9 FLOOD RISK

9.1 Introduction

This chapter considers the potential impact of the Proposed Scheme on flood risk within the study area. It sets out the methodology employed in the assessment; summarises the baseline flood risk as defined through desk-based assessments, assesses the potential impact of the Proposed Scheme, and identifies mitigation measures. The assessment has been carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (2009).

9.2 Assessment Methodology

The assessment will comprise the following stages:

- Consideration of the flood maps available on the OPW website and updated modelling undertaken as part of the Burnfoot Flood Relief Scheme project to determine the existing flood risk to the site.
- Consideration of the potential interactions between the Proposed Scheme and the current site conditions, and identification of possible impacts.
- Identification of design solutions to avoid or minimise the potential impacts. Mitigation measures may be proposed during the construction and/ or operational phases of the proposed development.
- Assessment of residual impacts, taking into account the mitigation measures proposed.
- Evidence of compliance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities'.

9.2.1 Study Area

The Proposed Scheme is located at Burnfoot, Co Donegal. The Burnfoot River flows from east to west draining a narrow valley before flowing through the village and under the R238 regional road. It meets the Skeoge River to the west of the village and flows into a lagoon impounded by the causeways serving Inch Island before draining out to Lough Swilly via one way flow gates under the southern causeway. The Skeoge River drains an area including the outskirts of City of Derry/ Londonderry and then flows in a north westerly direction, through Bridge End and past the south-west of the village to meet the Burnfoot River. The Burnfoot River is subject to flash flooding with the village at risk of fluvial flooding and the flat, reclaimed agricultural lands downstream subject to flooding driven by the rivers and water levels in Lough Swilly. The locations of the watercourses are shown in Figure 9.1.

