



South Galway (Gort Lowlands) Flood Relief Scheme

Constraints Study Report

28 August 2018

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Executive Summary

This report sets out the key environmental constraints within the defined study area associated with the South Galway (Gort Lowlands) Flood Relief Scheme. Environmental constraints have been investigated under the following environmental topics:

- Biodiversity
- Cultural Heritage
- Landscape
- Soil Geology and Hydrology
- Water Resources
- Population and Land use
- Material Assets

Flood risk management measures and the design thereof will be developed within the context of these environmental constraints, such that the flood risk management measures are appropriate to their 'receiving environment'.

This Constraints Study report has been compiled following desktop assessment, site walkover surveys, consultation with environmental stakeholders/data holders, and public consultation. The constraints identified within the study area are documented and mapped in this report.

The Constraints Study is the first stage in the environmental assessment process for the South Galway (Gort Lowlands) Flood Relief Scheme. Further environmental assessment and field studies will be ongoing throughout the identification of the preferred option and Public Exhibition of the scheme.

Summary of Key Environmental Constraints

Biodiversity

The Flood Relief Scheme has the potential to negatively impact protected ecological sites and the sensitive species for which they are designated, leading to significant direct and indirect effects on the sites. Habitats of note in the study area include turloughs, limestone pavement, *Taxus baccata* woods, and fen habitat. Further ecological assessments will be carried out as the development of the scheme is progressed and as viable options are identified.

Cultural Heritage

The development of a flood relief scheme in this area has a relatively high potential to yield previously unrecorded cultural features of interest. All ground works must be monitored by an archaeologist. The National Monuments Service, the Architectural Advisory Unit and the Underwater Archaeological Unit of the Department of Arts, Heritage and the Gaeltacht should be consulted when determining viable options for flood relief.

Landscape

The design of the scheme must adapt to the receiving environment in any particular location in terms of materials, form, gradient, and new vegetation.

Opportunities to enhance the amenity value of the area should be explored during detailed design.

Soil Geology and Hydrology

It is recommended that construction within Geological Heritage Sites and geological sensitive sites are avoided where possible. Geotechnical investigation will be carried out once the potential flood alleviation measures are developed in order to identify local geology and ground conditions

Water Resources

Flood relief works have the potential impact on the biology, water quality, hydrology, and morphology of watercourses. It is recommended that the hydrological regime of all water resources which might be affected by viable flood risk management options are fully considered to ensure that the WFD Status (including hydromorphological status) is not affected by the scheme.

The hydrology of Kinvara bay will be assessed and a salinity model developed to determine the changes likely to occur in the bay should there be an increase in freshwater flows to the bay associated with the scheme.

Population and Land use

The study area extends over two separate administrative areas. The study area is mostly rural in nature with a low population density. The settlement areas within the study area may present constraints to the Flood Relief Scheme. Tourist attractions and community and recreational facilities may also present significant constraints within the study area and should be considered when identifying flood risk management options.

Material Assets

Regard must also be had to future changes that are likely to take place in the study area e.g. through the Water Services Investment Programme, investment by the National Roads Authority / Transport Infrastructure Ireland, Irish Rail, Eirgrid etc.

Emergency flood relief works have previously taken place in the study area. The effects of such historic work on access and on flood extents should be assessed as part of scheme development, and the need to augment any previous works determined.

