24	0.08	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	450	25
S1-CUL.25	4.68	0	100	0	0	0	0.30	1251.9	0.398	1	0.586	54.50	1.98	-	-
S1-CUL.26	0.23	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	920	85
S1-CUL.27	0.26	0	100	0	0	0	0.30	1704.7	-	-	-	-	-	480	16
S1-CUL.28	tbc														
S1-CUL.29	0.5	0	100	0	0	0	0.30	1260.3	0.464	1	0.731	17.81	2.21	-	-
S1-CUL.30	1.64	0	100	0	0	0	0.30	1260.3	0.464	1	0.731	17.81	2.21	-	-
S1-CUL.31	2.84	0	100	0	0	0	0.30	1312.4	0.368	1	1.187	28.03	1.99	-	-
S1-CUL.32	0.92	0	100	0	0	0	0.30	1260.3	0.464	1	0.731	17.81	2.21	-	-
S1-CUL.33															
S1-CUL.34	1.04	0	100	0	0	0	0.30	1360.2	0.340	1	1.278	38.88	1.95	-	-
S1-CUL.35															
S1-CUL.36															
Cloghroe River	10.75	0	44	3	0	53	0.41	1503.1	0.320	1	1.308	24.8259	1.98	-	-

3 PROPOSED CROSSING DETAILS

3.1 Environmental Requirements

As part of a preliminary Environmental assessment, a number of proposed crossings were deemed to be fisheries sensitive and were required to be constructed as box culverts. These crossings include:

- S1-CUL.01
- S1-CUL.12
- S1-CUL.13
- S1-CUL.14
- S1-CUL.22
- S1-CUL.25
- S1-CUL.28
- S1-CUL.31
- S1-CUL.34
- S1-CUL.35
- S1-CUL.36

Furthermore, two crossings have been designed as river bridges for ecological reasons:

- Blacklees River Bridge

  This single span river bridge spans the existing Blacklees River and adjacent proposed farm access track in the townland of Drumboe. There is approximately a minimum of 8m clearance between the bottom of the structure and stream bank levels with a span of approximately 52m.

- Cloghroe River Bridge

  This single span river bridge spans the diverted Cloghroe River (or Clogher Burn) in the townland of Callan downstream of the existing N13 crossing (Callan Bridge). There is approximately a minimum of 1.2m clearance between the bottom of the structure and the diverted stream banks. A 5m riparian buffer zone if provided offset from both stream banks resulting in a total structure span of 18m.

3.2 Existing Structures

S1-CUL.01 is located beneath the proposed realigned side road and adjacent N15 at the southwestern approach to Ballybofey in the townland of Meencaragh. There is an existing 2.4m x 1.5m (WxH) box culvert underneath the N15 at this location. It is proposed to replace this existing culvert with the longer and bigger S1-CUL.01.

S1-CUL.14 is located beneath a domestic access in the townland of Drumboe. There is an existing 2m x 1.6m (WxH) clear opening at this location. It is proposed to replace this existing culvert with the longer and bigger S1-CUL.14 to account for the realigned access.

3.3 Culvert Sizing Calculations

Most culverts were sized based on the calculations set out in the updated CIRIA Culvert, Screen and Outfall Manual (2019), CIRIA Report No. C786; S1-CUL.14 was sized using HEC-RAS modelling software. A summary of the resulting calculation outputs and proposed culvert details are given in **Table 4** below.

The Backlees and Cloghroe River crossings were sized using HEC-RAS modelling software and their outputs are given **in Table 5** and **Figures 1** (Backlees River) and **Figure 2** (Cloghroe River) below**.**

Table 4: Proposed Culvert Sizes & Hydrological Calculation Output

Culvert Name	Type	Length	Size			Depth of Embedment	USIL (Top of Embedment)	DSIL (Top of Embedment)	Culvert Gradient	Freeboard (Min. 0.3m)	Net Head Loss (Max. 0.3m)
			Diameter	Width	Height (incl. embedment)						
		(m)	*(m)*	*(m)*	*(m)*	*(m)*	*(mOD)*	*(mOD)*	*(1:x)*	*(m)*	*(m)*
S1-CUL.01	Box	51.77		3.2	2	0.50	79.418	79.100	162.8	0.474	0.290
S1-CUL.02	Pipe	34.11	1.2			0.30	77.309	77.240	494.4	0.675	0.039
S1-CUL.03	Pipe	30.45	1.2			0.30	76.569	75.430	26.7	0.525	0.060
S1-CUL.04	Pipe	9.00	1.2			0.30	81.870	81.826	204.5	0.390	0.024
S1-CUL.05	Pipe	9.00	1.2			0.30	81.750	81.732	500.0	0.345	0.039
S1-CUL.06	Pipe	18.91	1.5			0.30	81.473	81.402	266.4	0.417	0.001
S1-CUL.07	Pipe	15.18	1.5			0.30	81.101	81.070	489.7	0.576	0.110
S1-CUL.08	Box	27.89		2.5	2.2	0.50	79.813	78.419	20.0	0.900	0.297
S1-CUL.09	Pipe	37.41	1.8			0.30	73.724	72.100	23.0	0.353	0.124
S1-CUL.10	Box	34.75		2.2	2.2	0.50	71.796	71.689	324.8	0.420	0.080
S1-CUL.11	Box	6.86		2.5	1.9	0.50	71.501	71.477	285.8	0.330	0.225
S1-CUL.12	Box	18.27		1.8	1.8	0.50	21.771	21.415	51.3	0.353	0.239
S1-CUL.13	Box	26.67		2.5	1.8	0.50	19.850	19.700	177.8	0.515	0.284
S1-CUL.14	Box	8.50		6	2.5	0.50	67.000	66.600	21.3	0.450	0.240
S1-CUL.15	Pipe	110.52	1.2			0.30	87.893	86.600	85.5	0.391	0.078
S1-CUL.16	Pipe	81.89	1.2			0.30	72.629	67.328	15.4	0.415	0.170
S1-CUL.17	Pipe	13.86	1.2			0.30	66.526	66.244	49.1	0.395	0.277
S1-CUL.18	Pipe	33.06	1.5			0.30	101.671	101.600	465.7	0.556	0.216
S1-CUL.19	Box	25.10		2.8	2.1	0.50	68.975	68.572	62.3	0.320	0.158
S1-CUL.20	Box	12.25		2.8	2.1	0.50	67.600	67.450	81.6	0.320	0.284
S1-CUL.21	Box	56.71		3.5	2.1	0.50	64.138	63.568	99.5	0.410	0.270
S1-CUL.22	Box	56.52		4	2.2	0.50	60.062	58.161	29.7	0.575	0.295
S1-CUL.23	Pipe	84.44	1.2			0.30	44.763	39.231	15.3	0.531	0.079
S1-CUL.24	Pipe	86.88	1.2			0.30	37.508	34.428	28.2	0.618	0.042
S1-CUL.25	Box	76.60		5	4.5	0.50	32.550	32.491	1298.3	1.951	0.235
S1-CUL.26	Pipe	7.83	1.5			0.30	32.768	32.752	489.2	0.484	0.013
S1-CUL.27	Pipe	31.97	1.5			0.30	29.962	29.364	53.5	0.693	0.003
S1-CUL.29	Pipe	73.51	1.5			0.30	82.156	81.315	87.4	0.355	0.171
S1-CUL.30	Box	87.21		2.4	2.1	0.50	76.639	75.498	76.4	0.440	0.139
S1-CUL.31	Box	45.35		4.5	2.2	0.50	74.605	74.506	458.1	0.412	0.216
S1-CUL.32	Pipe	22.46	1.8			0.30	77.211	77.166	499.2	0.301	0.113
S1-CUL.33	Box	46.24		2	2	0.50	76.951	76.859	502.6	0.346	0.068
S1-CUL.34	Box	42.20		3.5	2	0.50	76.143	76.059	502.4	0.505	0.148
S1-CUL.35	Box	26.90		3.5	2	0.50	75.428	75.374	498.2	0.485	0.078
S1-CUL.36	Box	30.67		3.5	2	0.50	74.991	74.927	479.2	0.507	0.101

Table 5: River Bridge Crossing Details

Culvert/ Crossing	Townland	Structure Type	Approximate Structure Length	Approximate Structure Span	Structure Soffit Level	Stream Bed Level	Stream Bank Level	Design Flood Level
		-	*(m)*	*(m)*	*(mOD)*	*(mOD)*	*(mOD)*	*(mOD)*
Backlees River Crossing	Drumboe Upper	Single Span Bridge	80	52	67.10	62.05 to 56.86	64.10 to 57.30	63.35 to 58.36
Cloghroe River Crossing	Callan	Single Span Bridge	22	18	78.72	76.31 to 76.12	77.53 to 77.37	78.37 to 78.12

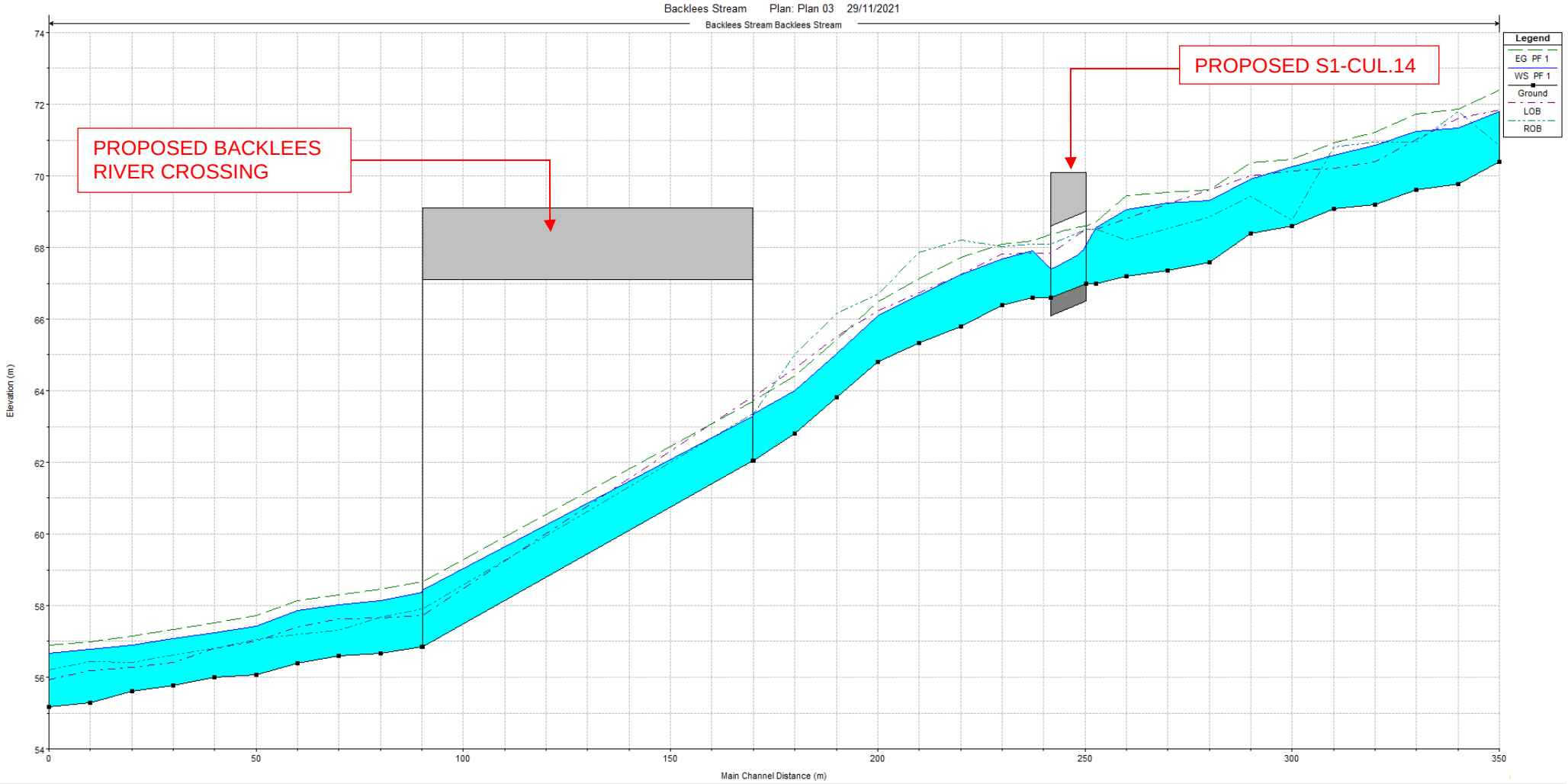

Figure 1: Backlees River HEC-RAS Profile output

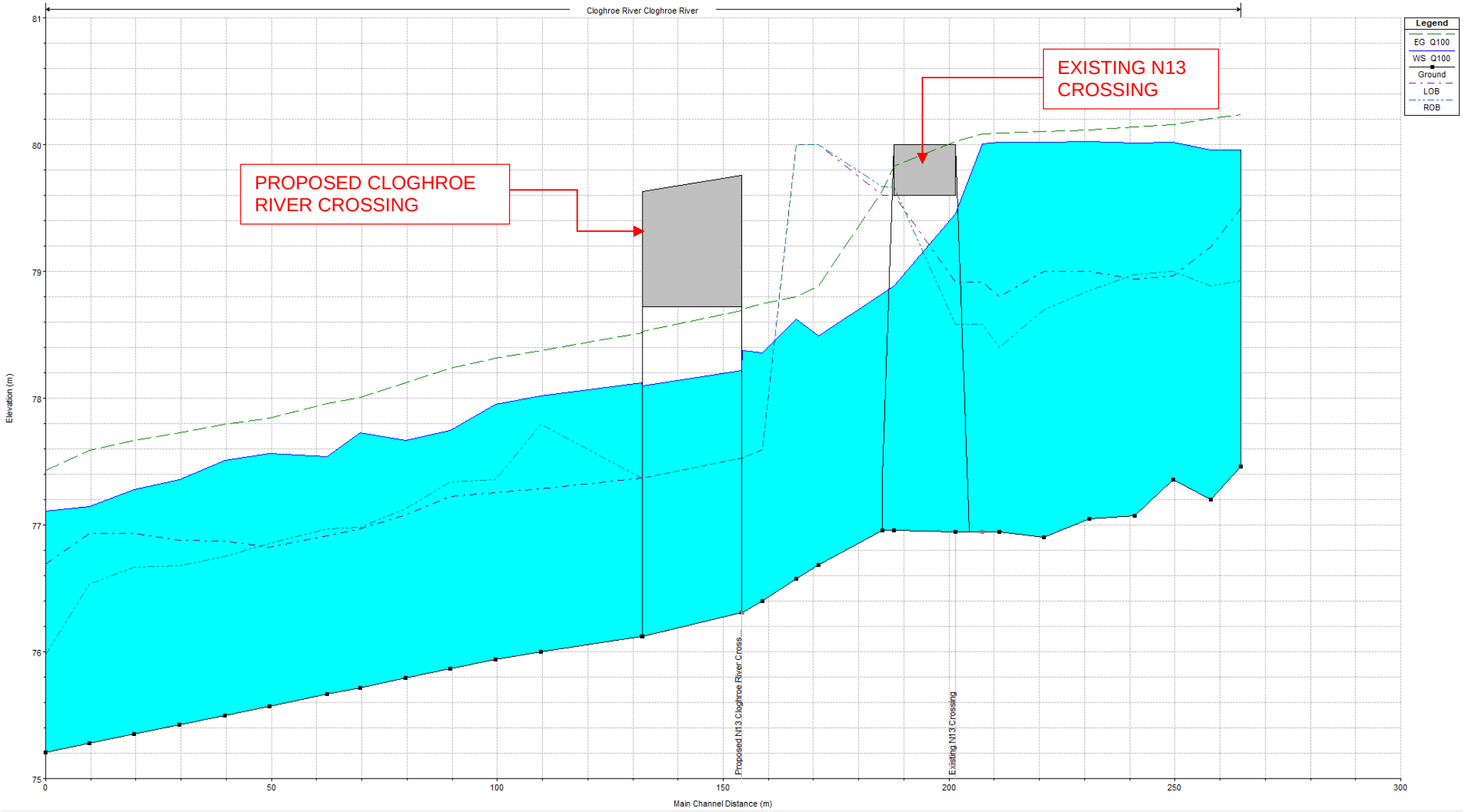

Figure 2: Cloghroe River HEC-RAS Profile output

Appendix A - SECTION 50 APPLICATION FORMS

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.01**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Meencargagh Stream			Catchment:	Foyle
Address (Townland – County):		Meencargagh, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	210368	Y:	392832	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.98	Km^2	Road Reference:	N15
Design Flood Flow:	5.89 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.908
IH 124	☒	0.877
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.283
FSU 5 - variable	☒	1.442

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.02
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 3.2m x 2.0m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	$4.8m^2$
Upstream Invert Level **78.918** mOD	Downstream Invert Level **78.600** mOD
Upstream Soffit Level **80.918** mOD	Downstream Soffit Level **80.600** mOD
Upstream Design Flood Level **80.444** mOD	Downstream Design Flood Level **79.835** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.02**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Dooish Stream			Catchment:	Foyle
Address (Townland – County):		Dooish, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	210891	Y:	393307	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.02	Km^2	Road Reference:	N15
Design Flood Flow:	0.13 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.101
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **77.009** mOD	Downstream Invert Level **76.940** mOD
Upstream Soffit Level **78.209** mOD	Downstream Soffit Level **78.140** mOD
Upstream Design Flood Level **77.534** mOD	Downstream Design Flood Level **77.426** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.03**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Dooish Stream			Catchment:	Foyle
Address (Townland – County):		Dooish, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	210989	Y:	393218	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.05 Km^2	Road Reference:		N15
Design Flood Flow:	0.46 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.366
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **76.269** mOD	Downstream Invert Level **75.130** mOD
Upstream Soffit Level **77.469** mOD	Downstream Soffit Level **76.330** mOD
Upstream Design Flood Level **76.944** mOD	Downstream Design Flood Level **75.745** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.04**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211157	Y:	393816	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.14 Km^2	Road Reference:		N15
Design Flood Flow:	0.66 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.520
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **81.570** mOD	Downstream Invert Level **81.526** mOD
Upstream Soffit Level **82.770** mOD	Downstream Soffit Level **82.726** mOD
Upstream Design Flood Level **82.380** mOD	Downstream Design Flood Level **82.313** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.05**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211141	Y:	393797	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.14 Km^2	Road Reference:		N15
Design Flood Flow:	0.66 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.520
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **81.450** mOD	Downstream Invert Level **81.432** mOD
Upstream Soffit Level **82.650** mOD	Downstream Soffit Level **82.632** mOD
Upstream Design Flood Level **82.305** mOD	Downstream Design Flood Level **82.248** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.06**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211078	Y:	393757	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.25 Km^2	Road Reference:		N15
Design Flood Flow:	1.13 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.894
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **81.173** mOD	Downstream Invert Level **81.102** mOD
Upstream Soffit Level **82.673** mOD	Downstream Soffit Level **82.602** mOD
Upstream Design Flood Level **82.256** mOD	Downstream Design Flood Level **82.183** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.07**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211015	Y:	393608	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.25 Km^2	Road Reference:		N15
Design Flood Flow:	1.13 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.894
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **80.801** mOD	Downstream Invert Level **80.770** mOD
Upstream Soffit Level **82.301** mOD	Downstream Soffit Level **82.270** mOD
Upstream Design Flood Level **81.725** mOD	Downstream Design Flood Level **81.584** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.08**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	210999	Y:	392522	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.52 Km^2	Road Reference:		N15
Design Flood Flow:	3.35 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.499
IH 124	☒	0.491
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.729
FSU 5 - variable	☒	0.820

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1681.5mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.02
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.5m x 2.2m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	4.25m^2
Upstream Invert Level **79.313** mOD	Downstream Invert Level **77.919** mOD
Upstream Soffit Level **81.513** mOD	Downstream Soffit Level **80.119** mOD
Upstream Design Flood Level **80.613** mOD	Downstream Design Flood Level **78.922** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.09**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211059	Y:	393491	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.52	Km^2	Road Reference:	N15
Design Flood Flow:	3.35 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.499
IH 124	☒	0.491
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.729
FSU 5 - variable	☒	0.820

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1681.5mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.02
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.8m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	$2.26m^2$
Upstream Invert Level **73.424** mOD	Downstream Invert Level **71.800** mOD
Upstream Soffit Level **75.224** mOD	Downstream Soffit Level **73.600** mOD
Upstream Design Flood Level **74.871** mOD	Downstream Design Flood Level **73.122** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.10**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211172	Y:	393432	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.77 Km^2	Road Reference:		N15
Design Flood Flow:	4.82 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.715
IH 124	☒	0.697
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.009
FSU 5 - variable	☒	1.179

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1681.5mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.02
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.2m x 2.2m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	3.74m^2
Upstream Invert Level **71.296** mOD	Downstream Invert Level **71.189** mOD
Upstream Soffit Level **73.496** mOD	Downstream Soffit Level **73.389** mOD
Upstream Design Flood Level **73.076** mOD	Downstream Design Flood Level **72.890** mOD

NOTES :

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3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.11**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cappry Stream			Catchment:	Foyle
Address (Townland – County):		Cappry, Ballybofey, Lifford, Co. Donegal			
Grid Reference	X:	211237	Y:	393472	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.77	Km^2	Road Reference:	N15
Design Flood Flow:	4.82 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.715
IH 124	☒	0.697
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.009
FSU 5 - variable	☒	1.179

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1681.5mm/yr; Soil Factor=0.4;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.02
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.5m x 1.9m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	3.50m^2
Upstream Invert Level **71.001** mOD	Downstream Invert Level **70.977** mOD
Upstream Soffit Level **72.901** mOD	Downstream Soffit Level **72.877** mOD
Upstream Design Flood Level **72.571** mOD	Downstream Design Flood Level **72.321** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.12**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Drumboe Lower Stream			Catchment:	Foyle
Address (Townland – County):		Drumboe Lower, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	212106	Y:	395461	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.83	Km^2	Road Reference:	N15
Design Flood Flow:	2.91 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.329
IH 124	☒	0.308
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.471
FSU 5 - variable	☒	0.689

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1347.6mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.09
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 1.8m x 1.8m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	2.34m^2
Upstream Invert Level **21.271** mOD	Downstream Invert Level **20.915** mOD
Upstream Soffit Level **23.071** mOD	Downstream Soffit Level **22.715** mOD
Upstream Design Flood Level **22.718** mOD	Downstream Design Flood Level **22.123** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.13**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name:	Donegal National Roads Office
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name:	RPS
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Drumboe Lower Stream			Catchment:	Foyle
Address (Townland – County):		Drumboe Lower, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	213121	Y:	395338	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.83	Km^2	Road Reference:	N15
Design Flood Flow:	2.91 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.329
IH 124	☒	0.308
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.471
FSU 5 - variable	☒	0.689

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1347.6mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.09
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.5m x 1.8m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	3.25m^2
Upstream Invert Level **19.350** mOD	Downstream Invert Level **19.200** mOD
Upstream Soffit Level **21.150** mOD	Downstream Soffit Level **21.000** mOD
Upstream Design Flood Level **20.635** mOD	Downstream Design Flood Level **20.201** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.14**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Backlees River			Catchment:	Foyle
Address (Townland – County):		Drumboe Upper, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	213894	Y:	396098	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		4.98	Km^2	Road Reference:	N15
Design Flood Flow:	20.77 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	1.749
IH 124	☒	1.549
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	4.121
FSU 5 - variable	☒	5.158

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1372.1mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.99
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 6.0m x 2.5m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	12.0m^2
Upstream Invert Level **66.500** mOD	Downstream Invert Level **66.100** mOD
Upstream Soffit Level **69.000** mOD	Downstream Soffit Level **68.600** mOD
Upstream Design Flood Level **68.550** mOD	Downstream Design Flood Level **67.910** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.15**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Greenhills Stream			Catchment:	Foyle
Address (Townland – County):		Drumboe Upper, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	214295	Y:	396597	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.21	Km^2	Road Reference:	N15
Design Flood Flow:	0.69 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.544
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **87.593** mOD	Downstream Invert Level **86.300** mOD
Upstream Soffit Level **88.793** mOD	Downstream Soffit Level **87.500** mOD
Upstream Design Flood Level **88.402** mOD	Downstream Design Flood Level **87.030** mOD

NOTES :

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5. All levels must be given to Ordnance Datum, Malin Head.