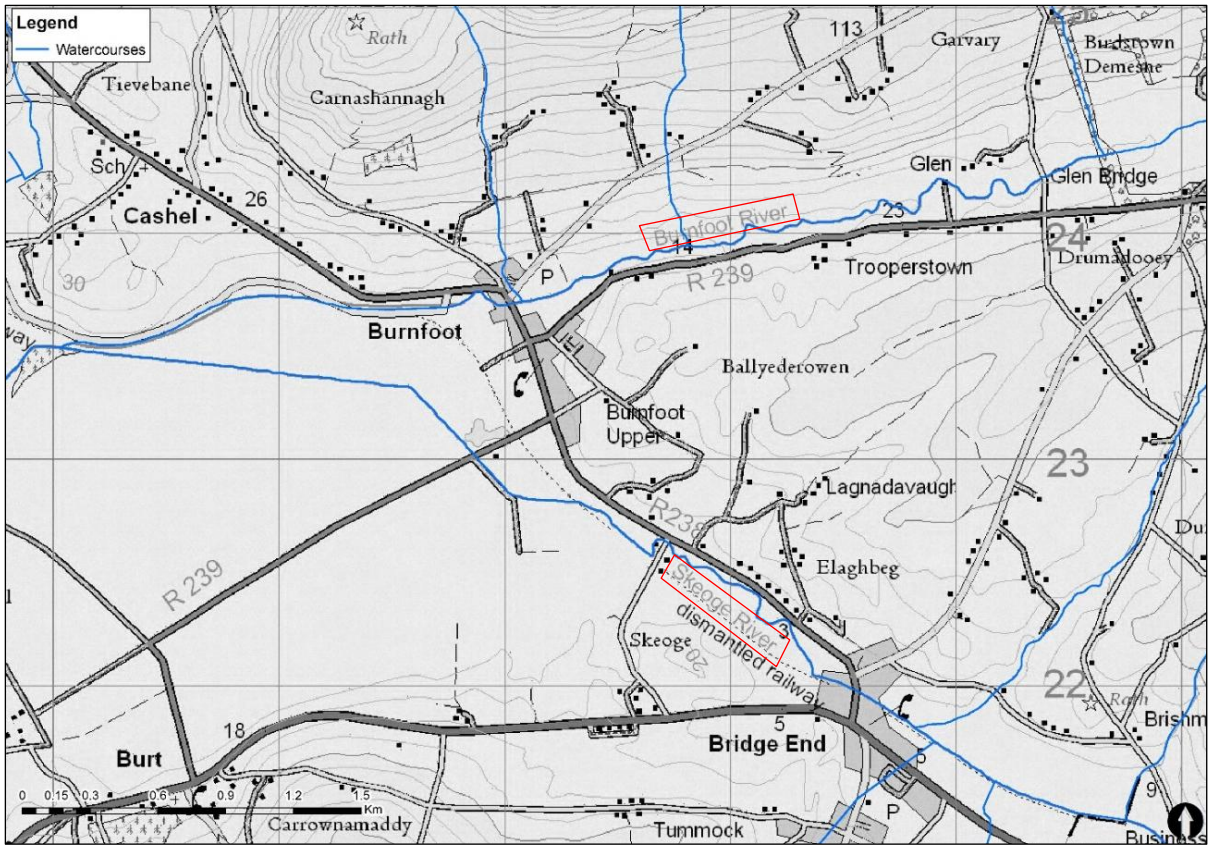

Figure 9.1: Locations of watercourses in Study Area

9.2.2 Baseline

The OPW, working in partnership with Donegal County Council and other Local Authorities, have completed the Northwestern and Neagh Bann Catchment Flood Risk Assessment and Management (NWNB CFRAM) Study which included Burnfoot. The predicted flood maps from the CFRAM Study can be found on the OPW Flood Info website (www.floodinfo.ie), and an extract is shown in Figure 9.2. The maps indicate a significant existing flood risk to the Burnfoot area. The CFRAM study identified Burnfoot as a town which would benefit from a flood relief scheme.

There is an existing defence along the Burnfoot River which is maintained by OPW under the Arterial Drainage Act, 1945. Figure 9.3 has been extracted from the floodinfo.ie website which provides records of the various drainage districts and the embankments located within them. The defence protects the area of land between the Burnfoot and Skeoge Rivers as shown in Figure 9.3.

The Office of Public Works (OPW) gathers and collates data from reported flood events throughout the country. From a review of the OPW's Past Flood Events database, there are a number of reported incidents of flooding within the Study Area, the locations of these are shown in Figure 9.4. The most recent significant fluvial flooding events were recorded at Burnfoot in November 2015 and August 2017.

Figure 9.2: Extract from OPW flood extents- Present day (Source: floodinfo.ie)

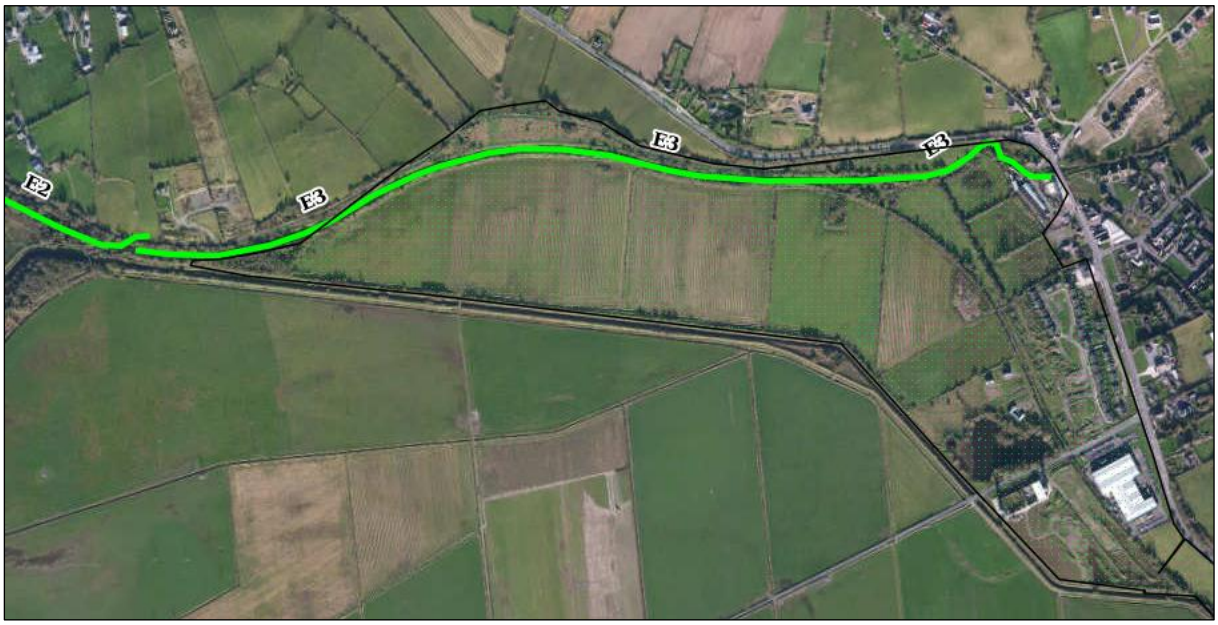

Figure 9.3: Extract of Arterial Drainage Districts mapping showing defence and benefitting areas (Source: floodinfo.ie)