1 Introduction

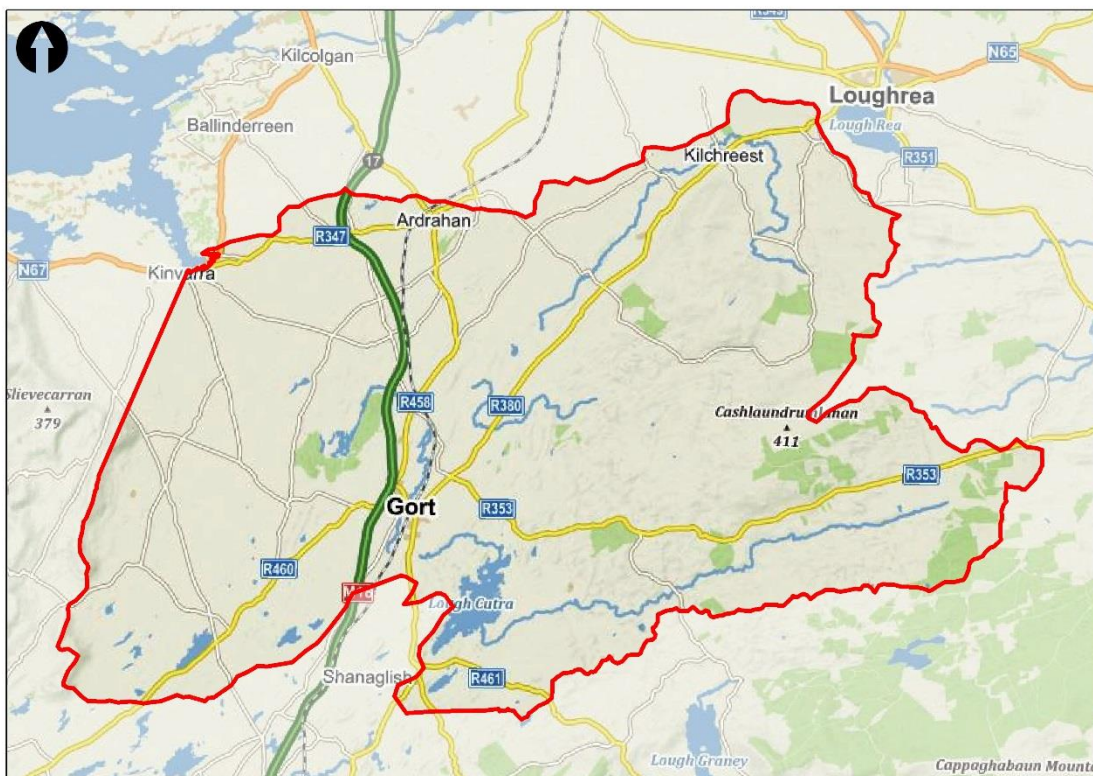
1.1 South Galway (Gort Lowlands) Flood Relief Scheme

Significant flood risk exists in South Galway, as evidenced by flooding in the winters of 1994/1995, 2009, 2014 and 2015/16. Flooding is caused by a combination of surface water and groundwater (turlough) flows which also have a tidal influence.

Galway County Council, acting as the Contracting Authority on behalf of the OPW, intend to develop a flood relief scheme for the affected areas of South Galway. The purpose of the South Galway (Gort Lowlands) Flood Relief Scheme is to identify the most appropriate measures to mitigate flood risk within the Gort lowlands region of Galway.

The principle study area (*Figure 1: Study Area*) for the South Galway (Gort Lowlands) Flood Relief Scheme is the Gort Lowlands area, its highland catchment (the Slieve Aughty Mountains), and its downstream receiving waters (Kinvara Bay). The study area extends over two administrative areas which include County Galway and County Clare.

Figure 1: Study Area



1.2 The Purpose of This Report

The purpose of this Constraints Study Report is to present all the characteristics and features of the study area such that key environmental constraints which may influence the identification of flood risk management options are considered in the development of a scheme. This constraints study is the first stage in environmental assessment of the South Galway (Gort Lowlands) Flood

Relief Scheme. Ongoing environmental assessment will be carried out throughout scheme development as demonstrated in *Table 1: Stages in Scheme Development*.

Table 1: Stages in Scheme Development

Stage	Environmental Impact Assessment	Scheme Design
Stage 1: Feasibility & Preferred Option Selection	Constraints Study (this stage) Screening for Appropriate Assessment Environmental Assessment of Viable Options	Hydrology Study & Hydraulic Modelling Site Investigations Flood Risk Assessments Flood Risk Management Options Cost Benefit Analysis Selection of Preferred Option
Stage 2: Environmental Assessment & Planning (including Public Exhibition)	Appropriate Assessment Environmental Impact Assessment Report	Subject to the identification of a cost beneficial scheme (Preferred Option), Ministerial Consent will be sought to proceed with a public exhibition of the scheme (out in accordance with the Arterial Drainage Acts).
Stage 3: Detailed design, tender process & award of construction contract	Environmental Design	Construction Contract Documents will be prepared subject to Ministerial Confirmation.