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Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.16**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Greenhills Stream			Catchment:	Foyle
Address (Townland – County):		Drumboe Upper, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	214302	Y:	396195	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.21	Km^2	Road Reference:	N15
Design Flood Flow:	0.69 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.544
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **72.329** mOD	Downstream Invert Level **67.028** mOD
Upstream Soffit Level **73.529** mOD	Downstream Soffit Level **68.228** mOD
Upstream Design Flood Level **73.114** mOD	Downstream Design Flood Level **67.643** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.17**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Greenhills Stream			Catchment:	Foyle
Address (Townland – County):		Drumboe Upper, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	214331	Y:	396121	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.21 Km^2	Road Reference:		N15
Design Flood Flow:	0.69 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.544
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **66.226** mOD	Downstream Invert Level **65.944** mOD
Upstream Soffit Level **67.426** mOD	Downstream Soffit Level **67.144** mOD
Upstream Design Flood Level **67.031** mOD	Downstream Design Flood Level **66.472** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.18**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Dunwiley Stream			Catchment:	Foyle
Address (Townland – County):		Dunwiley, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	215421	Y:	397668	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.32 Km^2	Road Reference:		N15
Design Flood Flow:	1.10 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.874
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **101.371** mOD	Downstream Invert Level **101.300** mOD
Upstream Soffit Level **102.871** mOD	Downstream Soffit Level **102.800** mOD
Upstream Design Flood Level **102.315** mOD	Downstream Design Flood Level **102.029** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.19**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Tircallan Stream			Catchment:	Foyle
Address (Townland – County):		Tircallan, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216097	Y:	397567	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.52	Km^2	Road Reference:	N15
Design Flood Flow:	7.02 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.544
IH 124	☒	0.501
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.218
FSU 5 - variable	☒	1.760

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1289.4mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.97
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.8m x 2.1m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	4.48m^2
Upstream Invert Level **68.475** mOD	Downstream Invert Level **68.072** mOD
Upstream Soffit Level **70.575** mOD	Downstream Soffit Level **70.172** mOD
Upstream Design Flood Level **70.255** mOD	Downstream Design Flood Level **69.695** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.20**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Tircallan Stream			Catchment:	Foyle
Address (Townland – County):		Tircallan, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216027	Y:	397365	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.52	Km^2	Road Reference:	N15
Design Flood Flow:	7.02 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.544
IH 124	☒	0.501
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.218
FSU 5 - variable	☒	1.760

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1289.4mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.97
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.8m x 2.1m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	4.48m^2
Upstream Invert Level **67.100** mOD	Downstream Invert Level **66.950** mOD
Upstream Soffit Level **69.200** mOD	Downstream Soffit Level **69.050** mOD
Upstream Design Flood Level **68.880** mOD	Downstream Design Flood Level **68.446** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.21**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Tircallan Stream			Catchment:	Foyle
Address (Townland – County):		Tircallan, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216098	Y:	397090	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.74	Km^2	Road Reference:	N15
Design Flood Flow:	7.95 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.616
IH 124	☒	0.565
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.363
FSU 5 - variable	☒	1.995

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1289.4mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.97
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal	☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 3.5m x 2.1m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	5.60m^2
Upstream Invert Level **63.638** mOD	Downstream Invert Level **63.068** mOD
Upstream Soffit Level **65.738** mOD	Downstream Soffit Level **65.168** mOD
Upstream Design Flood Level **65.328** mOD	Downstream Design Flood Level **64.488** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.22**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Tircallan Stream			Catchment:	Foyle
Address (Townland – County):		Tircallan, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216224	Y:	396984	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.87	Km^2	Road Reference:	N15
Design Flood Flow:	8.50 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.658
IH 124	☒	0.602
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.446
FSU 5 - variable	☒	2.132

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1289.4mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.97
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 4.0m x 2.2m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	6.80m^2
Upstream Invert Level **59.562** mOD	Downstream Invert Level **57.661** mOD
Upstream Soffit Level **61.762** mOD	Downstream Soffit Level **59.861** mOD
Upstream Design Flood Level **61.187** mOD	Downstream Design Flood Level **58.991** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.23**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Knockfair Stream			Catchment:	Foyle
Address (Townland – County):		Knockfair, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216535	Y:	396696	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.17	Km^2	Road Reference:	N15
Design Flood Flow:	0.47 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.376
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **44.463** mOD	Downstream Invert Level **38.931** mOD
Upstream Soffit Level **45.663** mOD	Downstream Soffit Level **40.131** mOD
Upstream Design Flood Level **45.132** mOD	Downstream Design Flood Level **39.521** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.24**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Castlebane Stream 02			Catchment:	Foyle
Address (Townland – County):		Castlebane, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216622	Y:	396466	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.08	Km^2	Road Reference:	N15
Design Flood Flow:	0.31 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.243
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.2m. The culvert will have 300mm embedment

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	0.91m^2
Upstream Invert Level **37.208** mOD	Downstream Invert Level **34.128** mOD
Upstream Soffit Level **38.408** mOD	Downstream Soffit Level **35.328** mOD
Upstream Design Flood Level **37.790** mOD	Downstream Design Flood Level **34.668** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.25**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Mullaghagarry River			Catchment:	Foyle
Address (Townland – County):		Castlebane, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216651	Y:	396208	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		4.68	Km^2	Road Reference:	N15
Design Flood Flow:	18.76 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	1.477
IH 124	☒	1.316
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	2.707
FSU 5 - variable	☒	4.683

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1251.9mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.98
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 5.0m x 4.5m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	20.0m^2
Upstream Invert Level **32.050** mOD	Downstream Invert Level **31.991** mOD
Upstream Soffit Level **36.550** mOD	Downstream Soffit Level **36.491** mOD
Upstream Design Flood Level **34.599** mOD	Downstream Design Flood Level **34.305** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.26**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Castlebane Stream 01			Catchment:	Foyle
Address (Townland – County):		Castlebane, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216754	Y:	396299	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.23	Km^2	Road Reference:	N15
Design Flood Flow:	0.83 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.660
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **32.468** mOD	Downstream Invert Level **32.452** mOD
Upstream Soffit Level **33.968** mOD	Downstream Soffit Level **33.952** mOD
Upstream Design Flood Level **33.484** mOD	Downstream Design Flood Level **33.455** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.27**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Treanamullin River			Catchment:	Foyle
Address (Townland – County):		Mullandrait, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216414	Y:	395782	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.26 Km^2	Road Reference:		N15
Design Flood Flow:	0.85 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☐	
IH 124	☐	
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☒	0.674
FSU 3 – variable	☐	
FSU 5 - variable	☐	

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1704.7mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (ADAS)	1.05

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **29.662** mOD	Downstream Invert Level **29.064** mOD
Upstream Soffit Level **31.162** mOD	Downstream Soffit Level **30.564** mOD
Upstream Design Flood Level **30.469** mOD	Downstream Design Flood Level **29.867** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.29**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Teevickmoy Stream			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216092	Y:	399087	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.50 Km^2	Road Reference:	N15	
Design Flood Flow:	1.76 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.190
IH 124	☒	0.181
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.337
FSU 5 - variable	☒	0.393

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1260.3mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.21
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.5m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	1.52m^2
Upstream Invert Level **81.856** mOD	Downstream Invert Level **81.015** mOD
Upstream Soffit Level **83.356** mOD	Downstream Soffit Level **82.515** mOD
Upstream Design Flood Level **83.001** mOD	Downstream Design Flood Level **81.989** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.30**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Lisnaree River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216127	Y:	399424	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.64	Km^2	Road Reference:	N15
Design Flood Flow:	5.27 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.568
IH 124	☒	0.522
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.903
FSU 5 - variable	☒	1.179

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1260.3mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.21
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.4m x 2.1m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	3.84m^2
Upstream Invert Level **76.139** mOD	Downstream Invert Level **74.998** mOD
Upstream Soffit Level **78.239** mOD	Downstream Soffit Level **77.098** mOD
Upstream Design Flood Level **77.799** mOD	Downstream Design Flood Level **76.519** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.31**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Lisnaree River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216145	Y:	399727	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		2.84	Km^2	Road Reference:	N15
Design Flood Flow:	11.48 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.988
IH 124	☒	0.892
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	2.113
FSU 5 - variable	☒	2.851

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1312.4mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.99
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 4.5m x 2.2m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	7.65m^2
Upstream Invert Level **74.105** mOD	Downstream Invert Level **74.006** mOD
Upstream Soffit Level **76.305** mOD	Downstream Soffit Level **76.206** mOD
Upstream Design Flood Level **75.893** mOD	Downstream Design Flood Level **75.578** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.32**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Lisnaree River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216310	Y:	399369	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.92 Km^2	Road Reference:	N15	
Design Flood Flow:	3.09 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.333
IH 124	☒	0.312
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.559
FSU 5 - variable	☒	0.691

FSR ☐ FSU ☐ Other ☐

Comments SAAR 1260.3mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.21
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
Irish Growth Curve (ADAS) used to convert 75yr to 100yr in ADAS.

Hydraulic/Structure Details

Description of Structure*3 Construction of a new pipe culvert with headwalls. The internal diameter of the culvert will be 1.8m. The culvert will have 300mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	$2.27m^2$
Upstream Invert Level **76.911** mOD	Downstream Invert Level **76.866** mOD
Upstream Soffit Level **78.711** mOD	Downstream Soffit Level **78.666** mOD
Upstream Design Flood Level **78.410** mOD	Downstream Design Flood Level **78.252** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.33**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Lisnaree River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216189	Y:	399333	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		0.92 Km^2	Road Reference:	N15	
Design Flood Flow:	3.09 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.333
IH 124	☒	0.312
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	0.559
FSU 5 - variable	☒	0.691

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1260.3mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	2.21
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686

Tidal ☐

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 2.0m x 2.0m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	3.0m^2
Upstream Invert Level **76.451** mOD	Downstream Invert Level **76.359** mOD
Upstream Soffit Level **78.451** mOD	Downstream Soffit Level **78.359** mOD
Upstream Design Flood Level **78.105** mOD	Downstream Design Flood Level **77.945** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.34**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Magheracorran River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	215978	Y:	399550	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.04	Km^2	Road Reference:	N15
Design Flood Flow:	5.42 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.410
IH 124	☒	0.380
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.072
FSU 5 - variable	☒	1.375

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1360.2mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.95
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 3.5m x 2.0m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	5.25m^2
Upstream Invert Level **75.643** mOD	Downstream Invert Level **75.559** mOD
Upstream Soffit Level **77.643** mOD	Downstream Soffit Level **77.559** mOD
Upstream Design Flood Level **77.138** mOD	Downstream Design Flood Level **76.906** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.35**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name:	Donegal National Roads Office
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name:	RPS
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Magheracorran River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216033	Y:	399616	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.04	Km^2	Road Reference:	N15
Design Flood Flow:	5.42 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.410
IH 124	☒	0.380
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.072
FSU 5 - variable	☒	1.375

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1360.2mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.95
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 3.5m x 2.0m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	5.25m^2
Upstream Invert Level **74.928** mOD	Downstream Invert Level **74.874** mOD
Upstream Soffit Level **76.928** mOD	Downstream Soffit Level **76.874** mOD
Upstream Design Flood Level **76.443** mOD	Downstream Design Flood Level **76.311** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
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3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**S1-CUL.36**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Magheracorran River			Catchment:	Foyle
Address (Townland – County):		Teevickmoy, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216091	Y:	399669	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		1.04	Km^2	Road Reference:	N15
Design Flood Flow:	5.42 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*							
OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West*	☐

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

Correspondence Number	*OPW Register No:*	
	Consent Issued	☐

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	0.410
IH 124	☒	0.380
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	1.072
FSU 5 - variable	☒	1.375

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1360.2mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.95
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Box structure with reinforced concrete headwalls and wingwalls. The internal dimensions of the box will be 3.5m x 2.0m (WxH). The culvert will have 500mm embedment.

Upstream and downstream invert levels below refer to the **structural invert levels** of the culverts.

Effective Conveyance Area *4	5.25m^2
Upstream Invert Level **74.491** mOD	Downstream Invert Level **74.427** mOD
Upstream Soffit Level **76.491** mOD	Downstream Soffit Level **76.427** mOD
Upstream Design Flood Level **75.984** mOD	Downstream Design Flood Level **75.820** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
2. Flow is the estimated flow from the catchment, without any factors applied.

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

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
4. Effective conveyance area is from channel bed level to design flood level.
5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**Backless River Crossing Bridge**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Backlees River			Catchment:	Foyle
Address (Townland – County):		Drumboe Upper, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	213949	Y:	396006	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		4.98	Km^2	Road Reference:	N15
Design Flood Flow:	20.77 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*	

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

OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West* ☐
Correspondence Number		*OPW Register No:*					
		Consent Issued	☐				

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	1.749
IH 124	☒	1.549
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	4.121
FSU 5 - variable	☒	5.158

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1372.1mm/yr; Soil Factor=0.3;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.99
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Single Span Bridge. Structure is 80m long with a span of approximately 52m

Upstream and downstream invert levels below refer to the watercourse invert levels.

Effective Conveyance Area *4	252m^2
Upstream Invert Level **62.05** mOD	Downstream Invert Level **56.86** mOD
Upstream Soffit Level **67.10** mOD	Downstream Soffit Level **67.10** mOD
Upstream Design Flood Level **63.35** mOD	Downstream Design Flood Level **58.36** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.

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

2. Flow is the estimated flow from the catchment, without any factors applied.

3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.

4. Effective conveyance area is from channel bed level to design flood level.

5. All levels must be given to Ordnance Datum, Malin Head.

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

Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment and Management of Flood Risks) Regulations SI 122 of 2010

Project Name	**Ten-T Priority Route Improvement Project Section 1 – N15 Ballybofey – Stranorlar Urban Region**	Structure Ref No.	**Cloghroe River Crossing Bridge**

Applicant (Correspondence will issue to agent)	
Company or Organisation Name: Donegal National Roads Office	
Postal Address:	NRDO, Drumlonagher, Donegal Town, Co. Donegal
Contact Person:	Damian McDermott
Phone:	+353 (0)74 9724500 Fax:
E-mail:	damian.mcdermott@dnrdo.ie

Agent (Correspondence will issue to agent)	
Company or Organisation Name: RPS	
Postal Address:	Lyrr Building, IDA Business and Technology Park, Mervue, Galway
Contact Person:	Brendan Lyons
Phone:	+353 (0)91 400 200 Fax:
E-mail:	brendan.lyons@rpsgroup.com

Location and Parameters of crossing					
Watercourse:	Cloghroe River			Catchment:	Foyle
Address (Townland – County):		Callan, Stranorlar, Lifford, Co. Donegal			
Grid Reference	X:	216071	Y:	400018	
Hydrometric Station(s) utilized (including reference number):		N/A			
Area of Contributing Catchment:		10.75	Km^2	Road Reference:	N15
Design Flood Flow:	51.08 m^3/s		Annual Exceedance Probability (AEP):		1.0 %

Statement of Authenticity

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

Name:	Brendan Lyons
Company/Organisation:	RPS
Signature:	Brendan Lyons
Date:	26th November 2021

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

For OPW use only	*Date of Receipt*	

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

OPW Drainage Maintenance Region	*East*	☐	*South East*	☐	*South West*	☐	*West* ☐
Correspondence Number		*OPW Register No:*					
		Consent Issued	☐				

ADDITIONAL INFORMATION

Hydrological Analysis

Methodology Applied

Method Used	Tick box if used or state other	Flow *2 (m^3/sec)
6 – Variable Catchment characteristics	☐	
3 – Variable FSSR Catchment Characteristics	☒	7.396
IH 124	☒	6.717
Gauged Flow	☐	
Unit Hydrograph	☐	
ADAS	☐	
FSU 3 – variable	☒	8.914
FSU 5 - variable	☒	12.751

FSR ☒ FSU ☒ Other ☐

Comments SAAR 1503.1mm/yr; Soil Factor=0.41;

Factors Applied

Type of Factor	Value Used
Climate Change	1.2
Irish Growth Curve (IH 124 & 3 - Variable Catchment Characteristics)	1.96
Factor for Standard Error (IH 124)	1.65
Factor for Standard Error (3 - Variable Catchment Characteristics)	1.58
OPW FSU Growth Factor	1.98
Factor for Standard Error (FSU 3 - Variable)	2.059
Factor for Standard Error (FSU 5 - Variable)	1.686
Tidal ☐	

Comments
FSU growth factors obtained using FSU Euclidean GLO distribution analysis of pooled records on opwhydonet.com.

Hydraulic/Structure Details

Description of Structure*3 Single Span Bridge. Structure is 22m long with a span of approximately 18m.

Upstream and downstream invert levels below refer to the watercourse invert levels.

Effective Conveyance Area *4	29.71 m^2
Upstream Invert Level **76.31** mOD	Downstream Invert Level **76.12** mOD
Upstream Soffit Level **78.72** mOD	Downstream Soffit Level **78.72** mOD
Upstream Design Flood Level **78.37** mOD	Downstream Design Flood Level **78.12** mOD

NOTES :

1. In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.

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

2. Flow is the estimated flow from the catchment, without any factors applied.

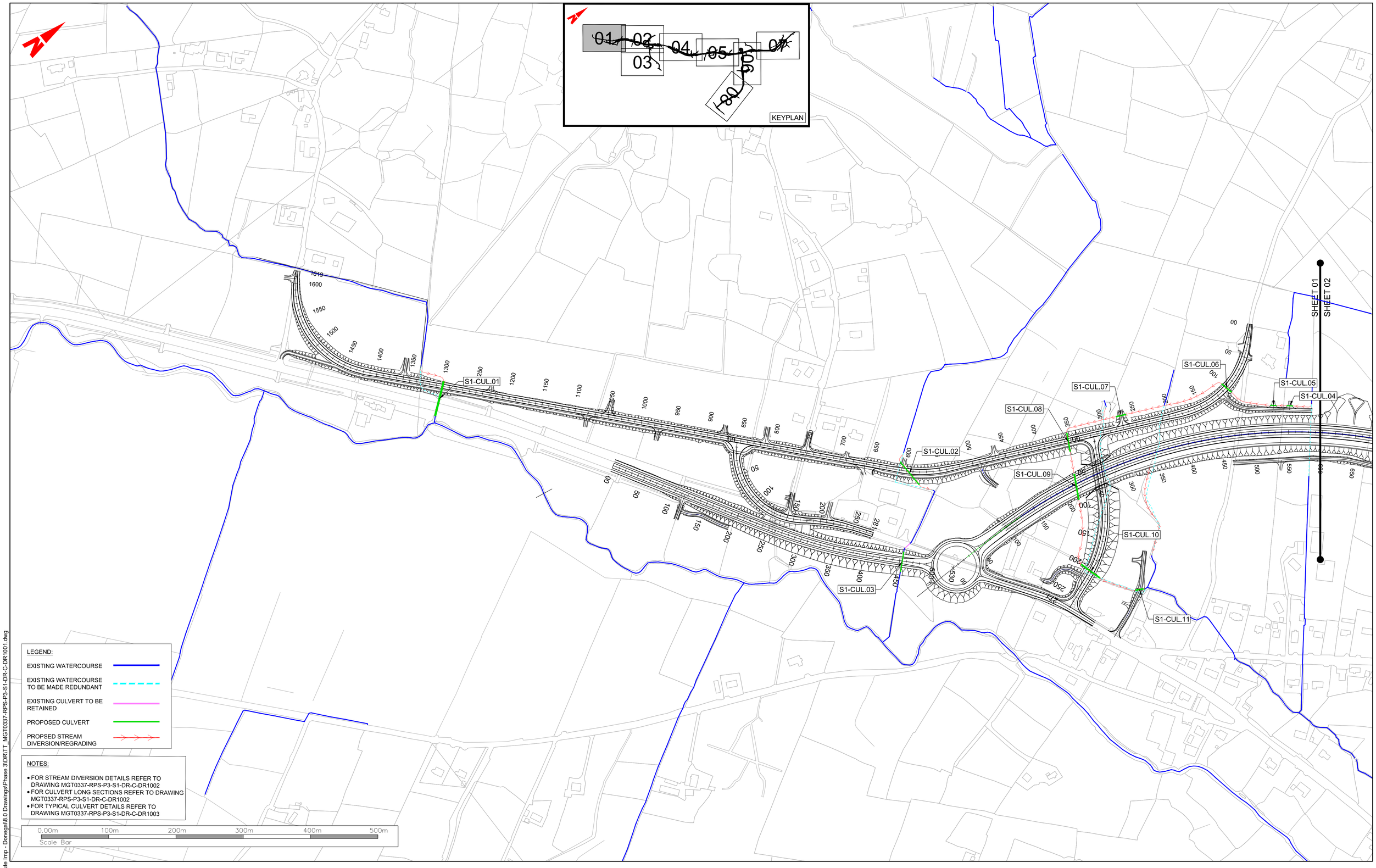
3. The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.

4. Effective conveyance area is from channel bed level to design flood level.

5. All levels must be given to Ordnance Datum, Malin Head.

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

Appendix B - DRAWINGS



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Bonneagar Iompair Éireann Transport Infrastructure Ireland

Co-financed by the Connecting Europe Facility of the European Union

Rialtas na hÉireann Government of Ireland

Tionscadal Éireann Project Ireland 2040

Comhairle Contae Dhún na nGall Donegal County Council

RPS BARRY TRANSPORTATION

NOTES

DO NOT SCALE, use figured dimensions only.

All levels are referred to Ordnance Survey Datum, Malin Head.