Figure 9.4: Locations of past flood events (Source: floodinfo.ie)

9.2.3 Legislation and Guidance

The assessment has been carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' which were published in 2009. The Guidelines introduced comprehensive mechanisms for the incorporation of flood risk identification, assessment, and management into the planning process. The core objectives of the guidelines are to:

- Avoid inappropriate developments in areas at risk of flooding.
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off.
- Ensure effective management of residual risk for development permitted in floodplains.
- Avoid unnecessary restriction of national, regional, or local economic and social growth.
- Improve the understanding of flood risk among relevant stakeholders.
- Ensure that the requirements of EU and national law in relation to the national environment and nature conservation are complied with at all stages of flood risk management.

9.2.4 Consultation

A number of collaborative workshops were held during the development of the Proposed Scheme. These workshops were attended by the OPW and Donegal County Council and several other stakeholders, who have a remit in flooding within the county and nationally. In addition, a number of public meetings were held to allow for a better understanding of the flood risk to the local community and householders/ landowners. These proved to be invaluable during the development of the Proposed Scheme, informing the flood risk assessment and the option development process.

Chapter 2 provides a summary of the consultation undertaken and some of the key issues raised.

9.2.5 Assessment Criteria and Assignment of Significance

The descriptions for value (sensitivity) of receptors are shown in Table 9.1. The descriptions for magnitude of impact are shown in Table 9.2.

Table 9.1: Environmental Sensitivity and Descriptions

Sensitivity of Receptor	Typical Description
Very High	Very high importance and rarity, international scale, and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

Table 9.2: Magnitude of Impact and Typical Descriptions

Magnitude	Example Descriptor
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features, or elements (Adverse). Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Medium	Loss of resource but not adversely affecting the integrity; partial loss of/damage to key characteristics, features, or elements (Adverse). Benefit to, or addition of, key characteristics, features, or elements; improvement of attribute quality (Beneficial).
Low	Some measurable change in attributes, quality, or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features, or elements (Adverse). Minor benefit to, or addition of, one (maybe more) key characteristics, features, or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features, or elements (Adverse). Very minor benefit to or positive addition of one or more characteristics, features, or elements (Beneficial).
No change	No loss or alteration of characteristics, features, or elements; no observable impact in either direction.

9.2.6 Significance of Effects

The approach to deriving effects significance from receptor value and magnitude of impacts shall be based on Table 9.3.

Table 9.3: Assessment of Significance Matrix

Sensitivity	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible or minor	Minor	Moderate	Moderate or major
High	Minor	Minor or moderate	Moderate or major	Major

9.3 Baseline Environment

Flooding in Burnfoot comes from the Burnfoot River and the Carnashannagh Watercourse, a tributary of the Burnfoot River. The Skeoge River does not cause direct flooding but is on the same river network system.

Updated hydraulic modelling of all watercourses in the Study Area was completed as part of the Proposed Scheme. This modelling provides an update to the OPW mapping shown in Figure 9.2. The results of the updated modelling are shown in Figure 9.5 which shows significant fluvial flood risk in Burnfoot in the present-day scenario. The flooding affects both residential properties and commercial properties. Roads are also impacted including the R238, and the main wastewater treatment works is also at risk. Flooding to agricultural lands downstream of Burnfoot occurs currently in all the flood event scenarios.

Under the requirements of 'The Planning System and Flood Risk Management Guidelines', when considering existing flood risk, it is necessary to assign flood zoning to the proposed development site. Flood zoning is defined as:

- Flood Zone A: areas where the probability of flooding from rivers and the sea is highest (greater than 1% for river flooding or 0.5% for coastal flooding);
- Flood Zone B: areas where the probability of flooding from rivers and the sea is moderate (between 0.1% and 1% for river flooding, and between 0.1% and 0.5% for coastal flooding);
- Flood Zone C: Areas where the probability of flooding from rivers and the sea is low (less than 0.1% for both river and coastal flooding).