This Constraints Study report has been compiled following desktop assessment, site walkover surveys, consultation with environmental stakeholders/data holders, and public consultation.

The environmental topics investigated in this report follow the EPA draft 'Advice Notes for Preparing Environmental Impact Statements' (September 2015) as follows:

- Biodiversity
- Cultural Heritage
- Landscape
- Soil Geology and Hydrology
- Water Resources
- Population and Land use
- Material Assets

The OPW, the competent authority in Ireland for the EU "Floods" Directive, has prepared Flood Risk Management Plans (FRMPs) for the country, which have been subject to Strategic Environmental Assessment and Appropriate Assessment. The FRMPs were published in early 2018, following approval by the Minister for Finance and Public Expenditure and Reform. It is expected that elements of the potential flood risk management measures identified in the FRMP as relevant to Gort will be adopted in to the South Galway (Gort Lowlands) Flood Relief Scheme (albeit there may be certain design changes). The constraints and mitigation identified in the Strategic Environmental Assessment and Appropriate Assessment for the FRMP will be reviewed and incorporated as relevant to the environmental assessment of the South Galway (Gort Lowlands) Flood Relief Scheme.

2 Background to Project

2.1 Current Flood Situation in Gort and the Need for the Scheme

The Gort Lowlands area has experienced exceptional flooding during the winters of 1994/1995, 2009, 2014 and 2015/16. The response to these events has necessitated emergency flood alleviation works. The OPW and Galway County Council recognises the hardship endured by those affected by the flood events and proposed the development of the South Galway (Gort Lowlands) Flood Relief Scheme.

Flood risk may be increased by:

- Climate Change resulting in higher rainfall and higher tide levels (which is affecting turlough levels)
- Future change in landuse within the catchment
- Possible collapse of underground conduits

An Engineering Study is being advanced in parallel with the Environmental Assessment of the Flood Relief Scheme which will consider potential flood risk management options for current and future flood risk. The constraints identified in this report will inform the selection of flood alleviation measures as part of the Engineering Study. The range of engineering measures under consideration at this Stage in the development of the scheme are presented in *Table 2: Potential Flood Risk Management Measures*.

Table 2: Potential Flood Risk Management Measures

Potential Flood Risk Management Measures

No Measures
Non-structural measures (e.g. flood early warning system or individual property protection)
Relocation of properties and/or infrastructure
Reconstruction of properties and/or infrastructure to a higher level
Flow diversion (e.g. controlled overland flow channel)
Flow reduction (e.g. upstream catchment management or flood storage)
Optimisation of Flood Plain Storage
Flood containment through construction of flood defences
Increased conveyance of existing channel (e.g. Gort River or established overland flow paths)
Increased conveyance of existing culverts, and bridges along overland flow paths
Improvements in drainage efficiency of underground karst conduits
Development Management Planning
Maintenance of karst features and rivers

Source: Ryan Hanley, May 2018

3 Constraints Assessment

3.1 Introduction to Constraints Assessment

The purpose of the constraints assessment is to identify the key constraints within the study area that may inhibit the development or the design of flood risk management measures under consideration as part of the flood relief scheme.

Drawings have been prepared which outline the key constraints identified within the study area. These are presented in Appendix A.

Environmental Constraints:

Environmental constraints are those constraints on the scheme development that arise due to the requirement to ensure the protection of the following:

- The Natural Environment
- Cultural Heritage
- Human Beings, Settlements, and infrastructure and
- The Landscape and Visual Environment

The construction of the Flood Relief Scheme will potentially impact on the receiving environment. This means that it is critical that there is a full understanding of the environmental constraints within the study area prior to the process of identifying locations for required infrastructure. This report identifies all the known significant environmental constraints identified within the study area under the following broad headings;

- Biodiversity
- Cultural Heritage
- Landscape
- Soil Geology and Hydrology
- Water Resources
- Population and Land use
- Material Assets

Technical Constraints:

Technical considerations will be assessed as part of the Engineering Design of the scheme. The technical and physical limitations of the scheme plus the practical construction and operation requirements will be assessed against the background of the environmental and planning constraints identified in this study. The objective is to deliver a safe, reliable, and cost beneficial scheme which will have due regard to the natural environment, stakeholders, and the public.