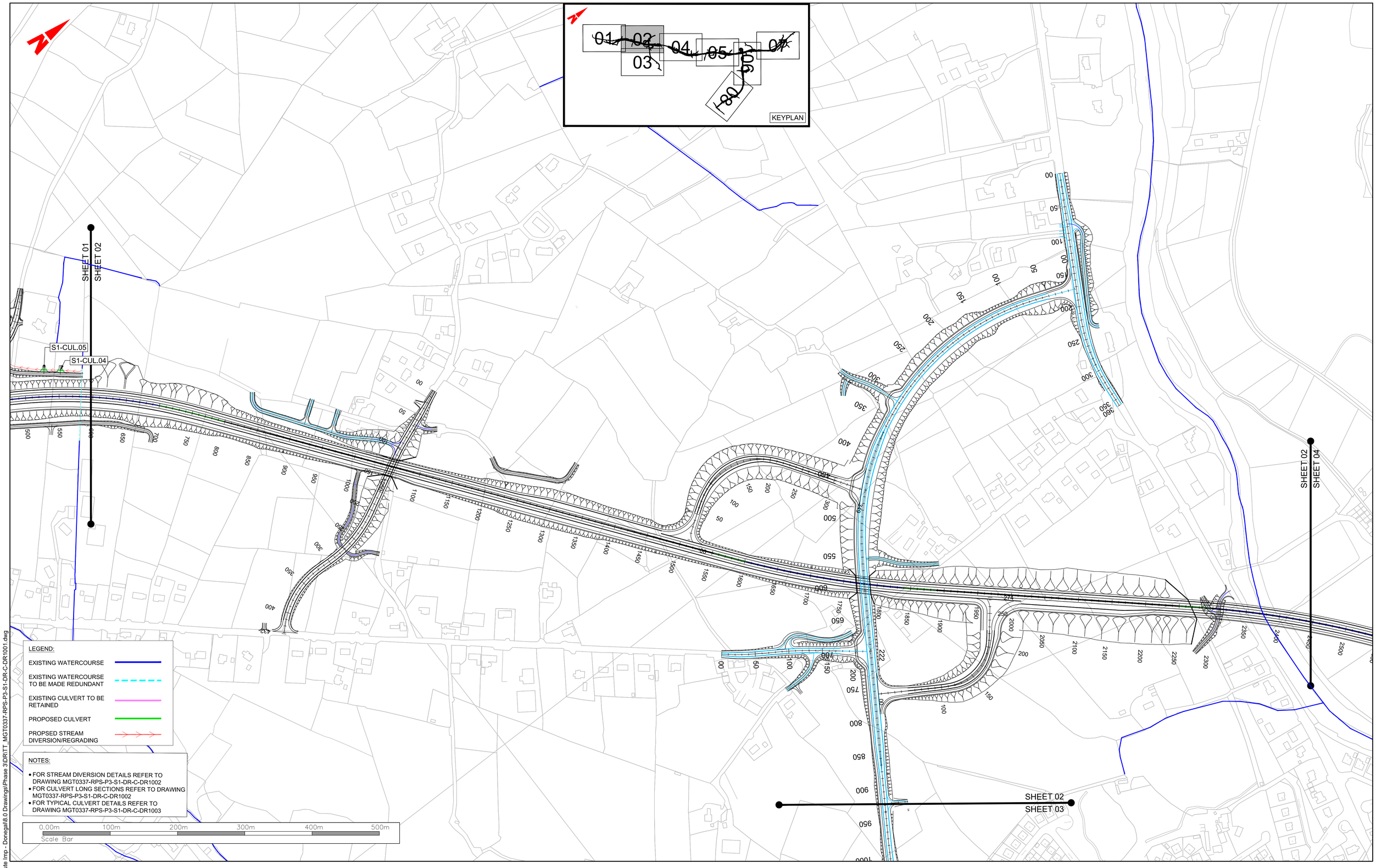
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

Designed: É.McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É.McKeon	Scale @ A1: 1:2500	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B.Lyons	@ A3: 1:5000	File Identifier:	P01
Checked: B.Lyons	Sheet: 01 of 08	TT_MGT0337-RPS-P3-S1-DR-C-DR1001	



T:\MGT0337 - Ten-T Priority Route Imp - Donegal\8.0 Drawings\Phase 3\DR\TT_MGT0337-RPS-P3-S1-DR-C-DR1001.dwg

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Co-financed by the Connecting Europe Facility of the European Union

Rialtas na hÉireann Government of Ireland
Tionscadal Éireann Project Ireland 2040

Comhairle Contae Dhún na nGall
Donegal County Council

RPS BARRY TRANSPORTATION

NOTES

DO NOT SCALE, use figured dimensions only.

All levels are referred to Ordnance Survey Datum, Malin Head.
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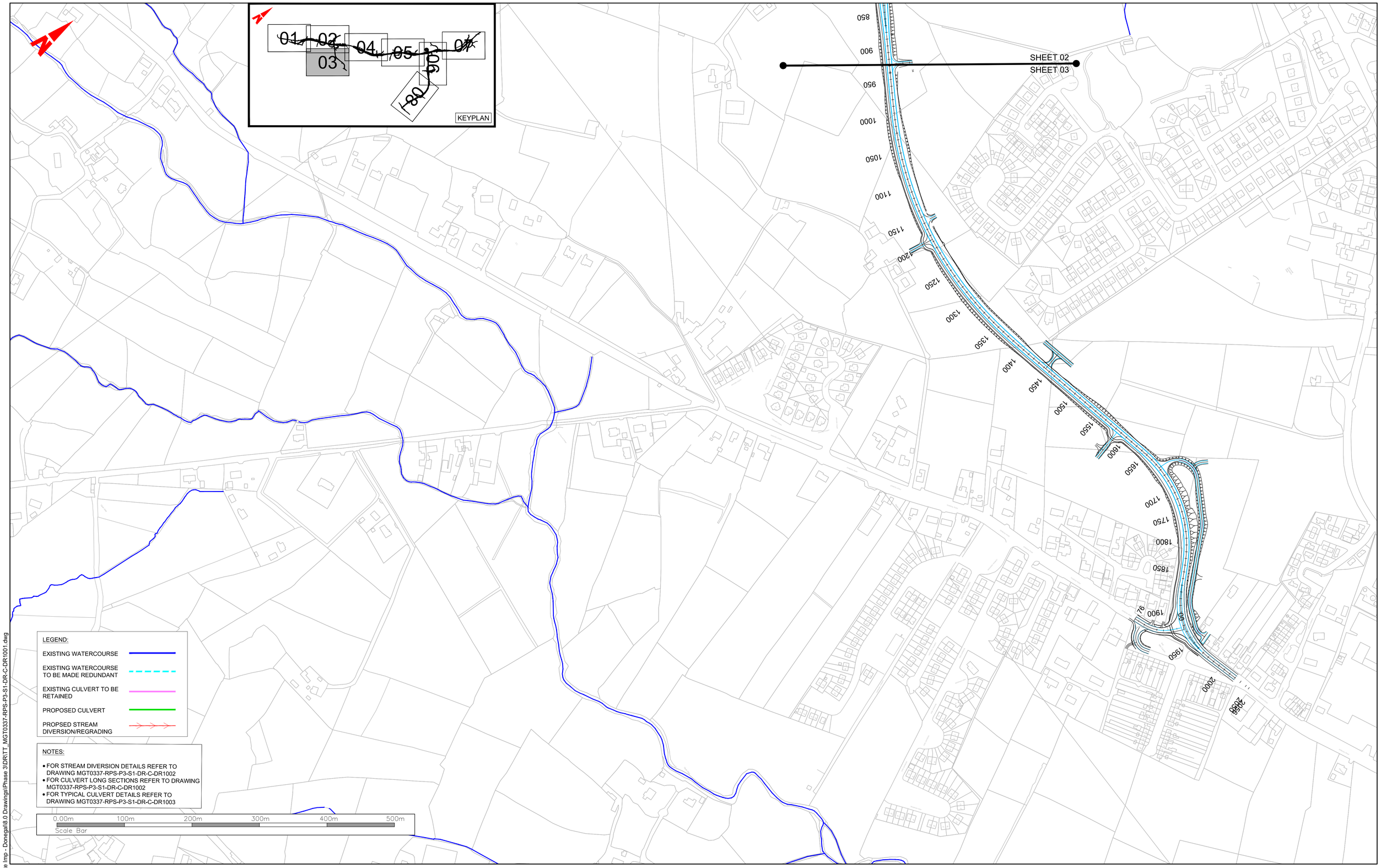
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title:	TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13
Drawing Title:	Section 1 Culverts & Stream Diversions Layouts
Status:	S3
Designed: É.McKeon	Date: NOV.2021
Drawn: É.McKeon	Scale @ A1: 1:2500
Approved: B.Lyons	@ A3: 1:5000
Checked: B.Lyons	Sheet: 02 of 08
Model File Identifier:	TT_MGT0337-RPS-P3-S1-M3-C-DR1001
File Identifier:	TT_MGT0337-RPS-P3-S1-DR-C-DR1001
Rev:	P01



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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title:	TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13
Drawing Title:	Section 1 Culverts & Stream Diversions Layouts
Status:	S3
Designed: É.McKeon	Date: NOV.2021
Drawn: É.McKeon	Scale @ A1: 1:2500
Approved: B.Lyons	@ A3: 1:5000
Checked: B.Lyons	Sheet: 03 of 08
Model File Identifier:	TT_MGT0337-RPS-P3-S1-M3-C-DR1001
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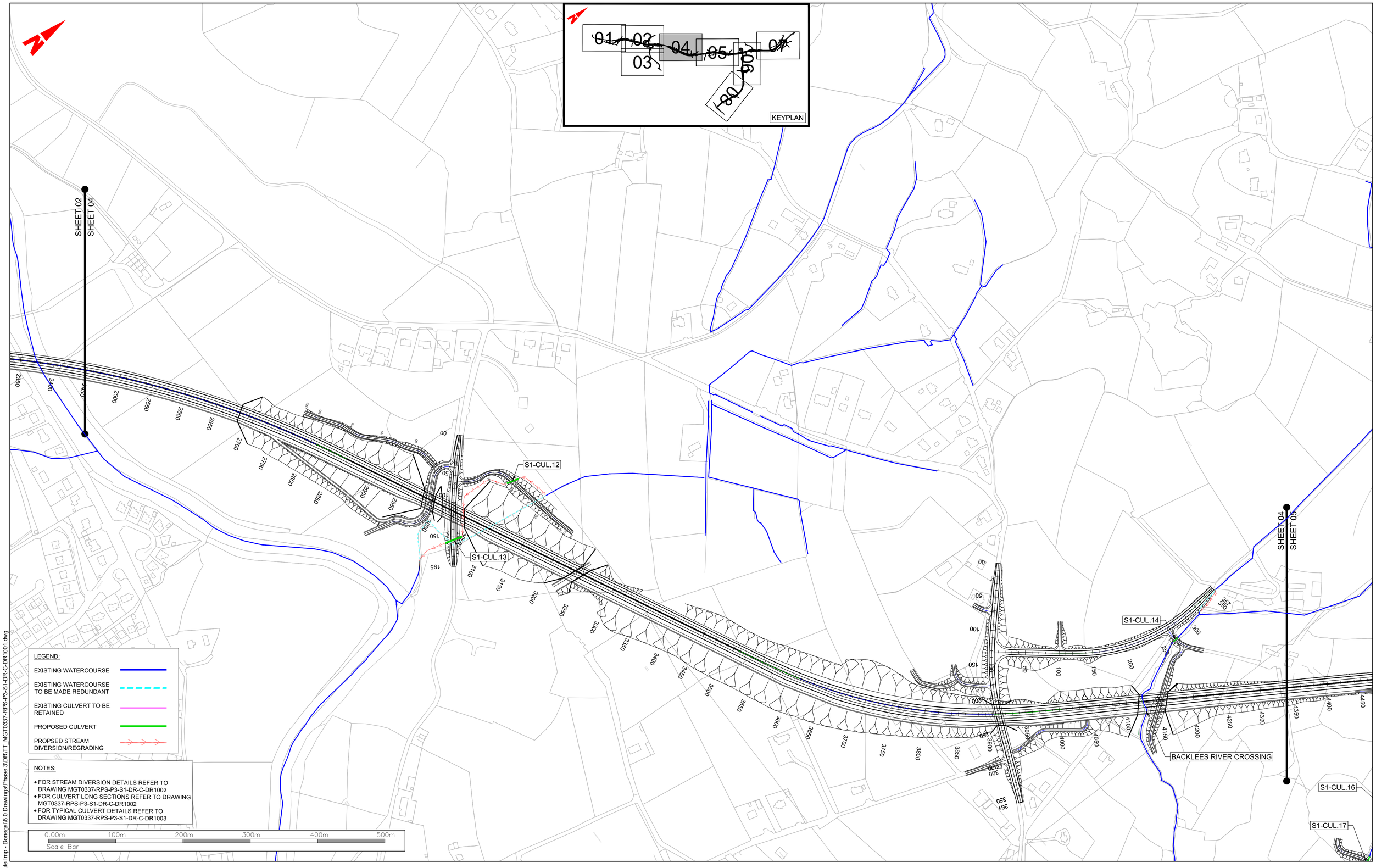
Rev:	P01



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Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

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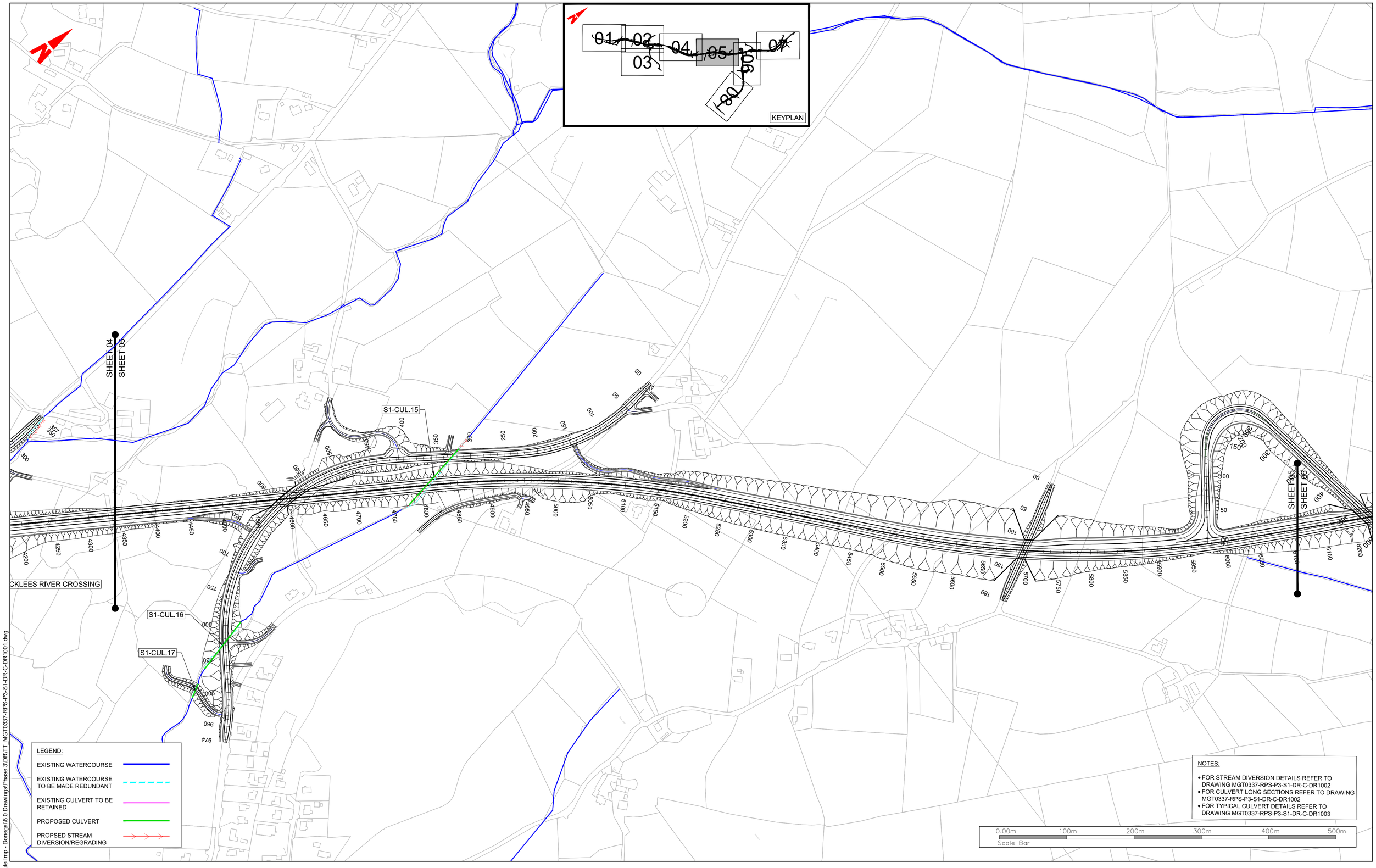

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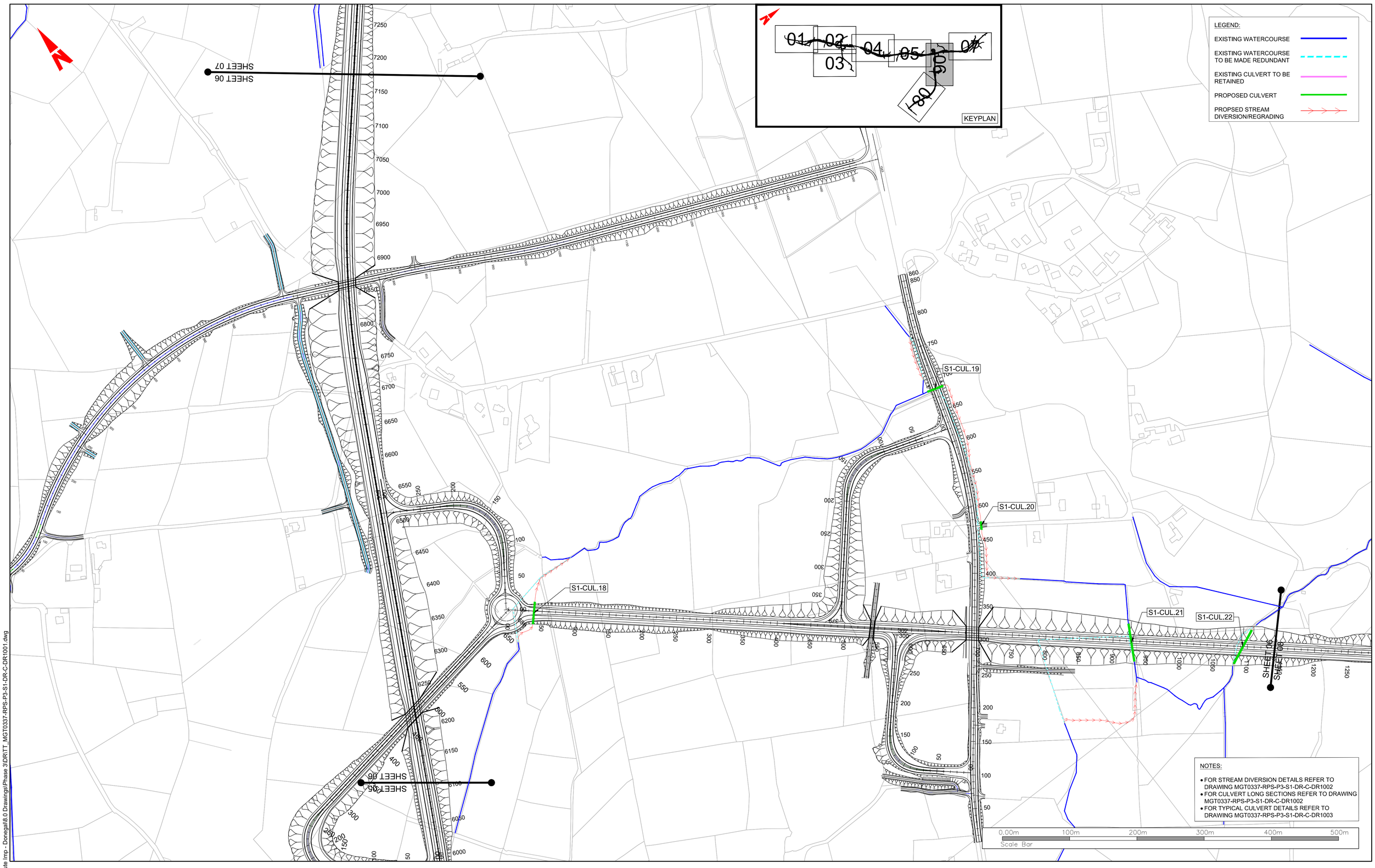

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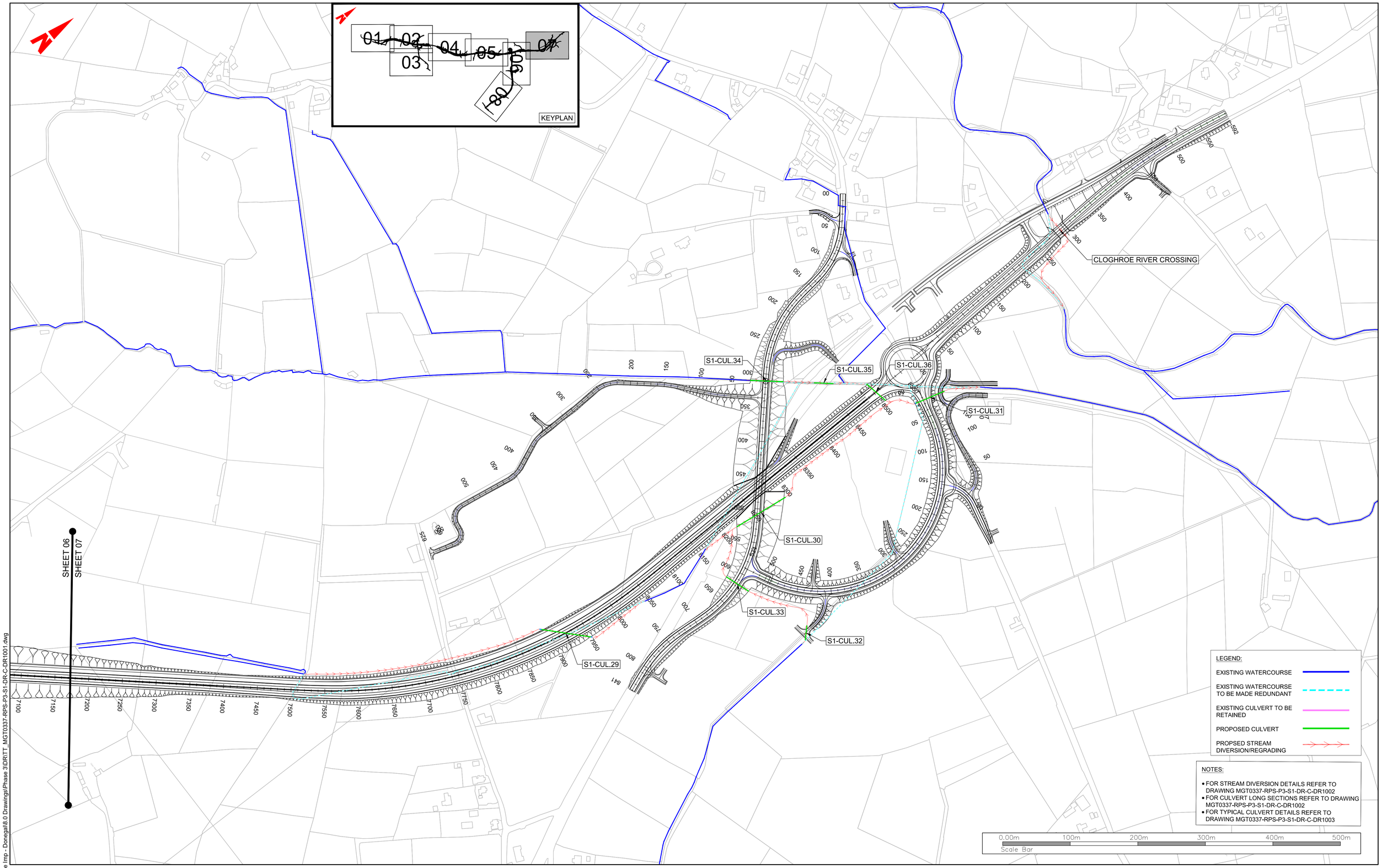