Clause 2.25 of the Guidelines states that the presence of flood protection structures should be ignored for the purpose of flood zoning. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of defences, and there is no guarantee that the defences will be maintained in perpetuity. Although the flood extents shown in Figure 9.5 include flood defences, it can be assumed that the Proposed Scheme will be constructed within Flood Zones A and B.

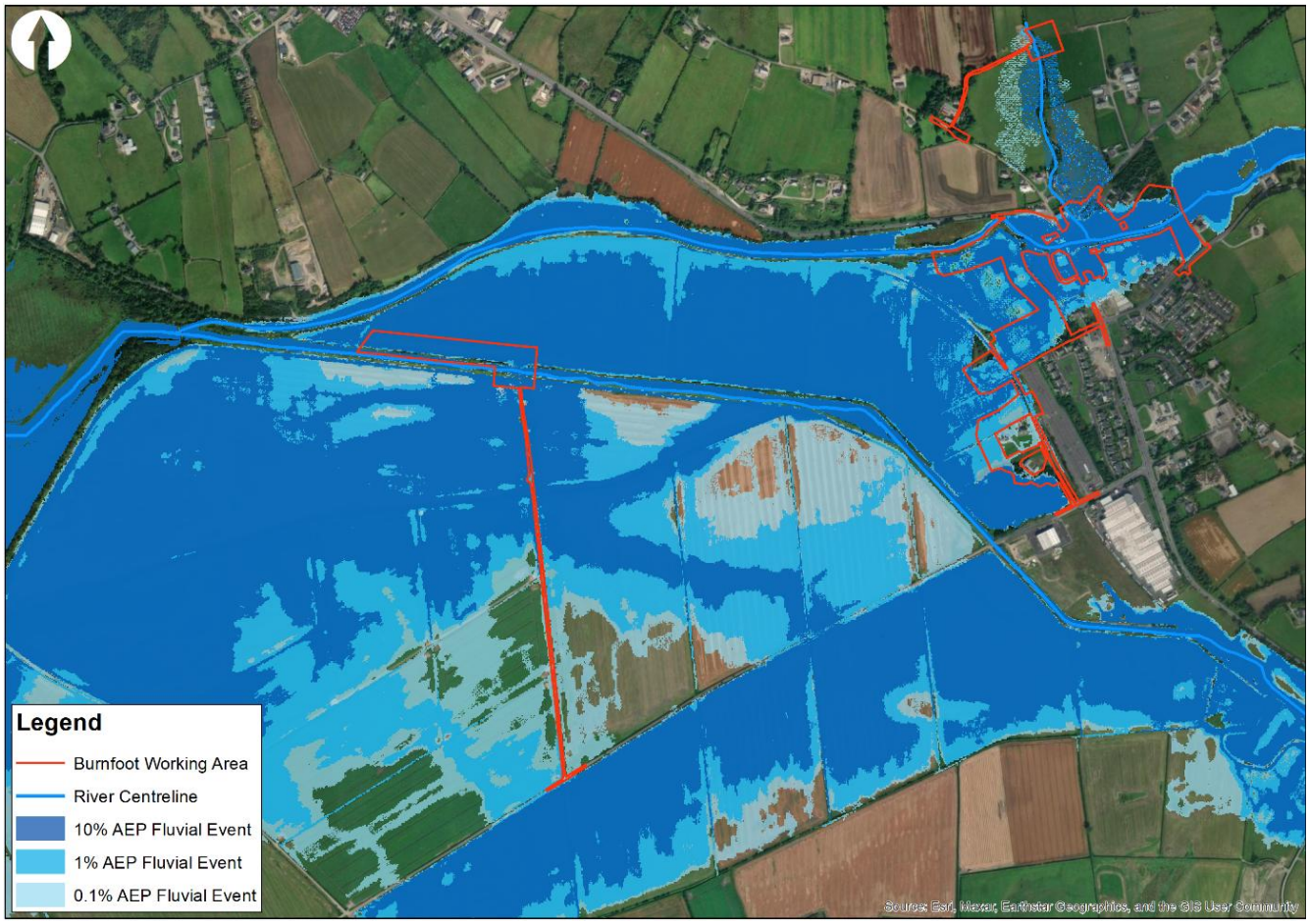

Figure 9.5: River flood extents (Present day) from FRS hydraulic modelling

9.4 Description of Likely Significant Effects

9.4.1 Assessment of Construction Effects

During construction, there is a risk of flooding to the works from extreme events that will need to be managed.