3.2 Principles of the Constraints Assessment

In undertaking the constraints assessment, the following guiding principles were adopted to ensure that the process resulted in an effective and robust output from this stage of scheme development:

- The integrity and quality of the information and data utilised in the development of constraints mapping is a critical element in the process. Data management is a key

element of the constraints process which has been managed to ensure that the data utilised is accurate and up to date

- Consultation is central to the process of identifying and sourcing of all required data on constraints within the study area
- Constraints included on the constraints mapping should include only those constraints that are considered to significantly impact on the identification of flood risk management options

3.3 Identification of Constraints

The constraints assessment was primarily a Desktop Study, supported by consultation and site walkovers. The constraints assessment consists of the following principle steps:

- Stakeholder & Public Consultation;
- Information Gathering;
- Data Mapping;
- Preparation of Constraints Report

Each of these steps were undertaken in order to ensure that the most accurate and up to date constraints maps for the study area were compiled, prepared, and reported. The tasks undertaken to complete each of the principle steps are detailed below.

Information Gathering

A preliminary list of potentially relevant constraints data required for the purposes of the assessment was collated based on the principles outlined in Section 3.2. The relevant datasets required were determined by the project team through desk based assessment and consultation with stakeholders and the public. Datasets were collected from existing available data relating to the study area through consultation with statutory bodies, the local authorities.

All available relevant datasets relating to the study area were collected and collated and on this basis, a master data list was created. This master dataset is provided in Appendix C. A hierarchical step by step approach was used to the sourcing of data, based on the ease of the availability of data.

1. Identify dataset required
2. Download from websites of data suppliers
3. If dataset is not available to download, request from data supplier
4. If dataset is not available from data supplier, digitise data

Where possible, all data was sourced in GIS format, compatible with ArcGIS v 10.2 software. Where digital data was not available in this format, it was accessed in available formats and translated to the format compatible with ArcGIS 10.2. In all cases, where data was digitised, it was done so using ArcGIS 10.2 software.

Data Collation & Quality Checking

Each dataset received was recorded in the data received database. Information was recorded for each dataset outlining the source of the data, date received, type of data, data format and quality of data.

All mapping data utilised for the purposes of generating Constraints Drawings was quality checked by an experienced GIS technical specialist. Data accuracy was assessed by comparing the data to other spatial datasets to determine the data is properly geo-located. Data

was also compared to hardcopy information to check the spatial extent. In addition, the contents of the attribute tables were checked. Further data analysis was undertaken to identify any data errors such as “overlaps”, “slivers” etc. The quality of each dataset used in the constraints drawings was then recorded in the data received register based on this checking process.

Data Mapping

Constraints drawings were prepared using ArcGIS v 10.2 GIS software. Several Constraints drawings were prepared to allow multiple data layers to be displayed concurrently. An experienced GIS technical specialist prepared the drawings to ensure that all relevant data is displayed clearly and concisely with legends indicating all the data contained on each constraint drawing. Constraints drawings are presented in Appendix B. A drawing list is provided below.

- MMD-229100098-N001-DR-A00-001_Corine
- MMD-229100098-N001-DR-A00-002_Designated_Sites
- MMD-229100098-N001-DR-A00-003_Landscape_Sensitivity
- MMD-229100098-N001-DR-A00-004_Hydrology
- MMD-229100098-N001-DR-A00-005_Geology
- MMD-229100098-N001-DR-A00-006_Landslides
- MMD-229100098-N001-DR-A00-007_Cultural_Heritage
- MMD-229100098-N001-DR-A00-008_Population
- MMD-229100098-N001-DR-A00-009_Water
- MMD-229100098-N001-DR-A00-010_Aquaculture_Fisheries
- MMD-229100098-N001-DR-A00-012_Soils
- MMD-229100098-N001-DR-A00-013_Subsoils
- MMD-229100098-N001-DR-A00-014_Materials_Assets
- MMD-229100098-N001-DR-A00-015_Aquifer_Vulnerability

Preparation of the Constraints Report

A Constraints Report was prepared to support and explain the content of the constraints drawings. This report outlines the process followed to generate the drawings and presents a detailed description of the constraints identified within the study area.