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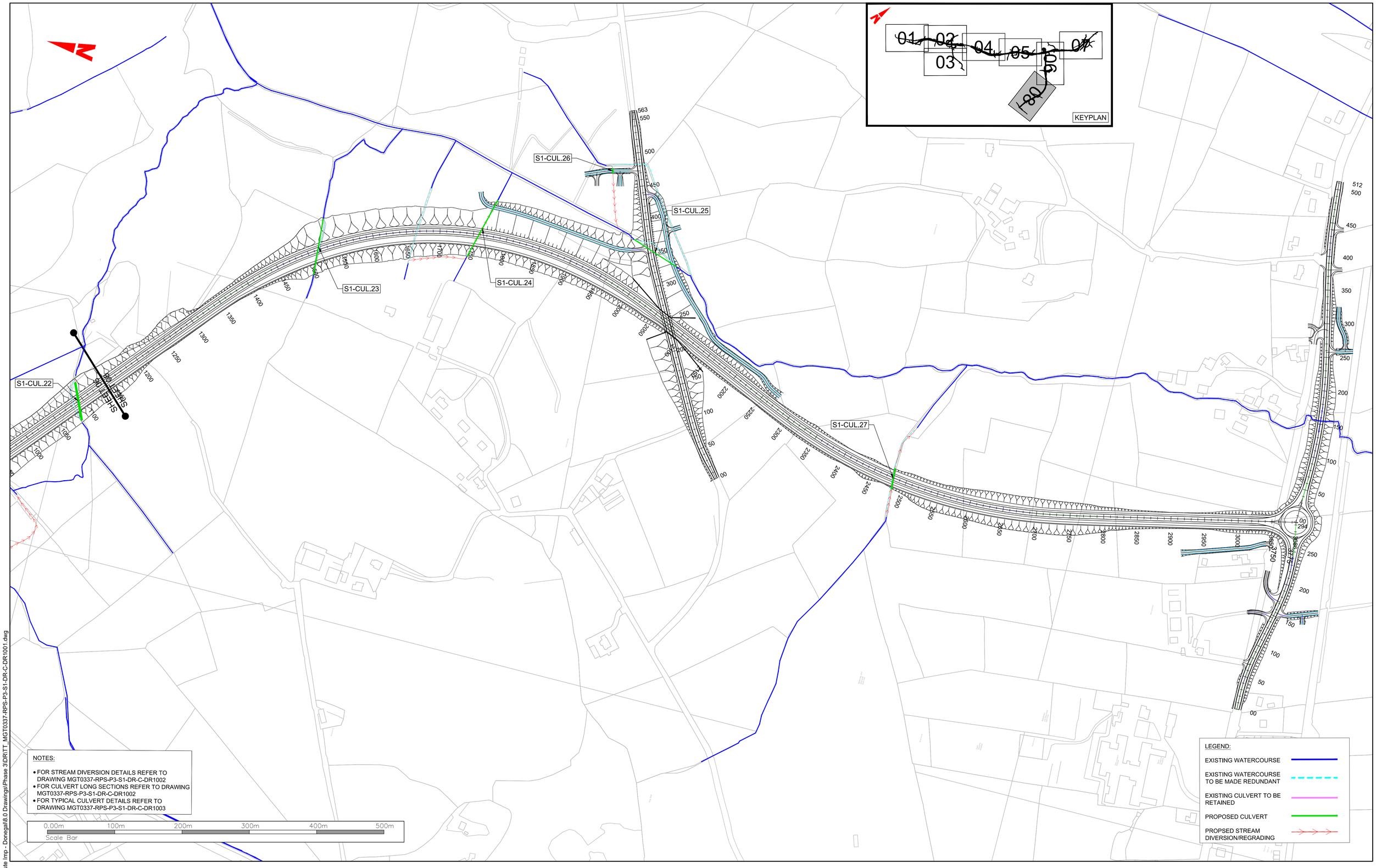

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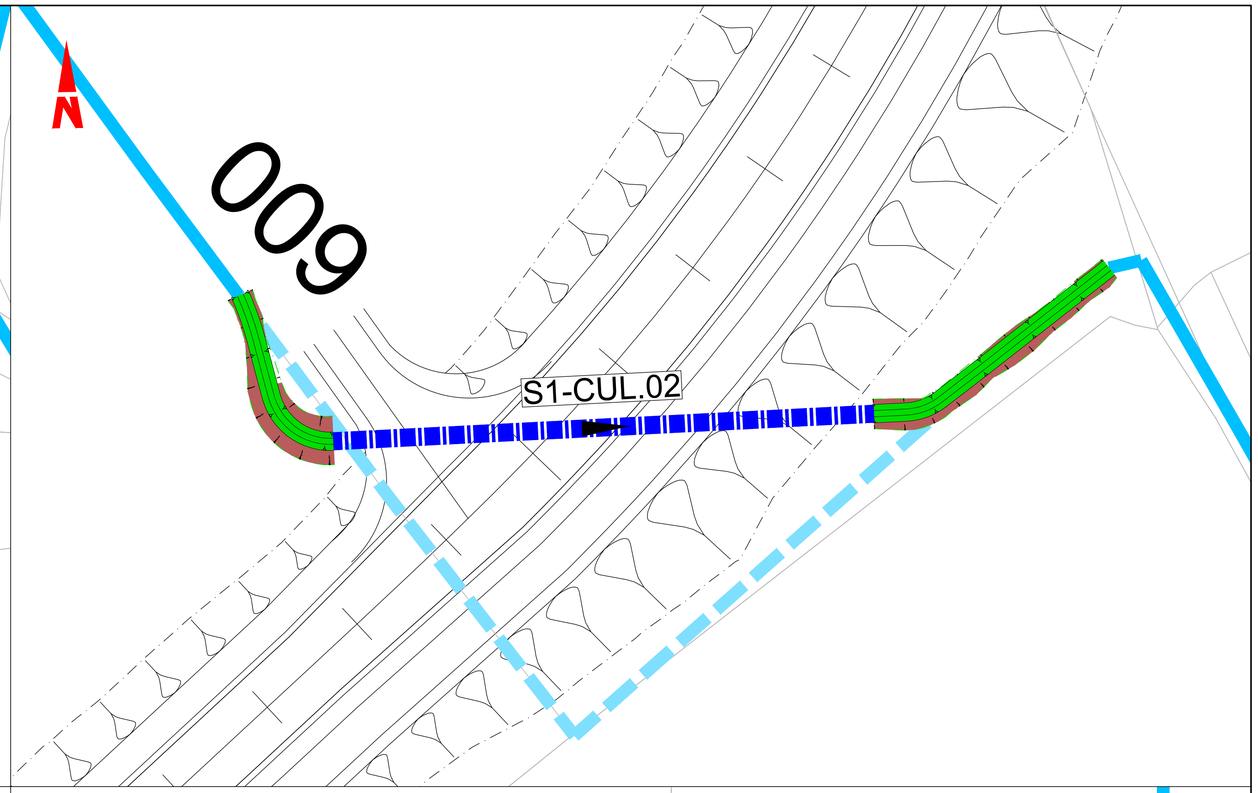

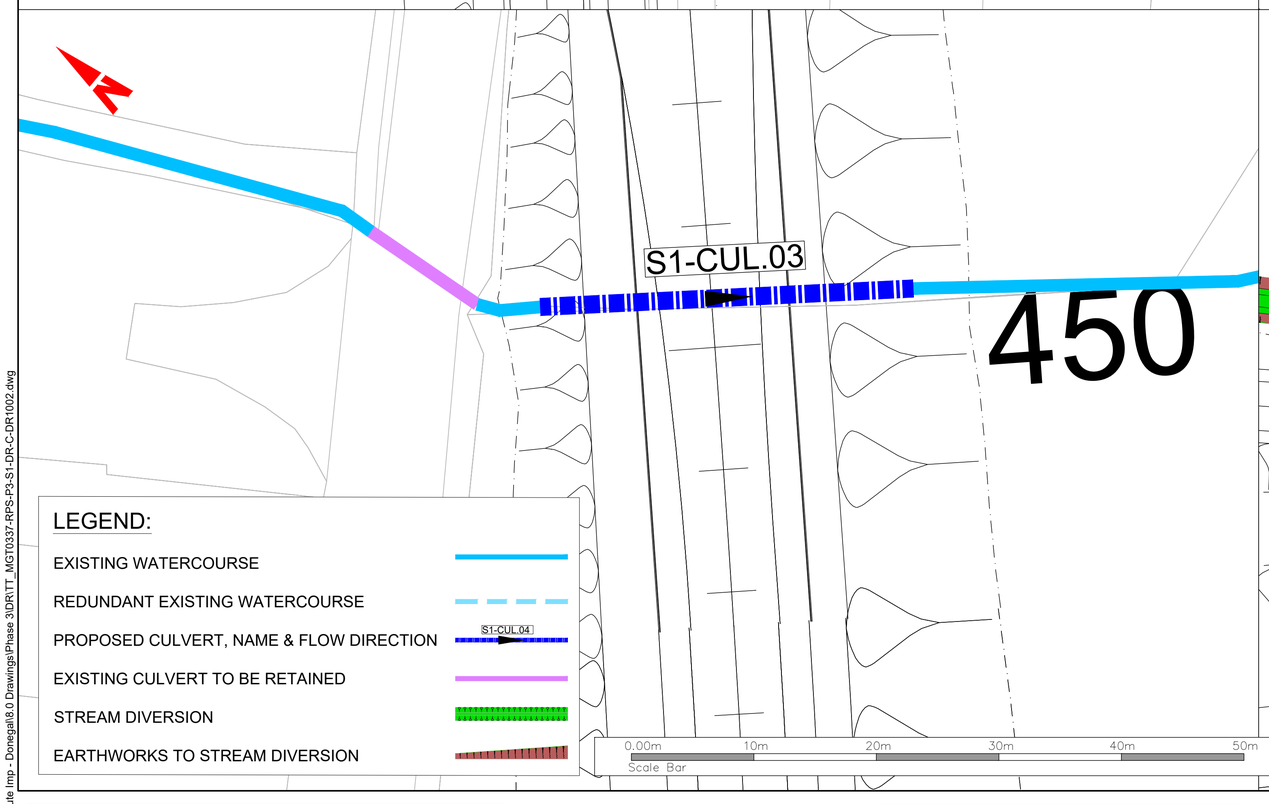

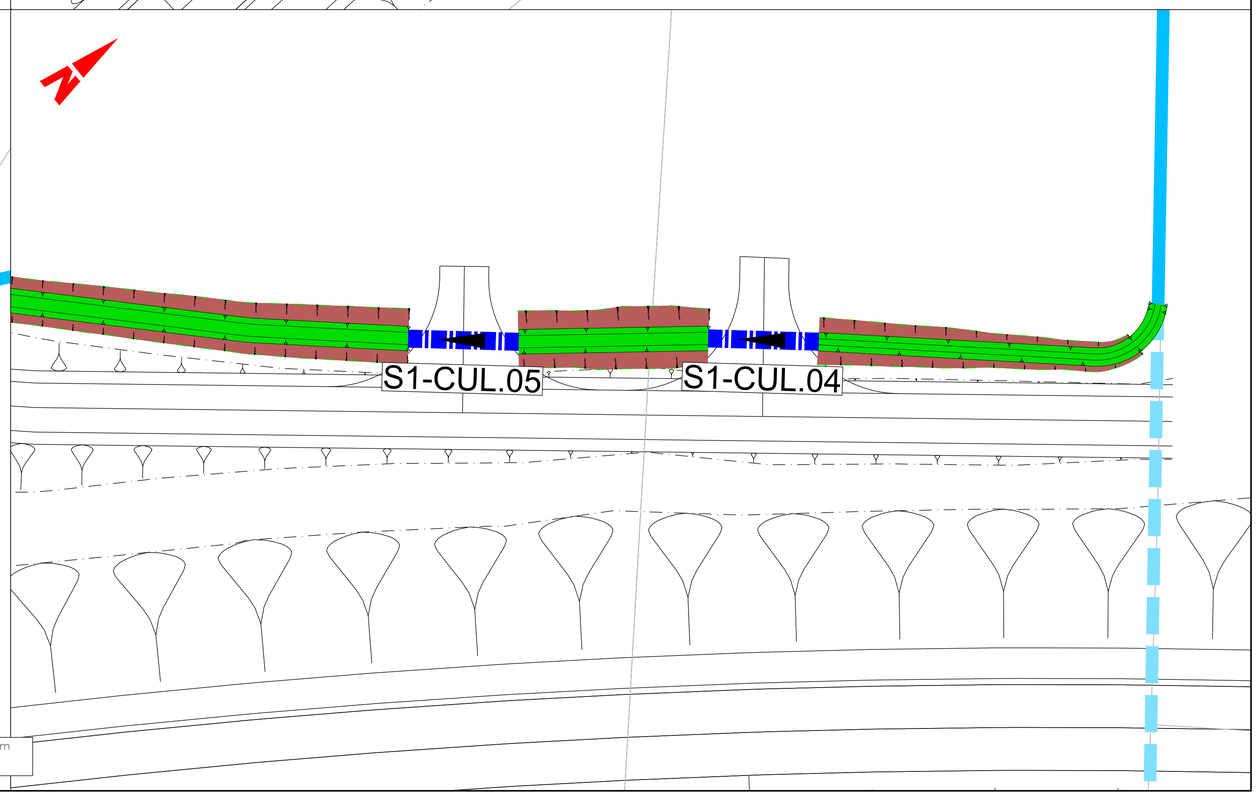

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Drawing Title: Section 1
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Status: S3

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Approved: B. Lyons	@ A3: 1:500	File Identifier:	P01
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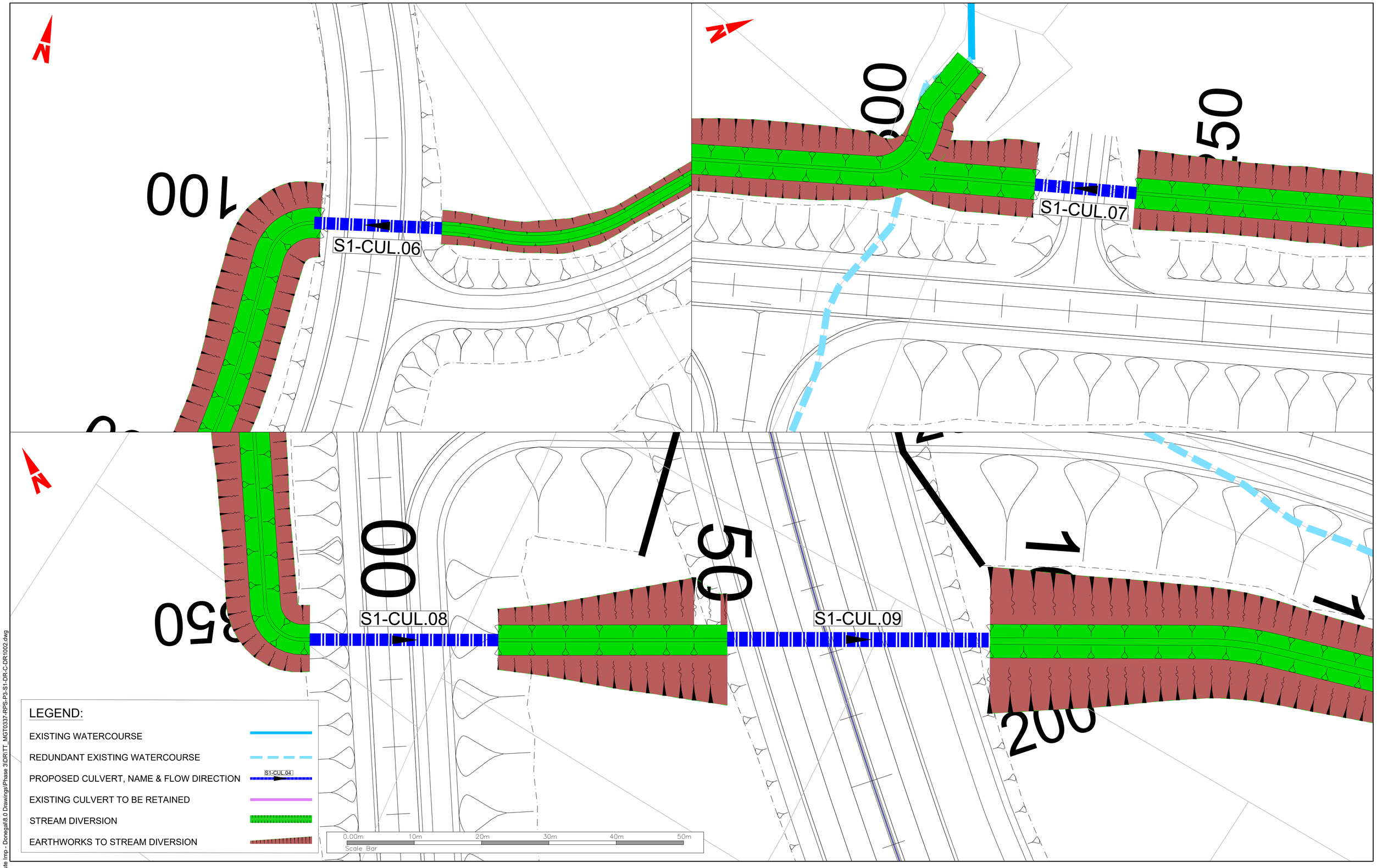

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Drawing Title:	Section 1 Culverts & Stream Diversions Layouts
Status:	S3
Designed: É. McKeon	Date: NOV.2021
Drawn: É. McKeon	Scale @ A1: 1:250
Approved: B. Lyons	@ A3: 1:500
Checked: B. Lyons	Sheet: 02 of 11
Model File Identifier:	TT_MGT0337-RPS-P3-S1-M3-C-DR1001
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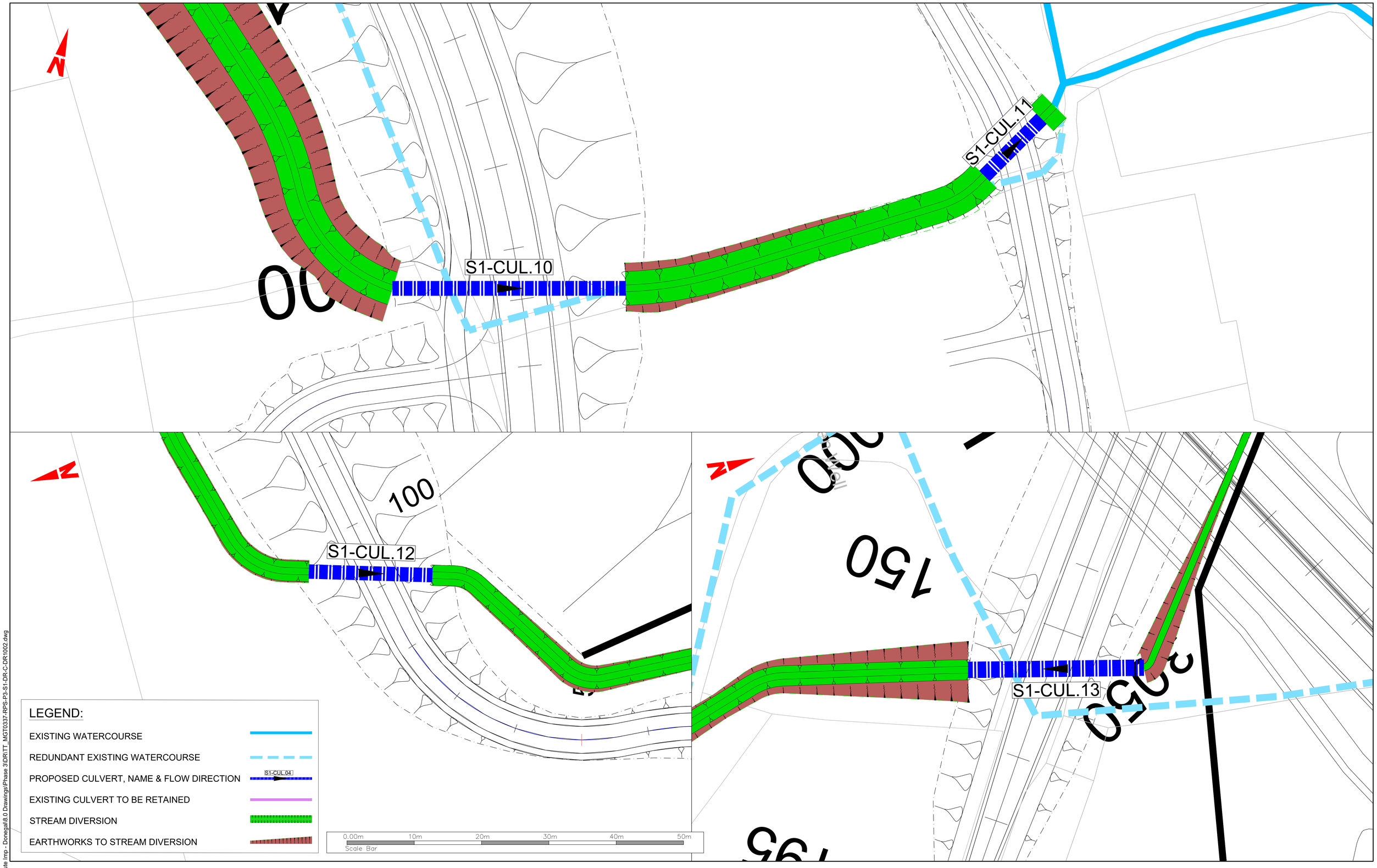
Rev:	P01



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Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

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Drawn: É. McKeon	Scale @ A1: 1:250		
Approved: B. Lyons	@ A3: 1:500	File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1002	
Checked: B. Lyons	Sheet: 03 of 11		

S1-CUL.14

S1-CUL.15

S1-CUL.16

S1-CUL.17

4800

250

850

000

LEGEND:

- EXISTING WATERCOURSE
- REDUNDANT EXISTING WATERCOURSE
- PROPOSED CULVERT, NAME & FLOW DIRECTION (S1-CUL.04)
- EXISTING CULVERT TO BE RETAINED
- STREAM DIVERSION
- EARTHWORKS TO STREAM DIVERSION

0.00m 10m 20m 30m 40m 50m
Scale Bar

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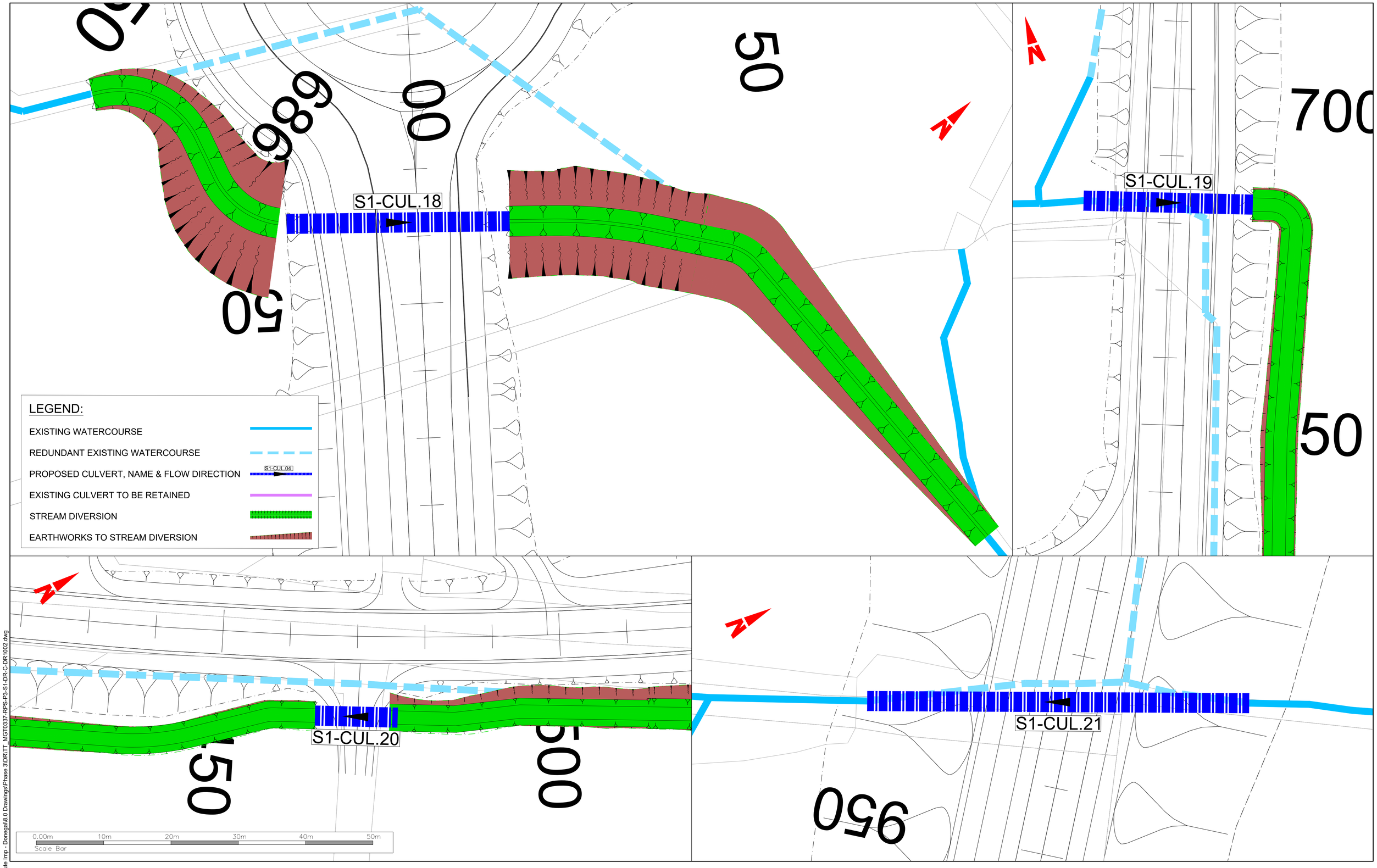