9.4.2 Assessment of Operational Effects

One of the objectives of the Proposed Scheme is to reduce the flood risk in the area. It is necessary to determine that the correct design standard has been used for the works, including an allowance for climate change. The Proposed Scheme has been designed to provide a 1 in 200-year return period Standard of Protection (SoP), which is also described as an 0.5% Annual Exceedance Probability (AEP). This means that the Proposed Scheme protects against a flood event that has a 0.5% chance of occurring in any given year. This is a very high standard of protection.

Freeboard is a height added to the predicted level of flood to take account of the uncertainty in estimating the probability of flooding. As part of the Burnfoot FRS a freeboard assessment, based on sensitivity modelling, was undertaken to determine a suitable freeboard for each reach of the flood defence. In general, a higher freeboard was provided than the standard allowances used in Ireland (0.3m for flood walls and 0.5m for

embankments). A freeboard allowance of 0.3-0.56m for walls and 0.5-0.75m for embankments has been included for in the design.

Climate change is predicted to have a significant effect on flood risk when considered over the design life of a flood relief scheme (50 years). As part of the Proposed Scheme, a Climate Change Adaption Plan was undertaken to assess and consider the potential impacts of climate change on the development and design of the Proposed Scheme. The plan identified several amendments that have been incorporated into the design of the Proposed Scheme to maintain the design SoP into the future. These include:

- increased foundations for flood defences so that their height can be increased in the future;
- ensuring there is space in the design to adapt structures in the future, and;
- sizing culverts to handle future flood flows.

The impact of the Proposed Scheme on flood risk has been assessed by hydraulic modelling. Pre- and post-scheme present-day flood extents are shown in Figure 9.6 for the 50% AEP scenario (high probability of occurring), and in Figure 9.7 for the 0.5% AEP scenario (low probability of occurring). These show that the Proposed Scheme provides protection to areas of Burnfoot. Part of the Proposed Scheme is to reconnect the floodplain downstream of Burnfoot to the river through the removal of the Arterial Drainage Scheme (ADS) embankments. This is an integral part of the Proposed Scheme for the purposes of providing flood relief to Burnfoot and to reduce flood driven environmental impacts further downstream at Inch Lough. The Proposed Scheme will therefore result in increased flooding of the agricultural lands downstream of Burnfoot (the floodplain). With the Proposed Scheme in place the frequency of flooding is not expected to increase but the extent and depth will increase, particularly in the lands between the Burnfoot and Skeoge Rivers. For the lands to the south of the Skeoge River the extent and depth will be greater in limited areas for more extreme events (see Figure 9.7) and less for more frequent events (see Figure 9.6). Two residential properties on Slab Road were identified from the hydraulic modelling as potentially being impacted by the removal of the ADS embankment; therefore a new embankment has been included in the Proposed Scheme to protect these properties. There is no increased flood risk to any receptors because of the Proposed Scheme.

It is necessary to consider the impact of the Proposed Scheme on storm runoff in the area. The new flood defences will have some degree of cut-off to prevent excessive flow beneath the embankments. Conversely this adversely restricts the ability of the land behind the defences to drain post-scheme. To facilitate this drainage and ensure the land behind the defences does not become water-logged, a series of land drains will be constructed behind the defences. This will consist of a series of perforated pipes bedded in no fines granular material and laid parallel to defences at the rear toe of the structure. Precast concrete manholes will be provided at regular intervals to facilitate access for maintenance or changes in direction. At suitable locations the drainage pipe will need to be cored through the flood wall and outfall to the river via a flapped discharge.

Under ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’, the Proposed Scheme which can be described as ‘Flood Control Infrastructure’ would be classified as ‘Water Compatible Development’. According to the Guidelines, this type of development is appropriate in all flood risk areas.