4 Environmental Constraints

4.1 Introduction

The Flood Relief Scheme has the potential to impact the receiving environment including the local population. This means that it is critical that there is a full understanding of the constraints within the study area prior to the process of identifying the preferred scheme. This report identifies all the known environmental constraints within the study area. These constraints are mapped on the associated constraints drawings.

Environmental constraints are considered under the following broad headings;

- Biodiversity;
- Cultural heritage
- Landscape;
- Soils Geology and Hydrogeology;
- Population and Land use;
- Water Resources; and
- Material and Assets.

The specific approach used to identify each constraint is outlined within each respective section. The key constraints for each of the environmental constraints are summarised at the end of each section.

4.2 Biodiversity

4.2.1 Introduction

A detailed desktop assessment was undertaken to identify areas of ecological significance within the study area which may form a constraint to the flood relief scheme. These ecological constraints will be considered further when defining the preferred scheme.

4.2.2 Background

Sites and areas of ecological significance within the study area have been identified and included on constraints drawing MMD-229100098-N001-DR-A00-002_Designated_Sites. Sites have been considered under the following headings:

- Designated Sites of International Importance;
- Designated Sites of National Importance; and
- Other Sites.

4.2.2.1 Designated sites of International Importance

Sites identified as sites of international importance within the study area including the following:

- Special Areas of Conservation (SACs) are areas with habitats protected by the designation under the Habitats Directive (92/43/EEC), as amended. The directive was transcribed into Irish law by the European Communities (Natural Habitats) Regulations, 2011;

- Special Protection Areas (SPA's) are sites designated for the protection of habitats used by bird species. These areas are designated under the Birds Directive (2009/147/EC), the codified version of 79/4089/EEC as amended);
- Ramsar Sites are wetlands of international importance designated under the Ramsar Convention 1971. This is an intergovernmental treaty which provides the framework for national action and international commitments of its member countries to maintain the ecological character of their wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. There are currently 45 sites in the Republic of Ireland; and
- Waters designated under the Shellfish Waters Directive 2006/113/EC in order to protect or improve water quality to support shellfish life and growth.

4.2.2.2 Designated Sites of National Importance

At a national level, the basic unit of conservation is the Natural Heritage Area (NHA); NHAs are designated to protect habitats, flora, fauna, and geological sites of national importance. The legislative framework for NHAs is provided by the Wildlife Act, 1976 and the Wildlife (Amendment) Act, 2000. The Geological Survey of Ireland (GSI) have also compiled a list of geological/geomorphological sites in need of protection through NHA designation. In addition, there are over 600 proposed NHA (pNHA), which were published in 1995, but have not since been statutorily designated. These sites are of significance for wildlife and habitats. Prior to statutory designation, pNHA are subject to limited protection, however for the purposes of this assessment all pNHA have been treated as fully protected.

4.2.2.3 National Parks and Nature reserves

A Nature Reserve is an area of importance to wildlife, which is protected under Ministerial order. The majority of Nature reserves are State owned; however, some are owned by organisations or private landowners.

4.2.2.4 Features of Ecological Interest (Non - Designated)

Other features of ecological interest within the study area are considered as part of this constraints assessment. These areas include areas which support or are likely to support species protected under the Wildlife Act and/ or under Annex IV of the Habitats Directive. Other features are considered as areas which contain Annex I type habitat, albeit outside of the boundary of an SAC. It should be noted that these features are not presented in the constraints mapping due to sensitivity surrounding the dissemination of such information into the public domain.

4.2.3 Resources

A significant number of ecological datasets and mapping data was consulted with for the purpose of this assessment. Datasets were obtained from both government departments and national authorities including the following:

- Department of Arts, Heritage and Gaeltacht (DAHG);
- Department of Environment, Community and Local Community;
- Department of Agriculture, Food and the Marine; and
- Environmental Protection Agency (EPA).

Relevant data was also sourced from the Local Planning Authorities (Galway County Council, and Clare County Council).

4.2.4 Existing Constraints

A significant proportion of the study area consists of designated sites of International and National importance.