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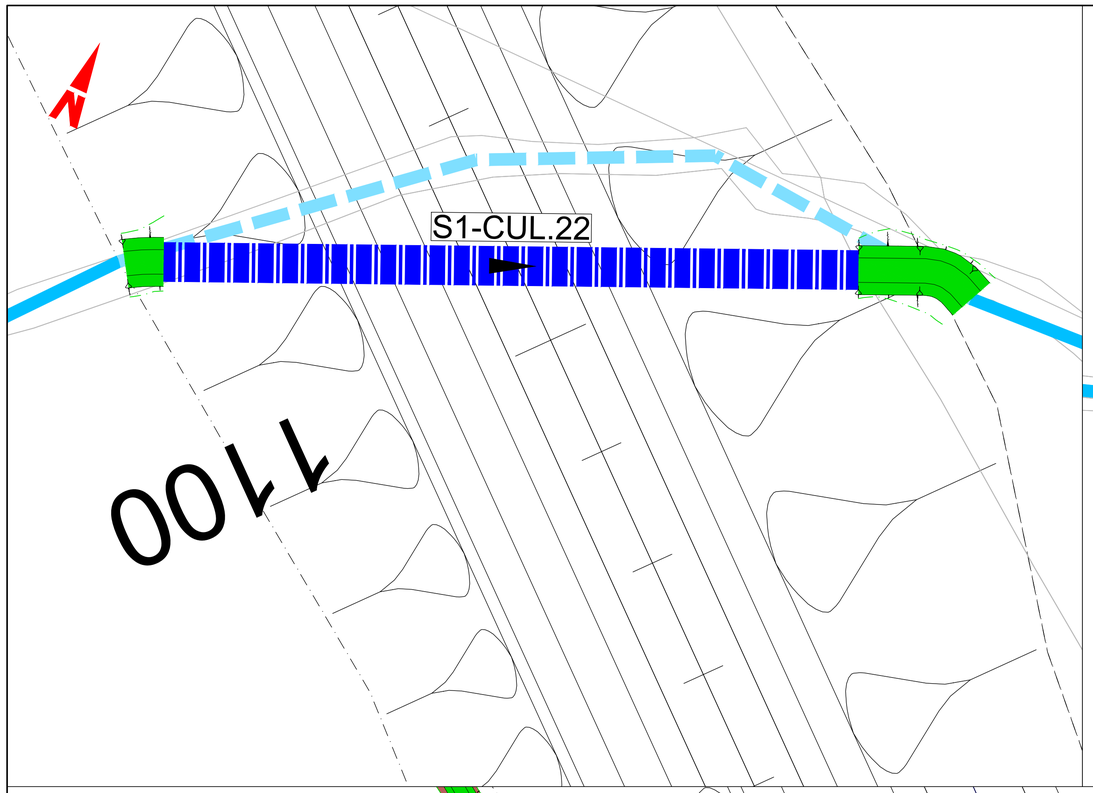

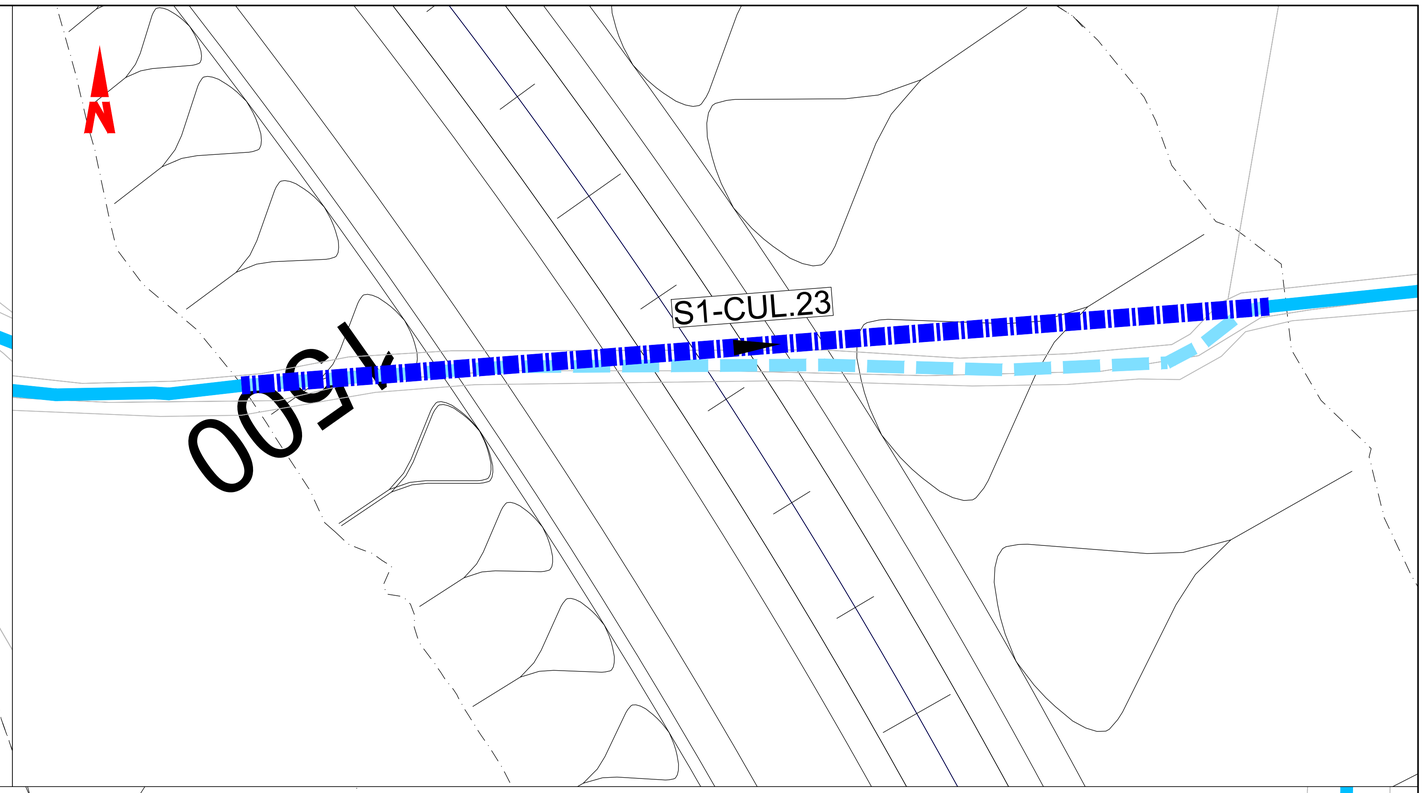

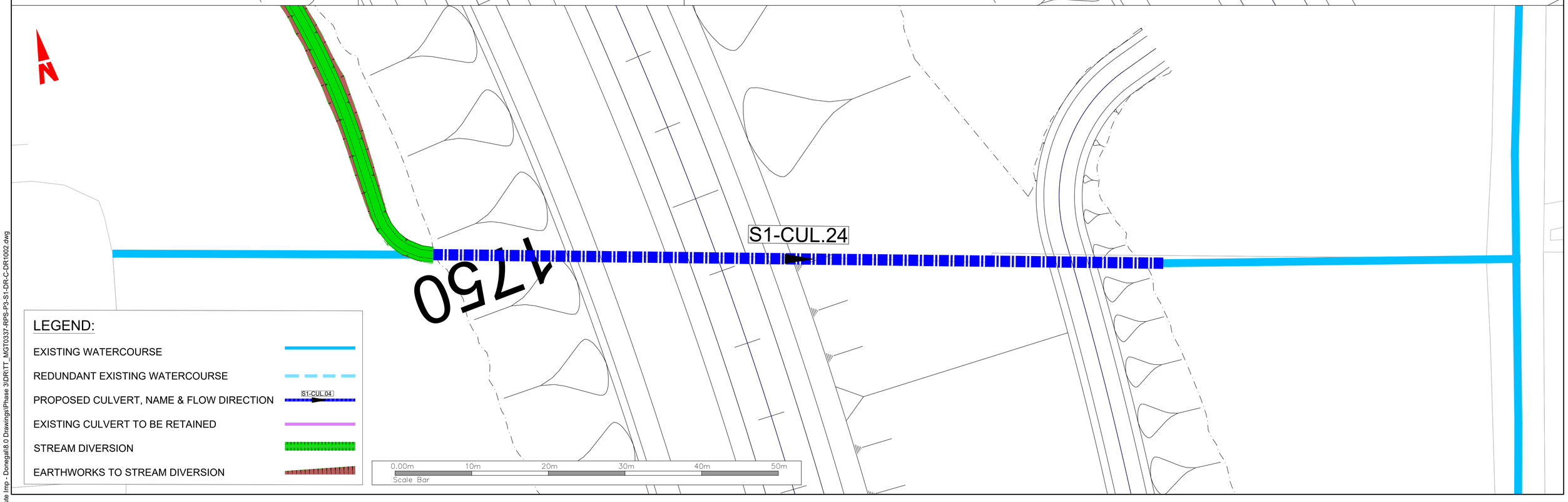

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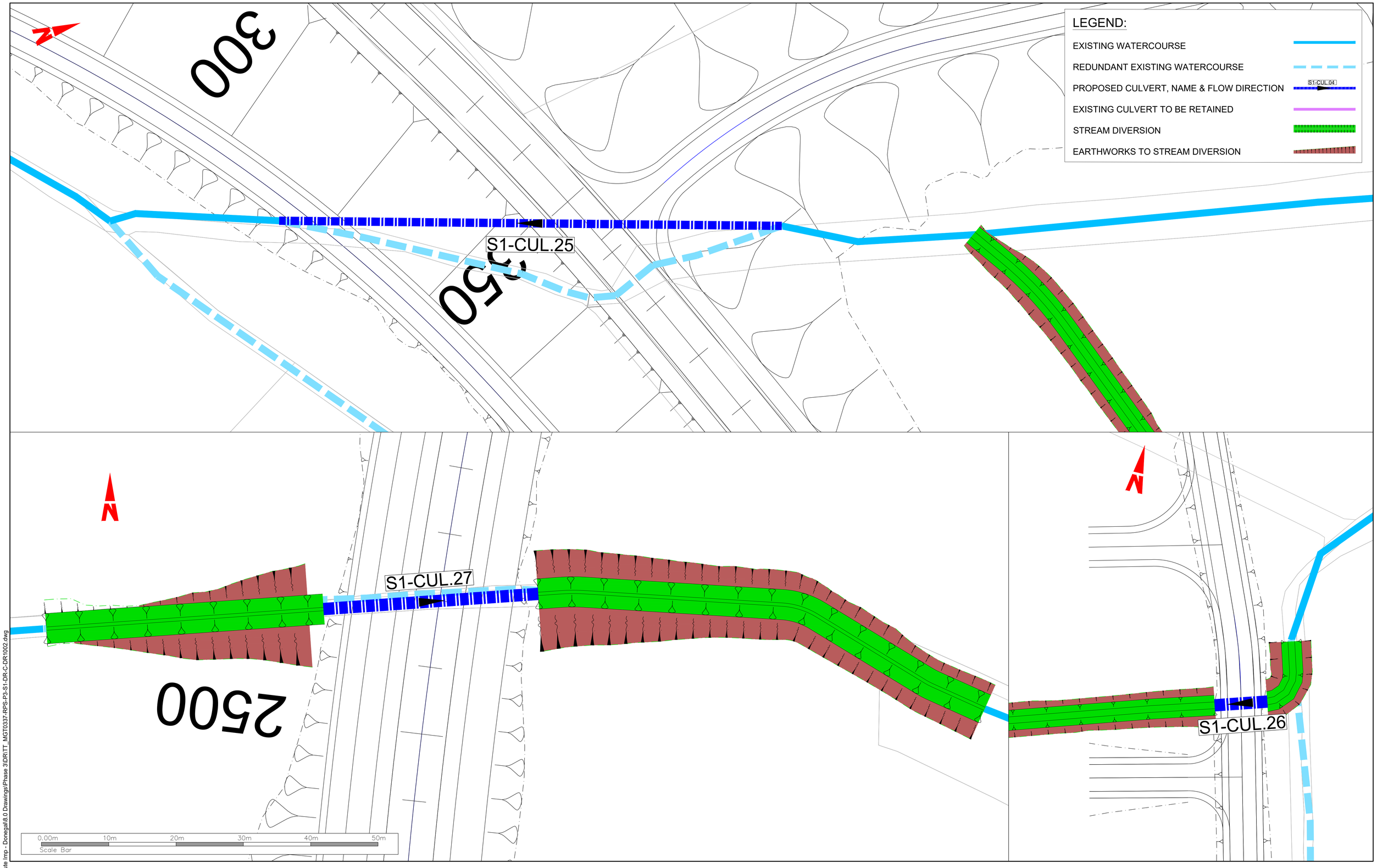
Checked: B. Lyons	Sheet: 06 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	



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Project Ireland 2040

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Comhairle Contae Dhún na nGall
Donegal County Council

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

Designed: É. McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:250	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:500	File Identifier:	
Checked: B. Lyons	Sheet: 07 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	P01

S1-CUL.29

7950

S1-CUL.31

8550

00

50

S1-CUL.32

S1-CUL.30

8250

8300

5500

55

LEGEND:

- EXISTING WATERCOURSE
- REDUNDANT EXISTING WATERCOURSE
- PROPOSED CULVERT, NAME & FLOW DIRECTION (S1-CUL.04)
- EXISTING CULVERT TO BE RETAINED
- STREAM DIVERSION
- EARTHWORKS TO STREAM DIVERSION

0.00m 10m 20m 30m 40m 50m
Scale Bar

T:\MGT0337 - Ten-T Priority Route Imp - Donegal\8.0 Drawings\Phase 3\DR\TT_MGT0337-RPS-P3-S1-DR-C-DR1002.dwg

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Donegal County Council

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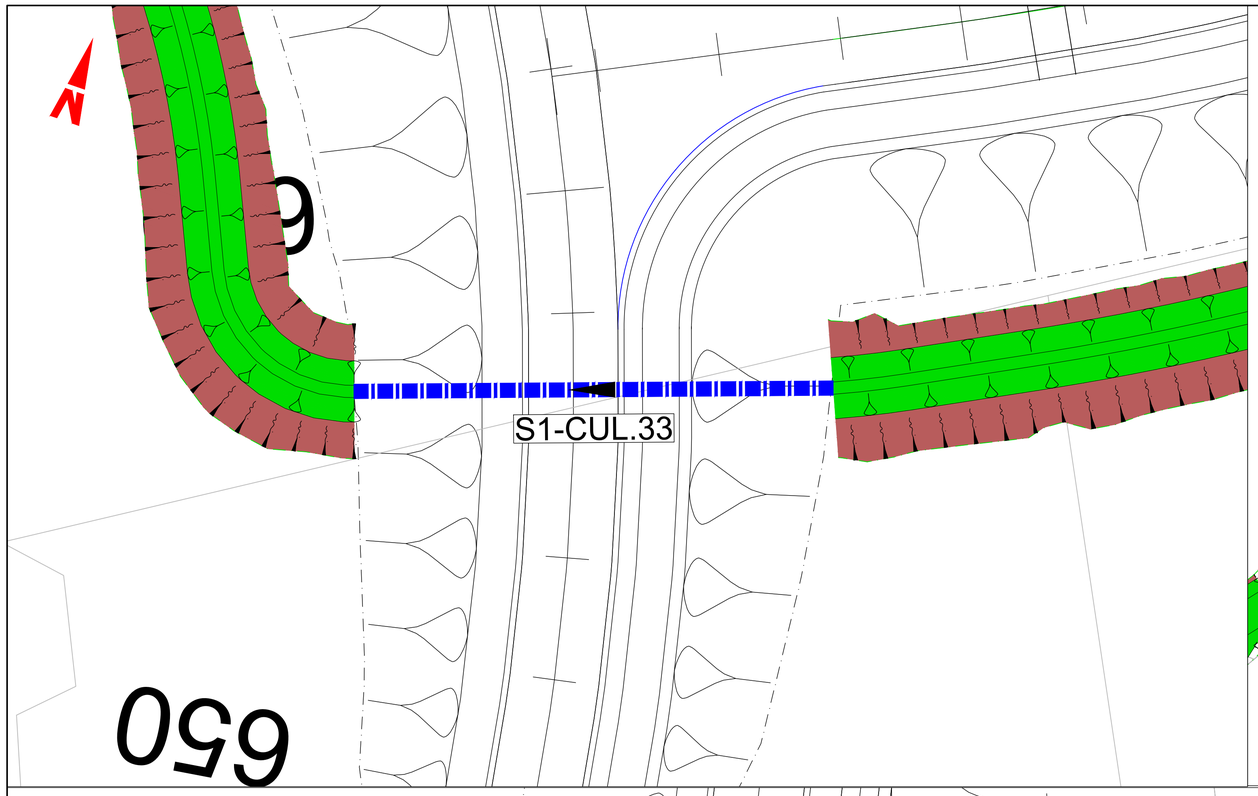
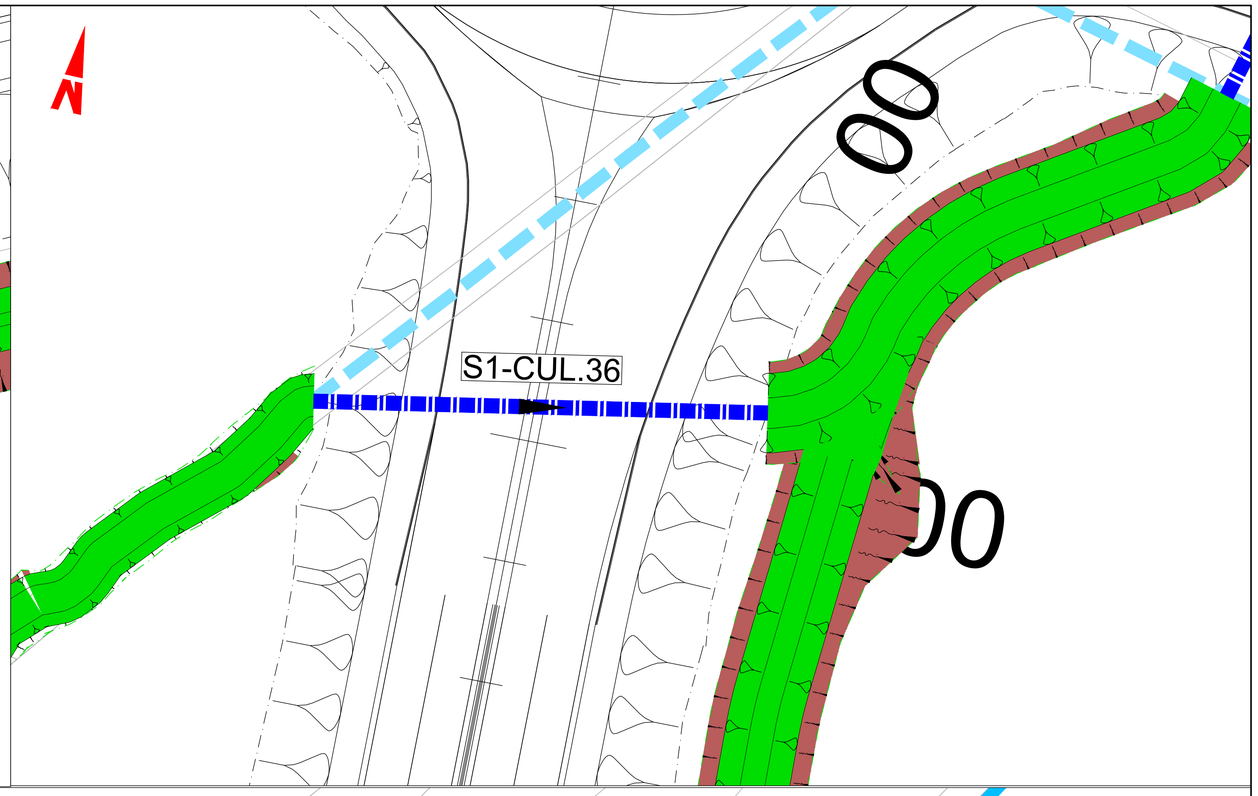
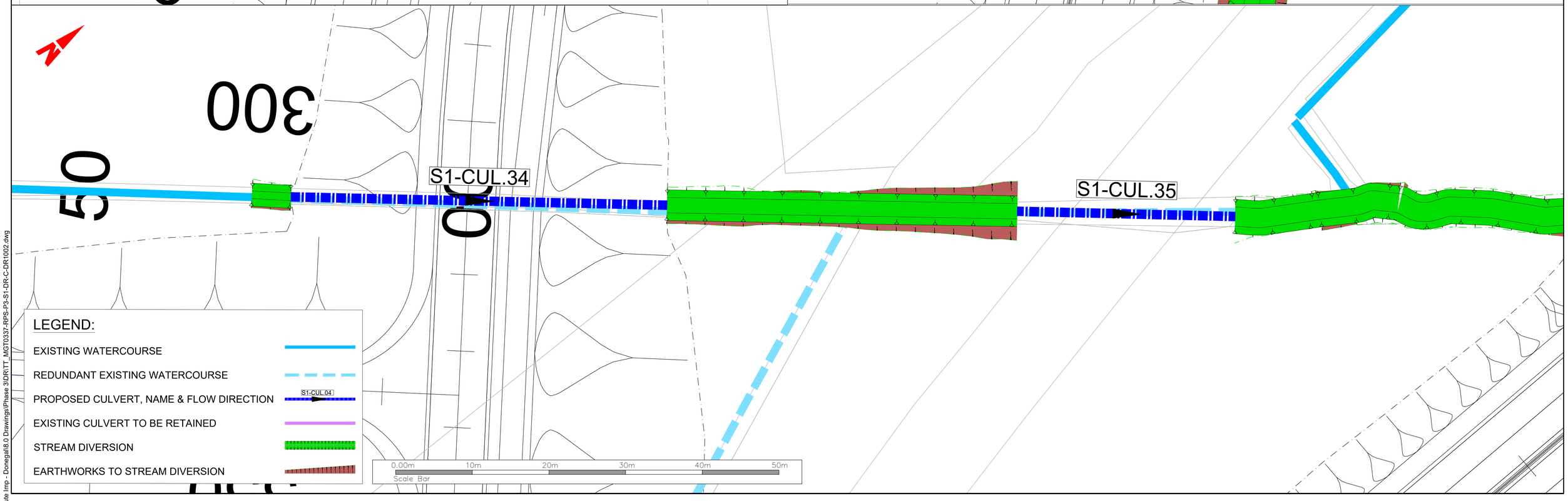
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title:	TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13		
Drawing Title:	Section 1 Culverts & Stream Diversions Layouts	Status:	S3
Designed: É. McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:250 @ A3: 1:500	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	P01
Approved: B. Lyons		File Identifier:	
Checked: B. Lyons	Sheet: 08 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	