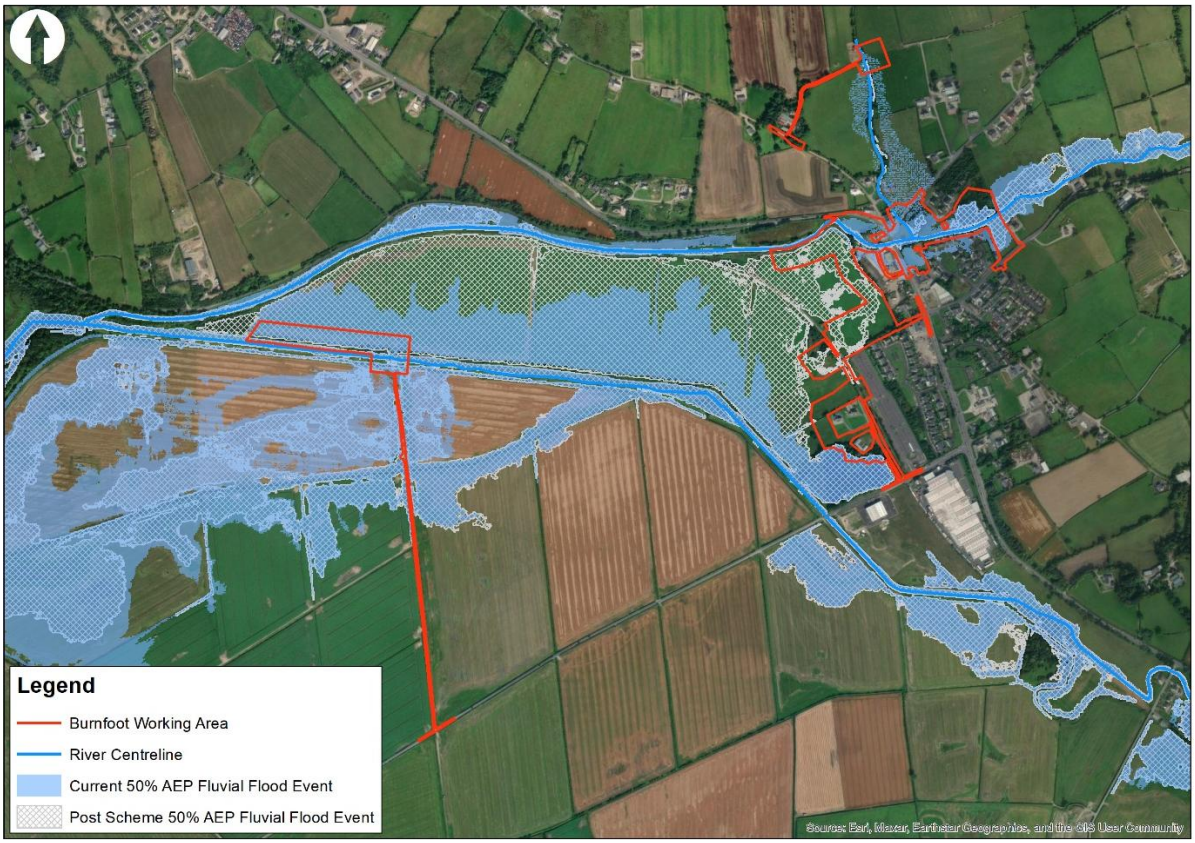

Figure 9.6: River flood extents - pre and post development (50% AEP, Present Day)