A list of all designated sites is provided hereunder. A considerable number of sites have been provided with dual European and National protection i.e. designated SAC/ SPA and NHA.

Table 3: Number of Designated Sites within the Study Area

Type of sites	Number of sites
SAC	16
SPA	4
Ramsar Sites	1
NHA	1
pNHA	10
Nature Reserves	2

Table 4: Designated Sites within the Study Area

Site Designation	Site Name	Site Code
SPA	Inner Galway Bay	004031
SPA	Lough Cutra	004056
SPA	Coole-Garryland	004107
SPA	Slieve Aughty Mountains	004168
SAC	Caherglassaun Turlough	000238
SAC	Coole-Garryland Complex	000252
SAC	Galway Bay Complex	000268
SAC	Peterswell Turlough	000318
SAC	Termon Lough	001321
SAC	Sonnagh Bog	001913
SAC	East Burren Complex	001926
SAC	Lough Coy	002117
SAC	Ardrahan Grassland	002244
SAC	Kiltartan Cave (Coole)	000286
SAC	Gortacarnaun Wood	002180
SAC	Drummin Wood	002181
SAC	Carrowbaun, Newhall and Ballylee Turloughs	002293
SAC	Cahermore Turlough	002294
SAC	Ballinduff Turlough	002295
SAC	Lough Cutra	000299
NHA	Slieve Aughty Bog	001229
pNHA	Caherglassaun Turlough	000238
pNHA	Coole-Garryland Complex	000252
pNHA	Galway Bay Complex	000268
pNHA	Kiltartan Cave (Coole)	000286
pNHA	Lough Cutra	000299
pNHA	Peterswell Turlough	000318
pNHA	Pollduagh Cave, Gort	000320
pNHA	Termon Lough	001321

Site Designation	Site Name	Site Code
pNHA	Sonnagh Bog	001913
pNHA	East Burren Complex	001926

4.2.4.1 Special Area of Conservation

There are 16 SACs within the study area. The Habitats Directive lists certain habitats (Annex I and priority habitats) and species (Annex II) that must be protected within SACs. Key habitats within the SAC sites include, but are not limited to, turlough, raised and blanket bogs, fens, limestone pavement, and habitats associated with rivers and lakes. Key species designated within the SAC sites include lesser horseshoe bat and otter. All SAC's within the study area are mapped on **MMD-229100098-N001-DR-A00-002_Designated_Sites**.

A number of the SAC identified within the study area occur within identified flood zones¹ such as Caherglassaun Turlough SAC, Coole-Garryland Complex SAC and Peterswell Turlough SAC. Such SACs are considered to have a higher potential to act as a constraint to the flood relief scheme.

Potential impacts from the development of the Flood Relief Scheme include alteration of hydrology, water quality and disturbance effects. Potential impacts will depend on proximity and connectivity of the SACs to the works and on the sensitivity of the species or habitats to the impacts.

4.2.4.2 Special Protection Areas

There are 4 SPAs located within the study area. All SPA sites are mapped on **MMD-229100098-N001-DR-A00-002_Designated_Sites**. The Bird Directive lists species of wild birds which are protected within SPAs. The majority of the bird species designated within the SPAs are wintering waterfowl species, however a small number of breeding species such as curlew and hen harrier also occur within the study area. The wetlands themselves are also a conservation interest within the SPA sites. The Coole-Garryland SPA site occurs within the identified flood zones and may be a constraint to the scheme. The Slieve Aughty Mountains, which support Hen Harrier, are within the upper catchment of the study area.

Potential impacts from the Flood Relief Scheme on SPAs will depend on proximity and connectivity to the sites.

4.2.4.3 Ramsar Wetland Sites

There is one Ramsar Wetland site located within the study area; Coole Lough and Garryland Wood (Ramsar site no. 473). The Ramsar site is located north-west of Gort in County Galway. The site is also designated as SAC, SPA and a pNHA. The Ramsar site comprises turloughs, woodland, limestone heath and grassland. The site and adjacent nutrient poor lakes are the most important turlough complex in Ireland². Coole is also a Wildfowl Sanctuary.