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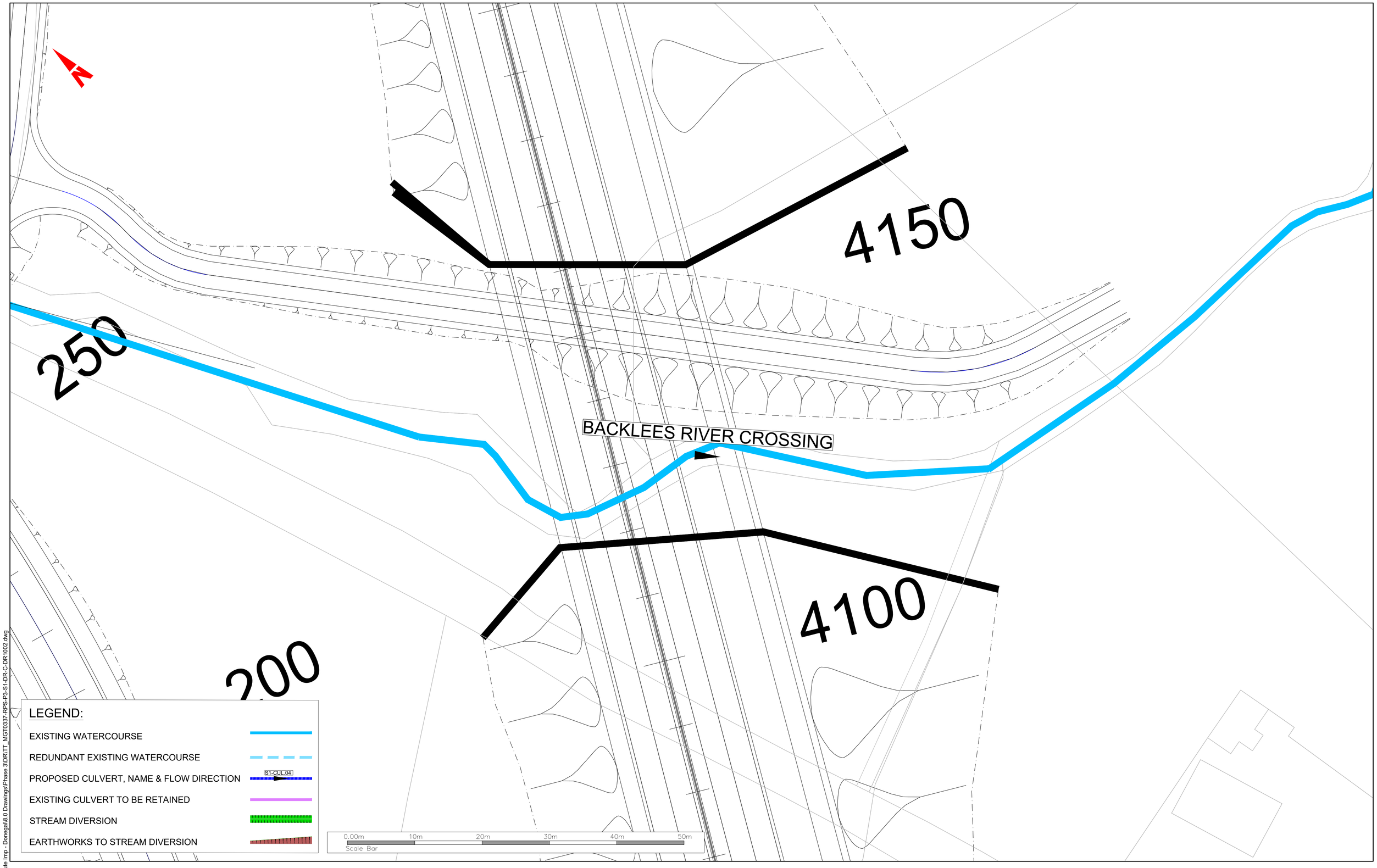
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

Designed: É. McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:250	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:500	File Identifier:	P01
Checked: B. Lyons	Sheet: 09 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	



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P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

Designed: É. McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:250	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:500	File Identifier:	P01
Checked: B. Lyons	Sheet: 10 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	

300

CLOGHROE RIVER CROSSING

Callan Bridge

Cloghroe River

200

150

LEGEND:

- EXISTING WATERCOURSE
- REDUNDANT EXISTING WATERCOURSE
- PROPOSED CULVERT, NAME & FLOW DIRECTION (S1-CUL_04)
- EXISTING CULVERT TO BE RETAINED
- STREAM DIVERSION
- EARTHWORKS TO STREAM DIVERSION

0.00m 10m 20m 30m 40m 50m
Scale Bar

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	24.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culverts & Stream Diversions Layouts

Status: S3

Designed: É. McKeon	Date: NOV.2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:250	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:500	File Identifier:	P01
Checked: B. Lyons	Sheet: 11 of 11	TT_MGT0337-RPS-P3-S1-DR-C-DR1002	

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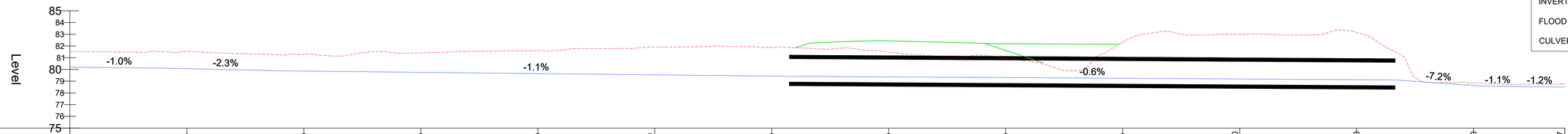
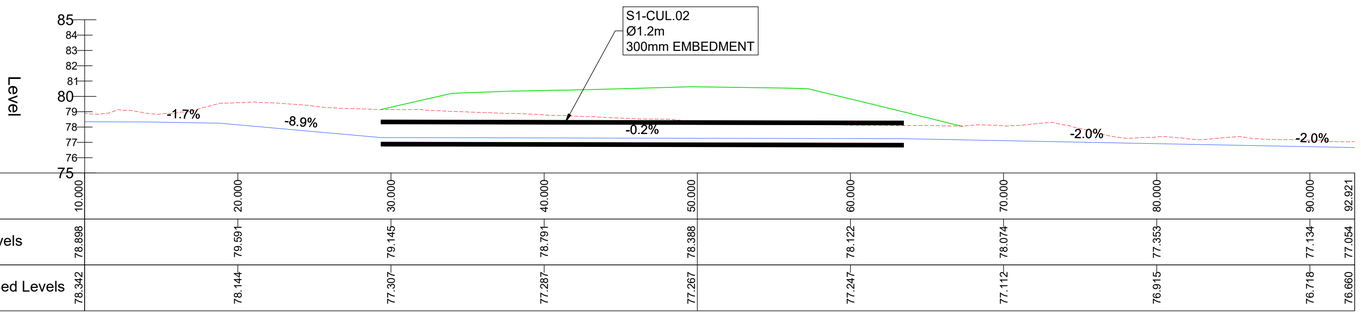
LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL



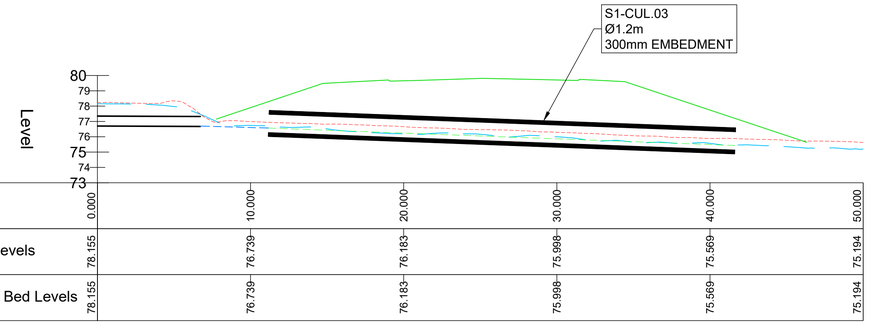
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	127.807
Existing Levels	81.526	81.541	81.274	81.412	81.594	81.909	81.867	81.483	80.962	82.324	83.002	83.164	78.813	78.775
Proposed Bed Levels	80.190	80.068	79.861	79.754	79.647	79.541	79.434	79.367	79.307	79.247	79.187	79.127	78.627	78.500

S1-CUL.01
SCALE: H 1:200,V 1:200. DATUM: 75.000



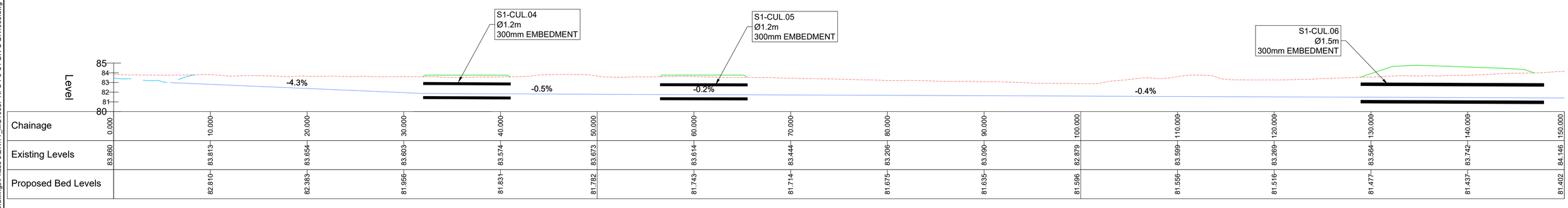
Chainage	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	92.921
Existing Levels	78.898	79.591	79.145	78.791	78.388	78.122	78.074	77.353	77.134	77.054
Proposed Bed Levels	78.342	78.144	77.307	77.287	77.267	77.247	77.112	76.915	76.718	76.660

S1-CUL.02
SCALE: H 1:200,V 1:200. DATUM: 75.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000
Existing Levels	78.155	76.739	76.183	75.998	75.569	75.194
Proposed Bed Levels	78.155	76.739	76.183	75.998	75.569	75.194

S1-CUL.03
SCALE: H 1:200,V 1:200. DATUM: 73.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000
Existing Levels	83.860	83.813	83.654	83.603	83.574	83.673	83.614	83.444	83.206	83.090	82.879	83.599	83.269	83.564	83.742	84.146
Proposed Bed Levels		82.810	82.383	81.956	81.831	81.782	81.743	81.714	81.675	81.635	81.596	81.556	81.516	81.477	81.437	81.402

S1-CUL.04 TO S1-CUL.06
SCALE: H 1:200,V 1:200. DATUM: 80.000

T:\MGT0337 - Ten-T Priority Route Imp - Donegal\8.0 Drawings\Phase 3\DR\TT_MGT0337-RPS-P3-S1-DR-C-DR1003.dwg

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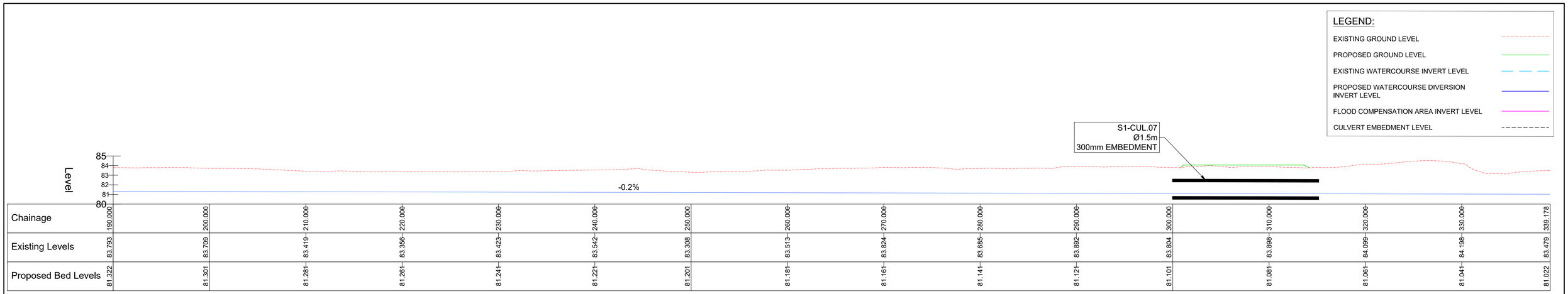
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

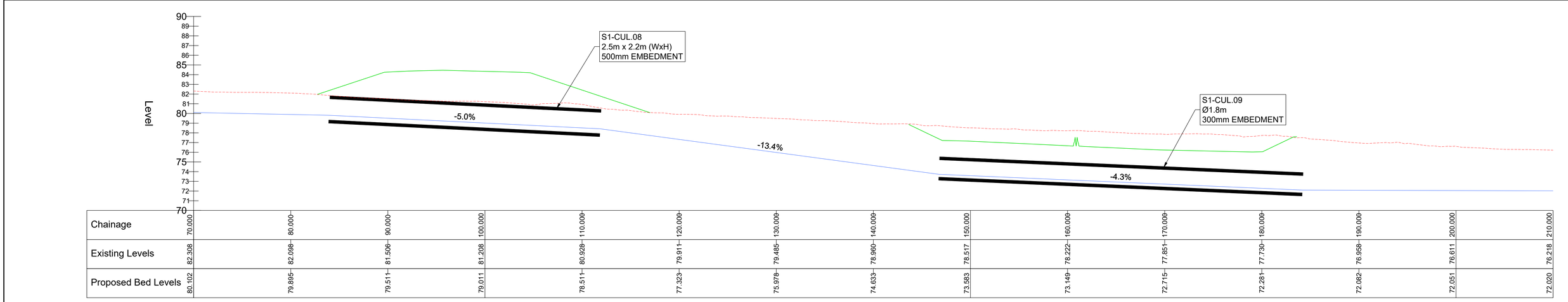
Drawing Title: Section 1
Culvert Long Sections

Status: S3

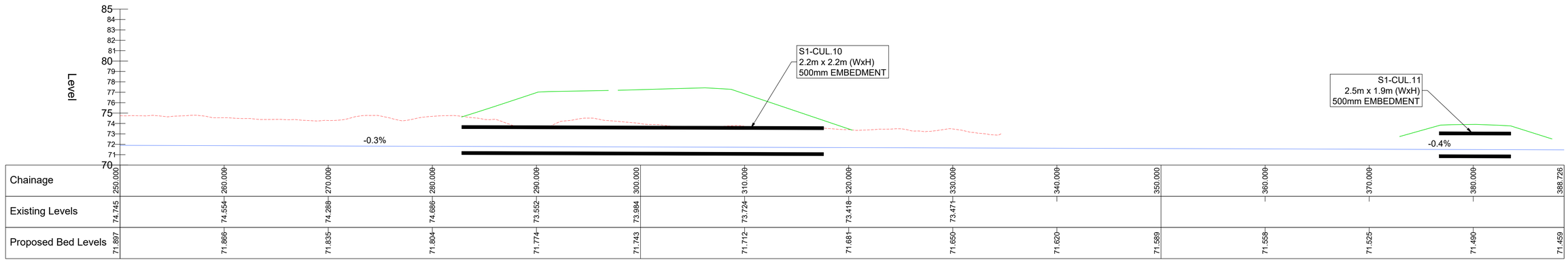
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	P01
Checked: B. Lyons	Sheet: 01 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	



S1-CUL.07
SCALE: H 1:200,V 1:200. DATUM: 80.000



S1-CUL.08 & S1-CUL.09
SCALE: H 1:200,V 1:200. DATUM: 70.000



S1-CUL.10 & S1-CUL.11
SCALE: H 1:200,V 1:200. DATUM: 70.000

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

Designed: É. McKeon
Drawn: É. McKeon
Approved: B. Lyons
Checked: B. Lyons

Date: NOV. 2021
Scale @ A1: 1:200
@ A3: 1:400
Sheet: 02 of 10

Model File Identifier: TT_MGT0337-RPS-P3-S1-M3-C-DR1001
File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1003

Rev: P01

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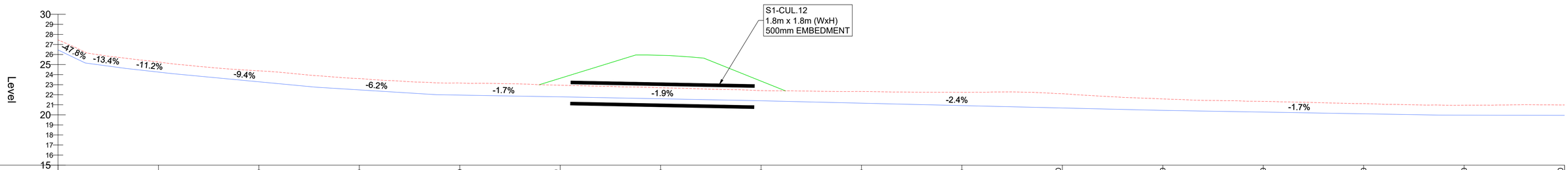

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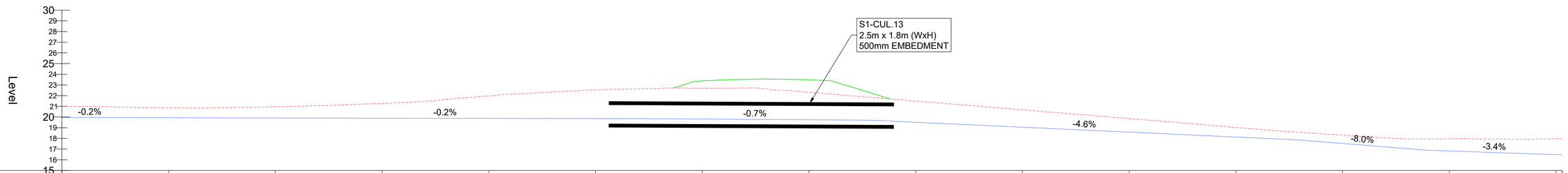
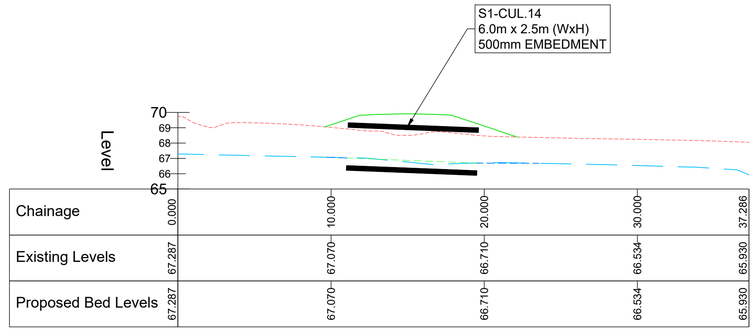
Existing Levels	27.456	25.254	24.378	23.608	23.165	22.944	22.684	22.412	22.321	22.237	22.101	21.581	21.338	21.117	20.961	20.985
Proposed Bed Levels	26.456	24.252	23.286	22.482	21.962	21.789	21.596	21.399	21.160	20.920	20.681	20.445	20.274	20.103	19.970	19.950

S1-CUL.12 & S1-CUL.13
SCALE: H 1:200,V 1:200. DATUM: 15.000



Chainage	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	299.999
Existing Levels	20.985	20.855	20.970	21.265	21.965	22.541	22.691	22.316	21.492	20.678	19.857	19.021	18.303	17.957	17.924	17.999
Proposed Bed Levels	19.950	19.930	19.910	19.893	19.875	19.857	19.809	19.740	19.506	19.046	18.587	18.127	17.524	16.824	16.470	16.470

S1-CUL.13
SCALE: H 1:200,V 1:200. DATUM: 15.000



Chainage	0.000	10.000	20.000	30.000	37.286
Existing Levels	67.287	67.070	66.710	66.534	65.930
Proposed Bed Levels	67.287	67.070	66.710	66.534	65.930

S1-CUL.14
SCALE: H 1:200,V 1:200. DATUM: 65.000

LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL

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Donegal County Council

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

Designed: É. McKeon
Drawn: É. McKeon
Approved: B. Lyons
Checked: B. Lyons

Date: NOV. 2021
Scale @ A1: 1:200
@ A3: 1:400
Sheet: 03 of 10

Model File Identifier: TT_MGT0337-RPS-P3-S1-M3-C-DR1001
File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1003

Rev: P01

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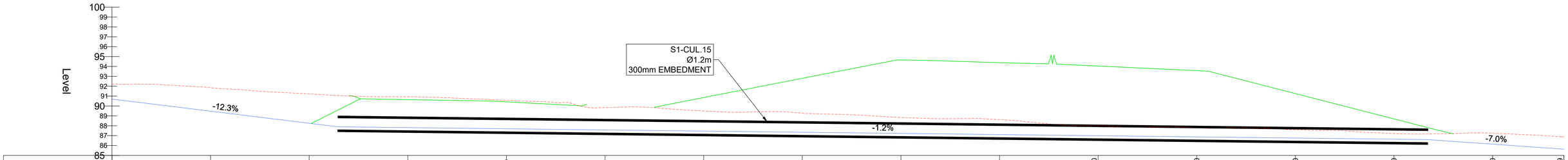
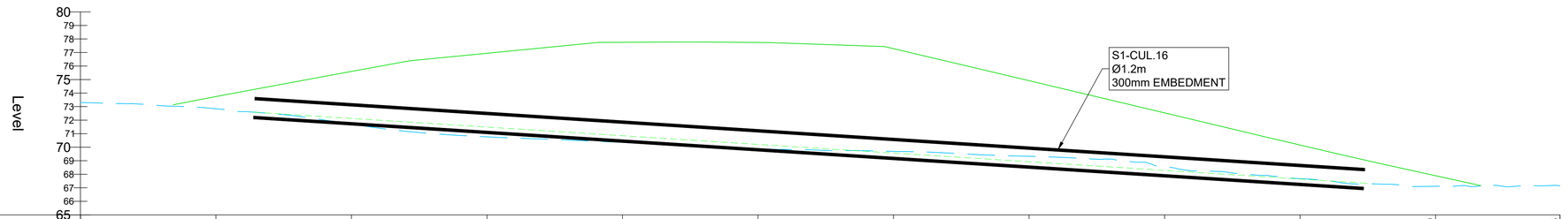


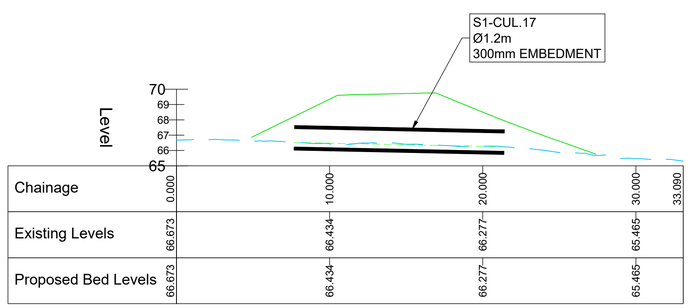
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	147.229
Existing Levels	92.218	91.851	91.222	90.936	90.572	89.835	89.499	89.269	88.834	88.628	88.010	87.783	87.600	87.215	87.253	86.869
Proposed Bed Levels	90.700	89.475	88.249	87.810	87.693	87.576	87.459	87.342	87.225	87.108	86.991	86.874	86.757	86.640	86.138	85.630

S1-CUL.15
SCALE: H 1:200,V 1:200. DATUM: 85.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	109.175
Existing Levels	73.319	72.844	71.710	70.764	70.357	69.869	69.692	69.328	68.546	67.671	67.112	67.147
Proposed Bed Levels	73.319	72.844	71.710	70.764	70.357	69.869	69.692	69.328	68.546	67.671	67.112	67.147