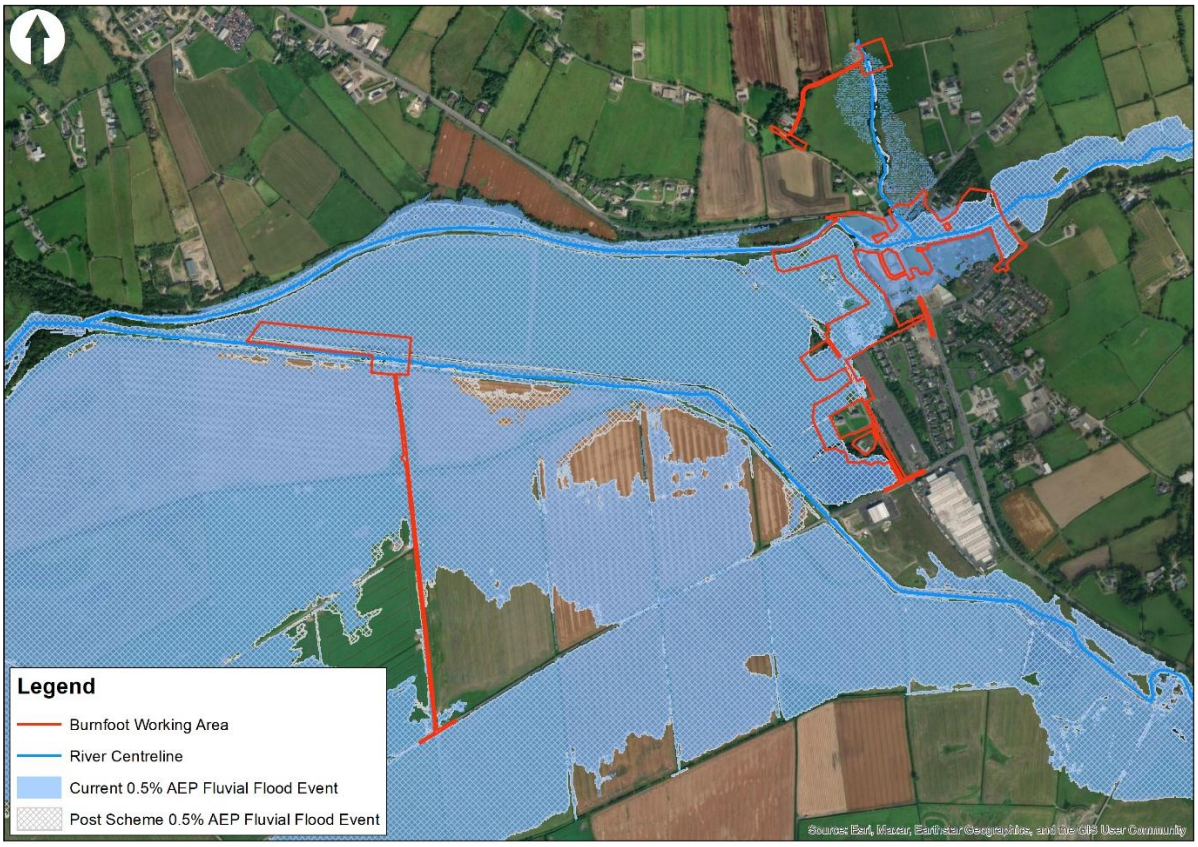

Figure 9.7: River flood extents - pre and post development (0.5% AEP, Present Day)

9.5 Interactions

This assessment overlaps with the Water Quality, which is covered in Chapter 10.

9.6 Mitigation and Monitoring

9.6.1 Mitigation

9.6.1.1 Construction Phase

Met Éireann provide a weather warnings alert service which is available on the Met Éireann app or through its website https://www.met.ie/. These warnings can be used during construction to manage the risk of flooding to the works from extreme events.

9.6.1.2 Operation Phase

One of the objectives of the Proposed Scheme is to reduce the flood risk in the area from fluvial flooding. Flood protection can therefore be considered as 'Primary mitigation' which is modifications to the location or design of the Proposed Scheme made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.

9.6.2 Monitoring

After completion of construction the flood relief scheme will be monitored and maintained by Donegal County Council.

9.7 Potential Cumulative Effects

For flood risk, any cumulative effects would come from developments that impact the floodplains that affect the site. This is likely to be a development that takes place within the floodplain in the vicinity of the proposed works. To gain planning permission, all new developments must show that they do not increase flood risk elsewhere in compliance with The Planning System and Flood Risk Management Guidelines. There will be no cumulative impacts on flood risk because of neighbouring developments.

9.8 Residual Impacts

There will a residual flood risk as the flood defences may be exceeded by a flood that is greater than that which they were designed to resist. However, the defences have been designed to a high standard of protection and include allowances for climate change adaptation and freeboard. The residual risk is low, particularly with a regular monitoring and maintenance regime put in place.

9.9 Summary of Effects

The significance of the effects of the project on flood risk has been assessed, and a summary of the potential flooding impacts and their significance is shown in Table 9.4.

This assessment has demonstrated that:

a) all sources of flood risk to and from the Proposed Scheme have been identified; and
b) there are adequate measures to manage and mitigate any increase in flood risk arising from the development and its operation.

Table 9.4: Summary of Likely Environmental Effects on Flood Risk

Receptor	Sensitivity of Receptor	Description of Effect	Duration	Magnitude	Significance	Significant or Not Significant
Floodplain	High	Increase in flood risk	Long term	Negligible	Minor	Not significant
Surface runoff	High	Increased runoff	Long term	Negligible	Minor	Not significant

9.10 Limitations of Assessment

There were no limitations that would affect the robustness of the assessment for EIAR purposes.