4.2.4.4 Natural Heritage Areas / proposed Natural Heritage Areas

Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA) are the basic designation for wildlife in Ireland. There is one NHA site; Slieve Aughty Bog NHA, within the study area. The site comprises a number of individual bog units within the Slieve Aughty

¹ GSI Flood Extent 2009 - 2015

² <https://rsis.ramsar.org/ris/473>

Mountains. The bogs do not occur within the identified flood zones in the study area but are within the upper catchment serving the rivers which pass through Gort.

There are ten pNHA sites within the study area. A number of the sites occur within the identified flood zones including Peterswell Turlough pNHA, Coole-Garryland Complex pNHA and Caherglassaun Turlough pNHA.

Potential impacts from the Flood Relief Scheme on NHAs and pNHAs will depend on proximity and connectivity to the sites.

4.2.4.5 Nature Reserves

There is one Nature Reserves located within the study area. Coole-Garryland and Ballynastaig Wood Nature Reserves is located north of Gort in County Galway.

4.2.4.6 Other Features of Ecological Interest

A number other features of ecological interest were considered as part of the constraints assessment, as they have potential to be of national, regional and possibly international importance.

Annex I Habitats

Habitats listed in Annex I of the Habitats Directive are of international importance. EU requires specific sites to be designated under the Habitats Directive for important habitats, for flora and fauna species or for both. These sites are designated as Special Areas of Conservation (SAC's) and all sites are noted above. However, Annex I Habitats can be found outside of designated SAC sites. The potential conservation importance of these sites under the Habitats Directive is considered within the constraints assessment. The principal Annex I habitat types identified in the study area include the following:

- Semi Natural Woodlands
- *Taxus baccata* woods
- Semi-natural dry grassland
- Limestone pavement
- Wet Heath / Blanket Bog Habitat
- Petrifying springs
- March / Fen
- Estuaries
- Turloughs
- Oligotrophic lakes

The potential for these habitats to be affected by the scheme will be dependent upon connectivity between the scheme and the habitats. This will be determined at the next stage in scheme development: assessment of viable options.

A large number of groundwater dependent habitats occur within the study area including turloughs and fens. The distribution of these habitats is discussed further in Section 4.6 (Water Resources).

Other Ecological Receptors

Other ecological receptors which are likely to occur within the study area may include, but are not limited to:

- Bats (including lesser horseshoe bats)
- Protected non-volant mammals and their resting sites (e.g. badgers, otters, red squirrel, pine marten etc.);
- Protected reptile and amphibian species;
- Protected invertebrate species (marsh fritillary etc.)
- Protected and rare flora species;
- Breeding bird sites of significant conservation concern;
- Wintering bird sites

NPWS Records of Protected Species

The NPWS records for protected species within the study area were obtained from the following 10k square grids; M30, M31, M41, M50, M51, M60, M61, R39, R49, R59 and R69.

Species listed within the square grids include species protected under both the Habitat Directive and the Wildlife Act (2000). An example of species previously recorded within the study include badger (*meles meles*), otter (*lutra lutra*), lesser horseshoe bat (*Rhinolophus hipposideros*), pygmy shrew (*Sorex minutus*), pine marten (*Martes martes*), and Red squirrel (*Sciurus Vulpes*).

A number of birds listed under the Birds of Conservation Concern – Red list have also previously been recorded within the study area which include northern shoveler (*Anas clypeata*), corn crake (*Crex crex*), Yellowhammer (*Emberiza citrinella*), black-headed gull (*Larus ridibundus*) and Eurasian curlew (*Numenius arquata*).

A number of Flora Protection Order species occur within the study area including limestone Fern (*Gymnocarpium robertianum*), wood bitter-vetch (*Vicia orobus*), narrow-leaved helleborine (*Cephalanthera longifolia*) and wood small-reed (*Calamagrostis epigejos*).

It is important that the development of the Flood Relief Scheme aims to avoid impacting or disturbing protected species and their resting sites. Where disturbance cannot be avoided appropriate mitigation may be required to ensure that the population(s) of protected species is not affected. Any such disturbance must be under license from NPWS.