S1-CUL.16
SCALE: H 1:200,V 1:200. DATUM: 65.000



Chainage	0.000	10.000	20.000	30.000	33.090
Existing Levels	66.673	66.434	66.277	65.465	
Proposed Bed Levels	66.673	66.434	66.277	65.465	

S1-CUL.17
SCALE: H 1:200,V 1:200. DATUM: 65.000

LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL

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NOTES

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

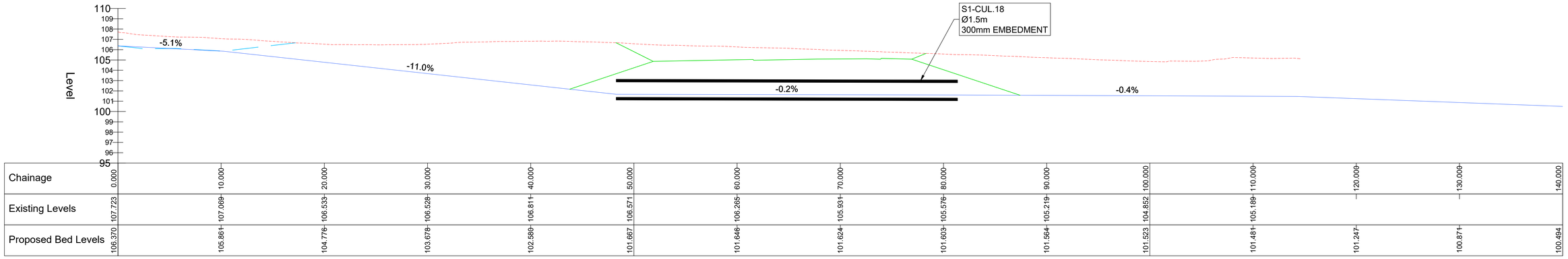
Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

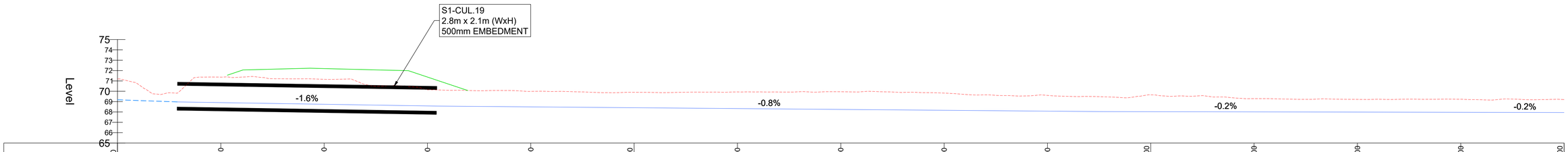
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	P01
Checked: B. Lyons	Sheet: 04 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	

T:\MGT0337 - Ten-T Priority Route Imp - Donegal\8.0 Drawings\Phase 3\DR\TT_MGT0337-RPS-P3-S1-DR-C-DR1003.dwg



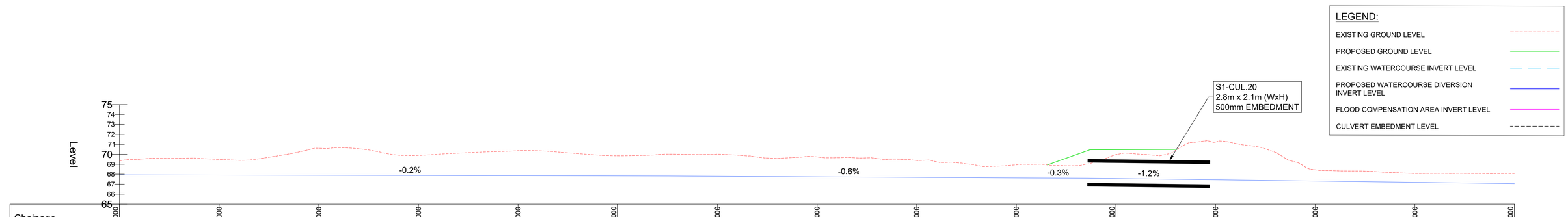
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
Existing Levels	107.723	107.069	106.533	106.528	106.811	106.571	106.265	105.931	105.576	105.219	104.852	105.189	—	—	
Proposed Bed Levels	106.370	105.861	104.776	103.678	102.580	101.667	101.646	101.624	101.603	101.564	101.523	101.481	101.247	100.871	100.494

S1-CUL.18
SCALE: H 1:200,V 1:200. DATUM: 95.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
Existing Levels	71.182	71.365	71.156	70.143	69.990	69.900	69.939	69.957	69.826	69.603	69.660	69.291	69.219	69.231	69.203
Proposed Bed Levels		68.907	68.747	68.586	68.497	68.414	68.331	68.249	68.166	68.084	68.031	68.011	67.991	67.971	67.951

S1-CUL.19
SCALE: H 1:200,V 1:200. DATUM: 65.000



Chainage	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000
Existing Levels	69.344	69.489	70.605	69.887	70.367	69.851	70.008	69.738	69.383	68.945	69.967	71.220	68.446	68.072	68.066
Proposed Bed Levels	67.931	67.911	67.891	67.871	67.851	67.831	67.793	67.738	67.682	67.627	67.565	67.442	67.314	67.186	67.058

S1-CUL.20
SCALE: H 1:200,V 1:200. DATUM: 65.000

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NOTES

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title:	TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13		
Drawing Title:	Section 1 Culvert Long Sections		Status: S3
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	
Checked: B. Lyons	Sheet: 05 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	P01

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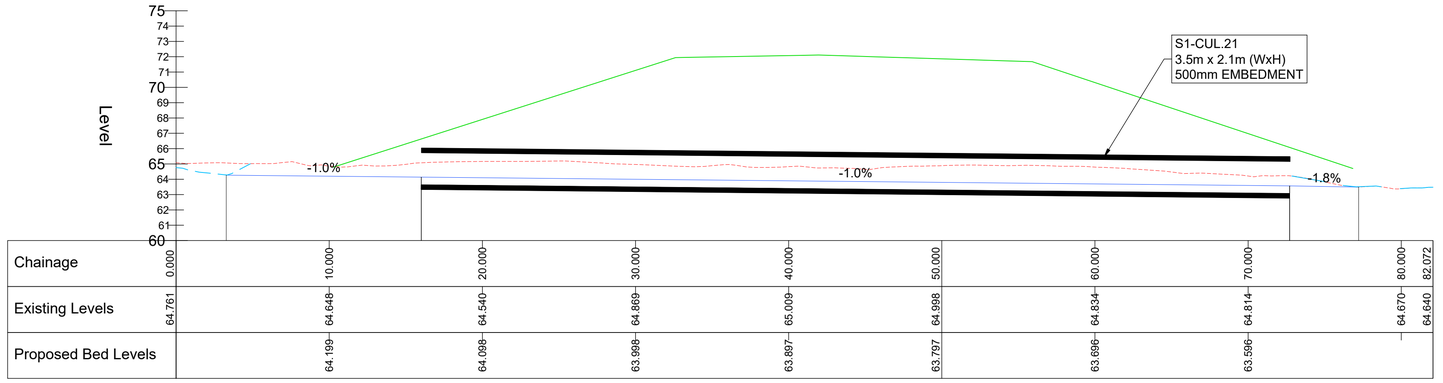
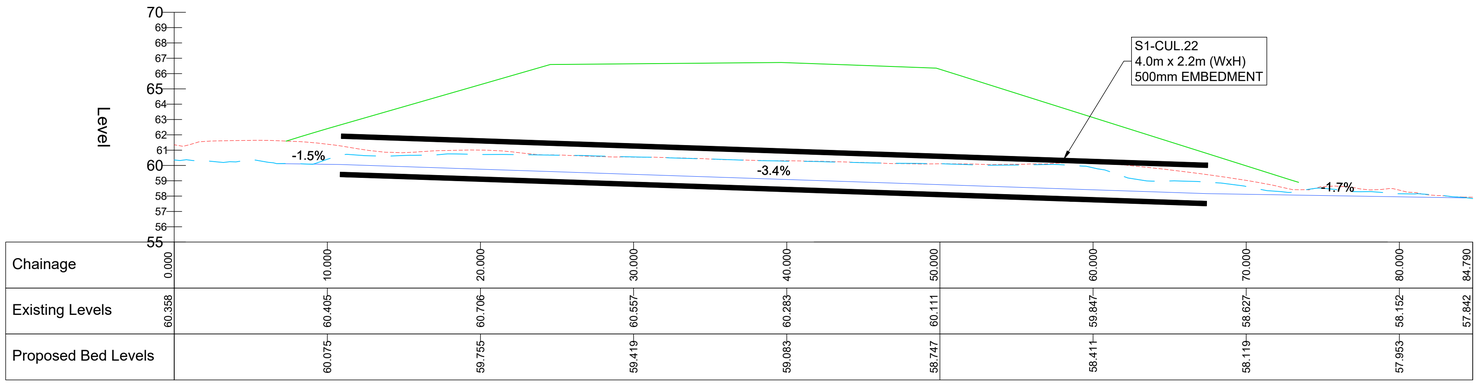


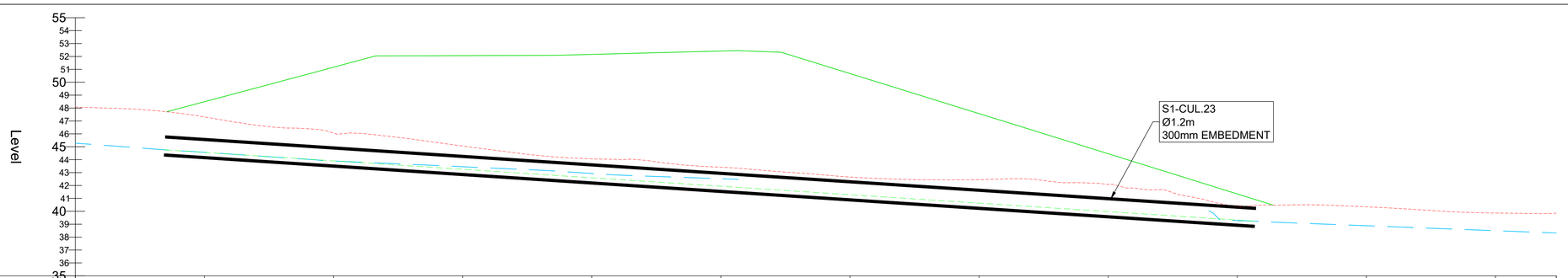
Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	82.072
Existing Levels	64.761	64.648	64.540	64.869	65.009	64.998	64.834	64.814	64.670	64.640
Proposed Bed Levels		64.199	64.099	63.998	63.897	63.797	63.696	63.596		

ALIGNMENT - S1-CUL.21
SCALE: H 1:200,V 1:200. DATUM: 60.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	84.790
Existing Levels	60.358	60.405	60.706	60.557	60.283	60.111	59.847	58.627	58.152	57.842
Proposed Bed Levels		60.075	59.755	59.419	59.083	58.747	58.411	58.119	57.953	

S1-CUL.22
SCALE: H 1:200,V 1:200. DATUM: 55.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	114.717
Existing Levels	48.078	47.315	46.059	45.061	44.067	43.417	42.655	42.457	42.089	40.386	40.348	39.865	39.859
Proposed Bed Levels	45.280	44.571	43.896	43.454	42.932	42.525				39.279	38.882	38.497	38.316

ALIGNMENT - S1-CUL.23
SCALE: H 1:200,V 1:200. DATUM: 35.000

LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

Designed: É. McKeon
Drawn: É. McKeon
Approved: B. Lyons
Checked: B. Lyons

Date: NOV. 2021
Scale @ A1: 1:200
@ A3: 1:400
Sheet: 06 of 10

Model File Identifier: TT_MGT0337-RPS-P3-S1-M3-C-DR1001
File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1003

Rev: P01

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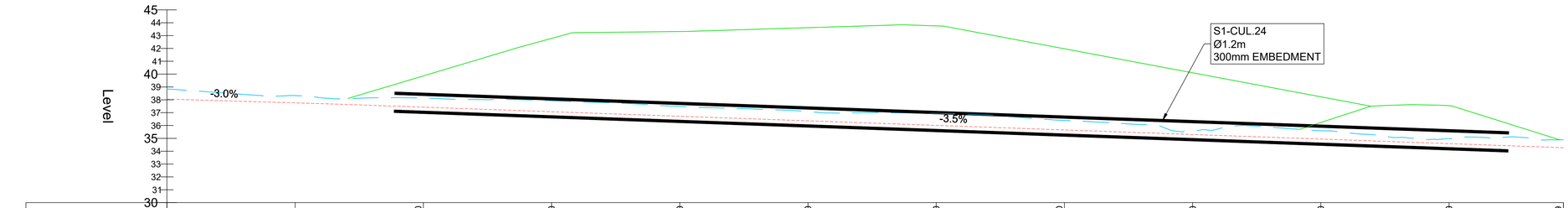
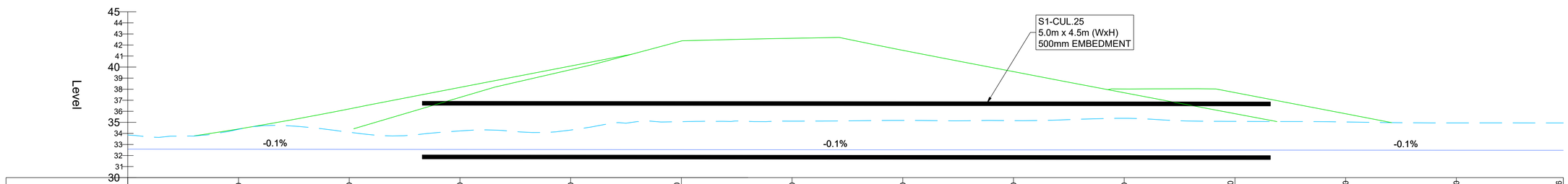


Chainage	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	188.919
Existing Levels	38.845	38.331	38.136	37.928	37.478	37.080	36.940	36.398	35.594	35.591	34.967	34.896
Proposed Bed Levels	38.057	37.761	37.428	37.073	36.719	36.364	36.010	35.655	35.300	34.946	34.591	34.275

S1-CUL.24
SCALE: H 1:200,V 1:200. DATUM: 30.000

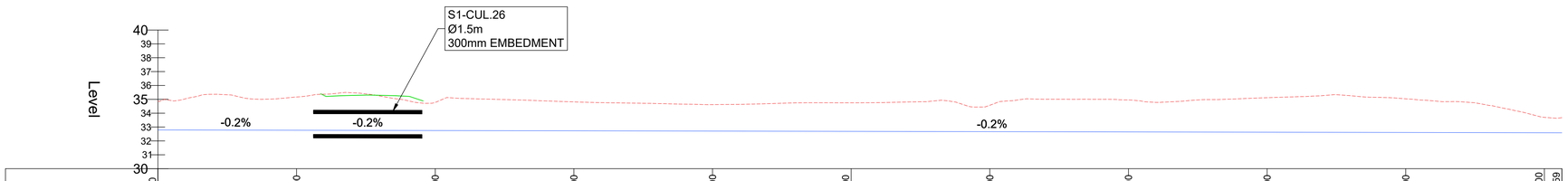
LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	129.666
Existing Levels	33.861	34.370	34.109	34.226	34.305	35.063	35.106	35.177	35.155	35.366	35.091	35.035	34.951	34.948
Proposed Bed Levels	32.575	32.566	32.557	32.548	32.540	32.532	32.524	32.516	32.508	32.500	32.492	32.485	32.480	32.474

S1-CUL.25
SCALE: H 1:200,V 1:200. DATUM: 30.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	101.259
Existing Levels	34.895	35.169	34.781	34.814	34.619	34.749	34.573	34.954	35.119	35.039	33.700	33.678
Proposed Bed Levels	32.790	32.770	32.750	32.730	32.710	32.690	32.670	32.650	32.630	32.610	32.590	32.587

S1-CUL.26
SCALE: H 1:200,V 1:200. DATUM: 30.000

NOTES

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title:	TEN-T Priority Route Improvement Project, Donegal Section 1 - N15/N13		
Drawing Title:	Section 1 Culvert Long Sections		Status: S3
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	
Checked: B. Lyons	Sheet: 07 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	P01

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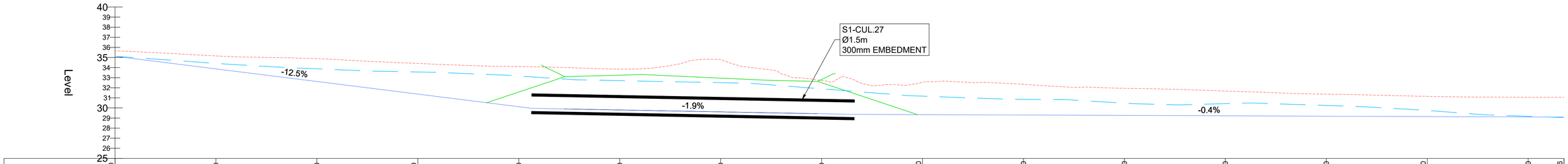
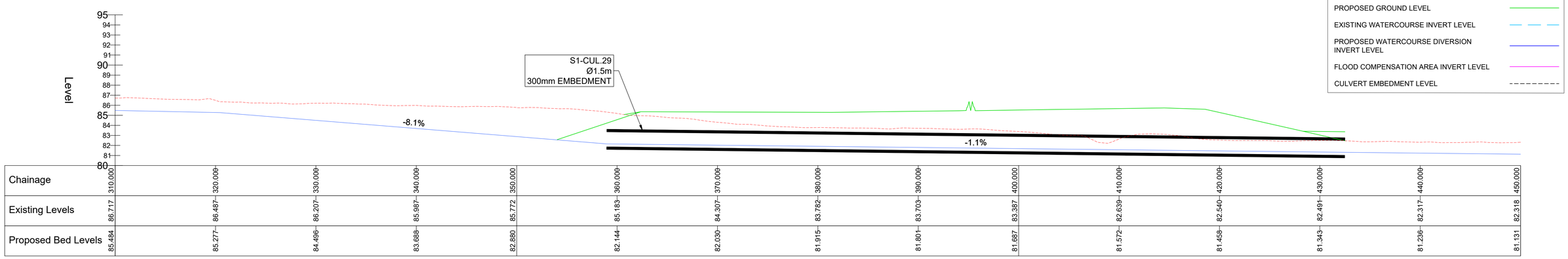


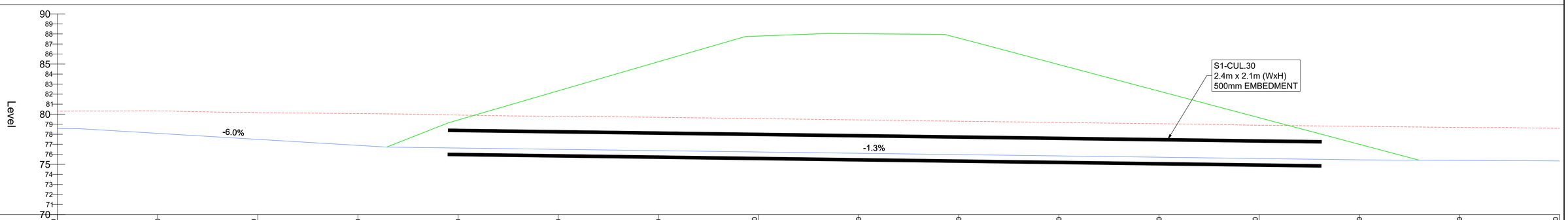
Chainage	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	163.546
Existing Levels	35.673	35.156	34.884	34.410	34.103	33.845	34.810	32.715	32.546	32.342	31.944	31.680	31.363	31.146	31.052	31.063
Proposed Bed Levels	35.120	33.870	32.620	31.370	30.120	29.799	29.611	29.424	29.337	29.298	29.260	29.221	29.182	29.143	29.104	29.090

S1-CUL.27
SCALE: H 1:200,V 1:200. DATUM: 25.000



Chainage	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000
Existing Levels	86.717	86.487	86.207	85.987	85.772	85.183	84.307	83.782	83.703	83.387	82.639	82.540	82.491	82.317	82.318
Proposed Bed Levels	85.484	85.277	84.496	83.688	82.880	82.144	82.030	81.915	81.801	81.687	81.572	81.458	81.343	81.238	81.131

S1.CUL.29
SCALE: H 1:200,V 1:200. DATUM: 80.000



Chainage	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000
Existing Levels	80.317	80.323	80.151	80.061	79.912	79.792	79.690	79.559	79.430	79.299	79.177	79.049	78.899	78.787	78.683	78.590
Proposed Bed Levels	78.575	78.090	77.491	76.891	76.626	76.495	76.364	76.233	76.102	75.971	75.841	75.710	75.579	75.448	75.392	75.338

S1-CUL.30
SCALE: H 1:200,V 1:200. DATUM: 70.000

LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

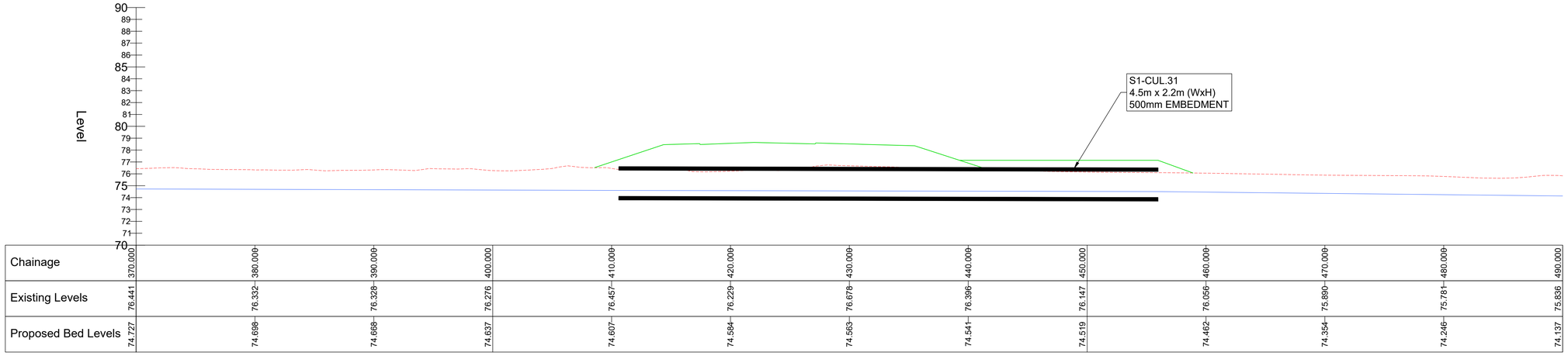
Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

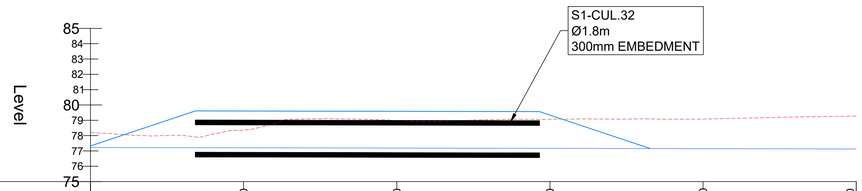
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	P01
Checked: B. Lyons	Sheet: 08 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	

T:\MGT0337 - Ten-T Priority Route Imp - Donegal\8.0 Drawings\Phase 3\DR\TT_MGT0337-RPS-P3-S1-DR-C-DR1003.dwg



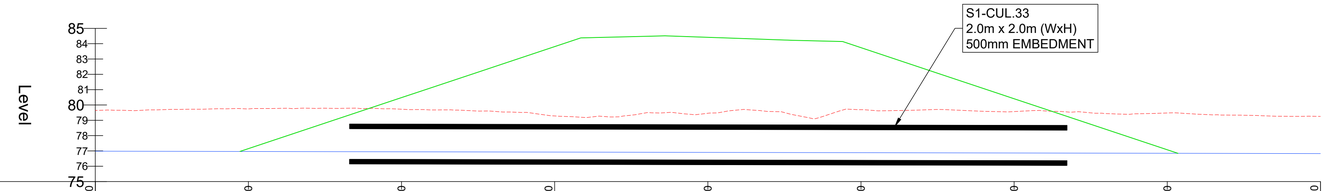
Chainage	370.000	380.000	390.000	400.000	410.000	420.000	430.000	440.000	450.000	460.000	470.000	480.000	490.000
Existing Levels	76.441	76.332	76.328	76.276	76.457	76.229	76.678	76.396	76.147	76.056	75.890	75.781	75.836
Proposed Bed Levels	74.727	74.698	74.668	74.637	74.607	74.584	74.563	74.541	74.519	74.462	74.354	74.246	74.137

S1-CUL.31
SCALE: H 1:200,V 1:200. DATUM: 70.000



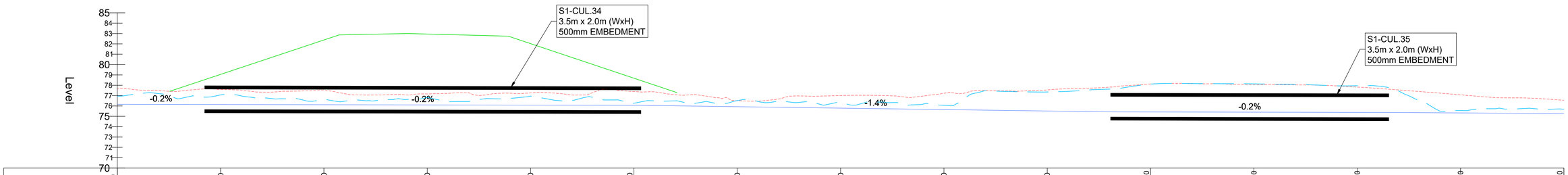
Chainage	0.000	10.000	20.000	30.000	40.000	50.000
Existing Levels	78.200	78.345	78.988	79.068	79.079	79.276
Proposed Bed Levels	77.225	77.205	77.185	77.165	77.145	77.125

S1-CUL.32
SCALE: H 1:200,V 1:200. DATUM: 75.000



Chainage	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000
Existing Levels	79.641	79.742	79.722	79.283	79.457	79.692	79.567	79.478	79.253
Proposed Bed Levels	76.985	76.965	76.945	76.925	76.905	76.885	76.865	76.845	76.825

S1-CUL.33
SCALE: H 1:200,V 1:200. DATUM: 75.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
Existing Levels	77.722	77.584	77.530	77.166	77.259	77.396	76.516	77.008	77.223	77.552	78.127	78.087	77.822	77.078	76.550
Proposed Bed Levels	76.160	76.140	76.120	76.100	76.080	76.060	75.929	75.791	75.652	75.513	75.420	75.400	75.380	75.329	75.264

S1-CUL.34 & S1-CUL.35
SCALE: H 1:200,V 1:200. DATUM: 70.000

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RPS BARRY TRANSPORTATION

NOTES

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Long Sections

Status: S3

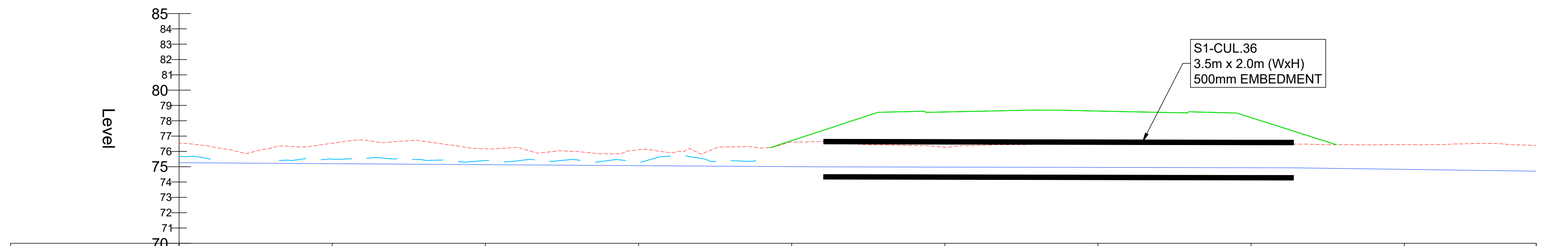
Designed: É. McKeon
Drawn: É. McKeon
Approved: B. Lyons
Checked: B. Lyons

Date: NOV. 2021
Scale @ A1: 1:200
@ A3: 1:400
Sheet: 09 of 10

Model File Identifier: TT_MGT0337-RPS-P3-S1-M3-C-DR1001

File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1003

Rev: P01

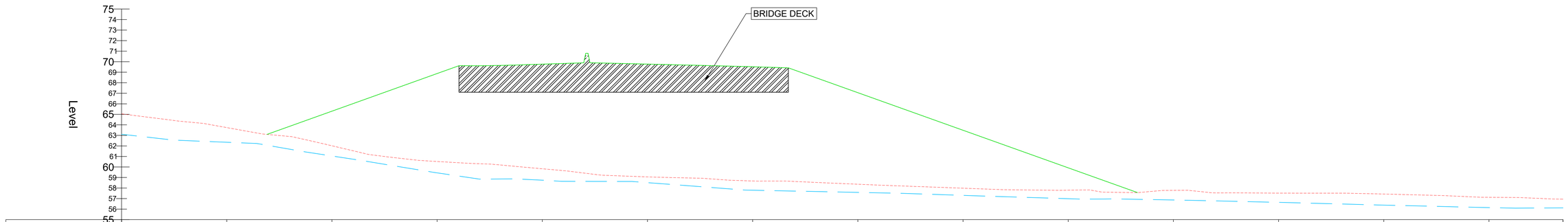


Chainage	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	228.614
Existing Levels	76.550	76.532	76.169	76.104	76.603	76.267	76.500	76.494	76.439	76.385
Proposed Bed Levels	75.264	75.199	75.134	75.069	75.004	74.974	74.954	74.933	74.828	74.710

S1-CUL.36
SCALE: H 1:200,V 1:200. DATUM: 70.000

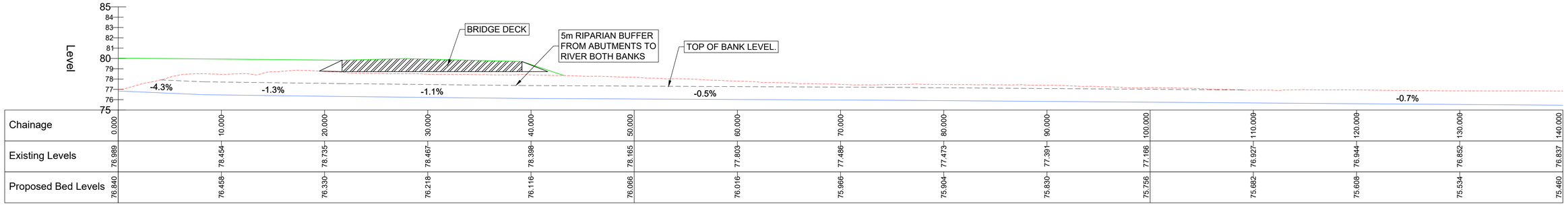
LEGEND:

- EXISTING GROUND LEVEL
- PROPOSED GROUND LEVEL
- EXISTING WATERCOURSE INVERT LEVEL
- PROPOSED WATERCOURSE DIVERSION INVERT LEVEL
- FLOOD COMPENSATION AREA INVERT LEVEL
- CULVERT EMBEDMENT LEVEL



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	137.045
Existing Levels	63.108	62.347	61.046	59.442	58.746	58.513	57.791	57.586	57.304	56.988	56.863	56.639	56.379	56.140	56.116
Proposed Bed Levels	63.108	62.347	61.046	59.442	58.746	58.513	57.791	57.586	57.304	56.988	56.863	56.639	56.379	56.140	56.116

BACKLEES STREAM RIVER CROSSING
SCALE: H 1:200,V 1:200. DATUM: 55.000



Chainage	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
Existing Levels	76.989	78.454	78.735	78.467	78.398	78.165	77.803	77.486	77.473	77.391	77.166	76.927	76.944	76.852	76.837
Proposed Bed Levels	76.840	76.458	76.330	76.218	76.116	76.066	76.016	75.966	75.904	75.830	75.756	75.682	75.608	75.534	75.460

CLOGHROE RIVER CROSSING
SCALE: H 1:200,V 1:200. DATUM: 75.000

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BARRY TRANSPORTATION

NOTES

DO NOT SCALE, use figured dimensions only.

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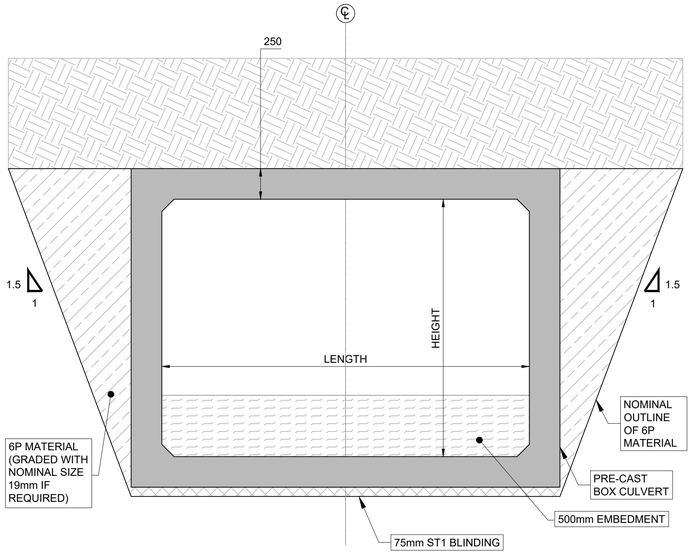
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

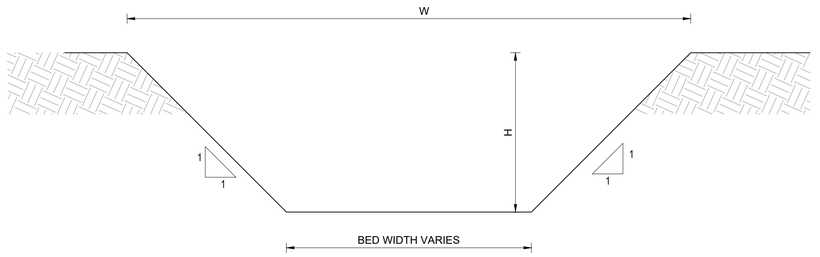
Drawing Title: Section 1
Culvert Long Sections

Status: S3

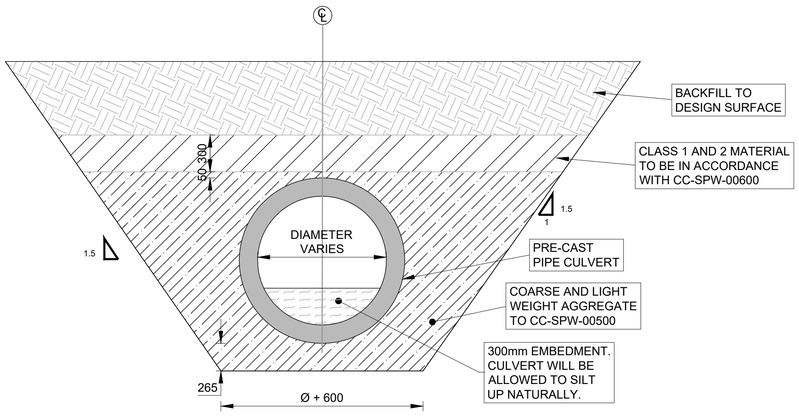
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:200	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:400	File Identifier:	P01
Checked: B. Lyons	Sheet: 10 of 10	TT_MGT0337-RPS-P3-S1-DR-C-DR1003	



BOX CULVERT
TYPICAL CROSS SECTION SCALE 1:25 @A1 ; 1:50 @A3



WATERCOURSE DIVERSION
TYPICAL CROSS SECTION SCALE 1:25 @A1 ; 1:50 @A3



PIPE CULVERT
TYPICAL CROSS SECTION SCALE 1:25 @A1 ; 1:50 @A3

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Donegal County Council

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NOTES

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Typical Details - Cross-sections

Status: S3

Designed: É. McKeon
Drawn: É. McKeon
Approved: B. Lyons
Checked: B. Lyons

Date: NOV. 2021
Scale @ A1: 1:25
@ A3: 1:50
Sheet: 01 of 03

Model File Identifier: TT_MGT0337-RPS-P3-S1-M3-C-DR1001
File Identifier: TT_MGT0337-RPS-P3-S1-DR-C-DR1004

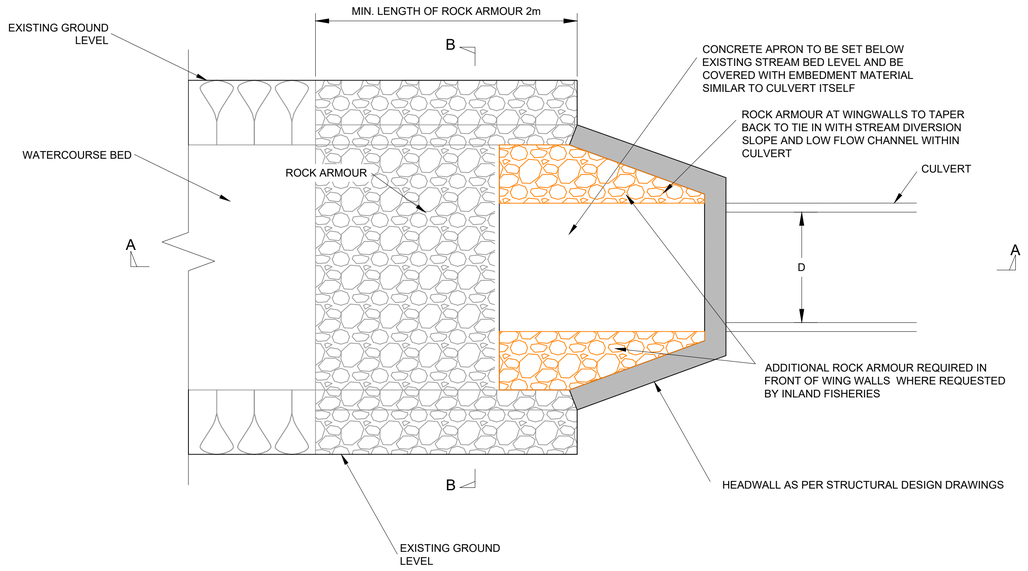
Rev: P01

NOTE:
ROCK ARMOUR DETAIL IS TO BE PROVIDED AT EVERY CULVERT THROUGHOUT THE PROJECT.

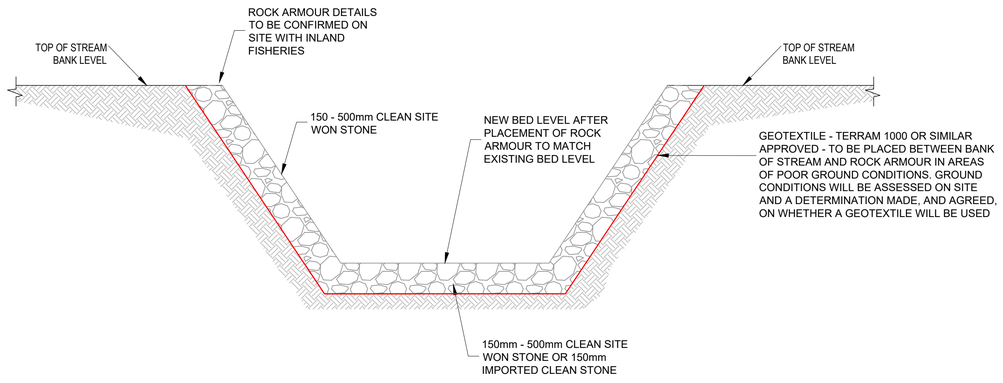
REFER TO DRAWING DR1004-03 FOR TRANSITION POOL DETAILS WHICH NEED TO BE PROVIDED WHERE REQUIRED BY INLAND FISHERIES.

REFER TO CC-SCD-00553-01 FOR DETAILS ON PIPE CULVERT HEADWALL GEOMETRY, SUBGRADE AND FOUNDATION REQUIREMENTS.

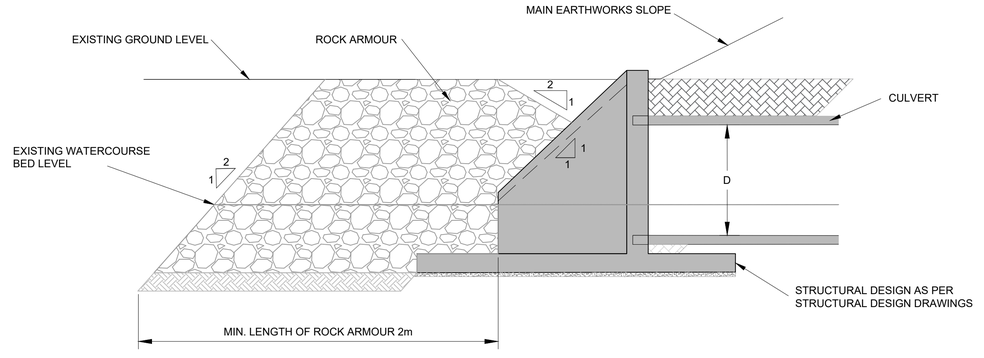
APPROACH TO BACKFILLING CULVERTS (WHERE REQUIRED BY INLAND FISHERIES) TO BE AGREED ON SITE WITH INLAND FISHERIES.



PLAN



SECTION B - B



SECTION A - A

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NOTES

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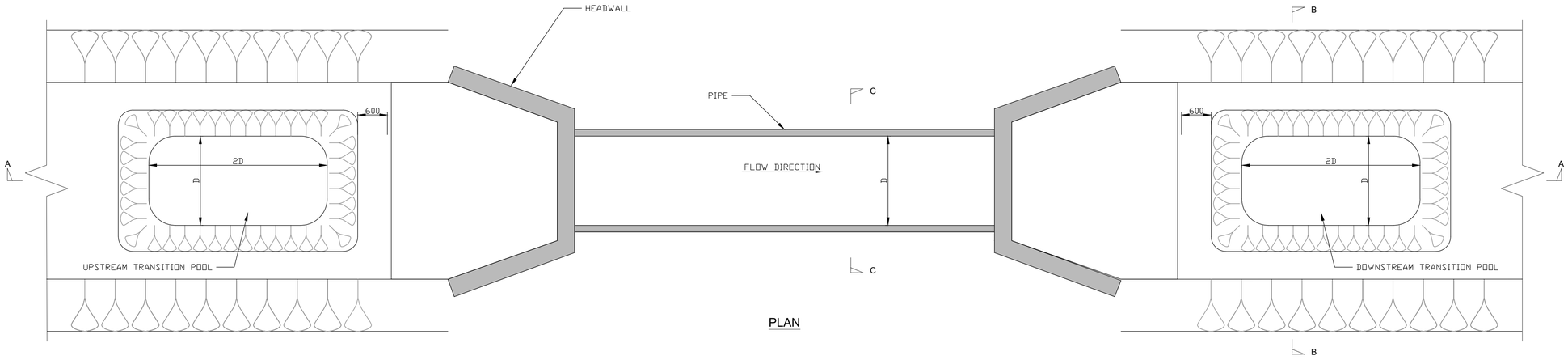
Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

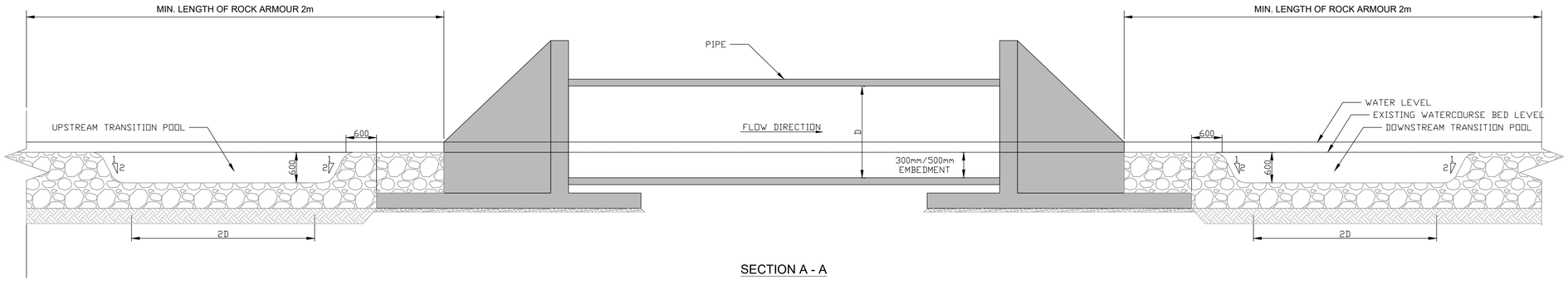
Drawing Title: Section 1
Culvert Typical Details - Headwalls & Rock Armour

Status: S3

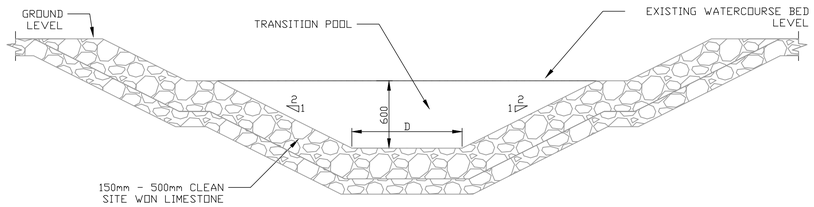
Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:50	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:100	File Identifier:	P01
Checked: B. Lyons	Sheet: 02 of 03	TT_MGT0337-RPS-P3-S1-DR-C-DR1004	



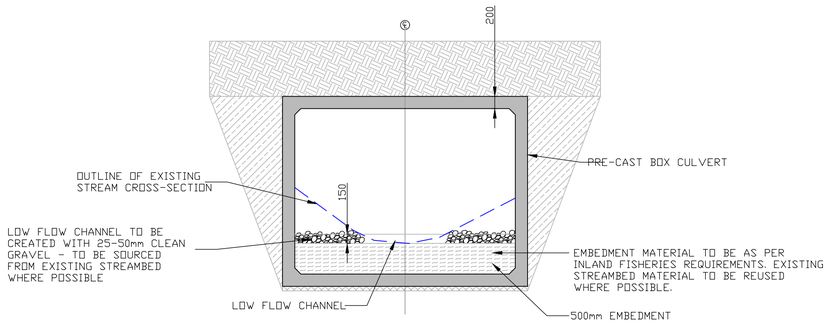
PLAN



SECTION A - A



SECTION B - B
TRANSITION POOL DETAIL



SECTION C - C
LOW FLOW CHANNEL DETAIL - BOX CULVERTS

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Rev.	Date	Drawn	Description	Chk'd	Appr.
P01	26.11.21	ÉMcK	FOR REVIEW & COMMENTS	BL	BL

Project Title: TEN-T Priority Route Improvement Project, Donegal
Section 1 - N15/N13

Drawing Title: Section 1
Culvert Typical Details - Transitiion Pools and Low Flow Channels

Status: S3

Designed: É. McKeon	Date: NOV. 2021	Model File Identifier:	Rev:
Drawn: É. McKeon	Scale @ A1: 1:50	TT_MGT0337-RPS-P3-S1-M3-C-DR1001	
Approved: B. Lyons	@ A3: 1:100	File Identifier:	P01
Checked: B. Lyons	Sheet: 03 of 03	TT_MGT0337-RPS-P3-S1-DR-C-DR1004	