Wintering Birds

The Irish Wetland Bird Survey (I-WeBS) is a scheme undertaken by Bird Watch Ireland which monitors wintering birds at various site and subsite across Ireland. There are a number of monitoring sites and subsites which occur within the study area. These include Kinvara Bay, Cahermore Turlough, Caherglassaun Lough, Lydacan Castle Turlough, Coole Lough, Garryland and Doo Lough Turloughs, Doonowen Turlough, Garryland North Turlough, Newtown Turlough, Ballinduff Turlough and Grassland, Ballylee Turlough, Lough Coy, Blackrock Turlough, Ballaunagh Turlough, Lough Cutra, Lough Bunny and Lough Skeardeen.

Fishery Habitat

Kinvara Bay is a nursery sites for a number of fish species which includes cod, herring, mackerel and whiting. The bay is also used as a spawning site by whiting.

There are three main rivers within the study area:

- The Kilchreest River (WFD Code Kilchreest_010) (also known as the Owenshree River)
- The Bolyneedorrish River (WFD Code Bolyneedorrish_010) and
- the Owendalulleegh River (WFD Code Owendalulleegh _010)

The IFI has indicated that these watercourses have limited fishery value owing to the fact that the lower catchment drains to ground.

Invasive species

A number of invasive plant and animal species have previously been identified within the study area which include Japanese knotweed (*Fallopia japonica*), rhododendron (*Rhododendron ponticum*), common garden snail (*Cornu aspersum*) and fallow deer (*Dama dama*). The potential for the translocation / spread of these species will be dependent upon the measures that are proposed for the scheme.

Development of measures under the scheme should aim to avoid work in the vicinity of invasive species in order to prevent the spread and dispersal of same. Where avoidance is not feasible invasive species management plans will be necessary.

4.2.5 Key Constraints

As outlined above the study area contains valuable biodiversity consisting of habitats and species of local importance, national importance and international importance, which have been identified and mapped. The extent of these areas and the value of the study area as habitat for a number of protected species offer significant constraint to the development of the flood relief scheme.

The key constraints associated with the development of the Flood Relief Scheme within the study area in terms of potential to impact on biodiversity are summarised below.

Table 5: Summary of Key Biodiversity-Related Constraints

What is the Constraint	How is the Constraint Addressed in the Constraints Report
<p>Damage/Loss of protected habitat / protected species - Potential for direct loss or damage to protected habitats and species within the study area due to the development of the Flood Relief Scheme.</p>	<p>All designated sites and other features of Ecological Interest should be considered in full when identifying suitable options for the flood relief scheme. It is recommended that designated sites are avoided where possible. However, it is acknowledged that the flooding is intrinsically linked to turlough habitats. It is important that the scheme is designed such that significant changes in hydrology do not occur which might alter the natural structure and function of the turlough habitat or the range of the habitat in the area.</p>
<p>Fragmentation and degradation of Habitats - Potential loss of habitats and connectivity between habitats due to the provision Flood Relief Scheme infrastructure. This includes potential loss or damage to hedgerows and tree lines which are important wildlife corridors for numerous species, particularly bats and mammals.</p> <p>Potential for the project to obstruct or impair mammal movements during the construction stage.</p>	<p>When assessing viable flood risk management options, it will be necessary to ensure that movement of species between identified ecological sites are not impaired by the provision of the Flood Relief Scheme.</p>
<p>Disturbance - Potential impacts during the construction phase include displacement from roosting/resting/breeding and foraging areas.</p>	<p>Avoidance of all designated sites and important ecological features should be prioritised where possible. In the event where works located within or in proximity to designated sites and ecological features appropriate mitigation measures should be implemented to minimise disturbance. It should be noted that it may be necessary to seek a disturbance licence from NPWS under the Wildlife Act or Habitats Regulations.</p>
<p>Hydrology and water quality impacts – Potential for alteration in hydrology which may affect both surface and ground water dependent habitats.</p>	<p>An alteration of hydrology within the study area has the potential to impact groundwater dependent terrestrial ecosystems such as turloughs or fens, which has the potential to impact the structure and function of the</p>

What is the Constraint	How is the Constraint Addressed in the Constraints Report
Potential for water quality impacts due to the release of polluted runoff into hydrologically connected ground and surface waterbodies.	habitats as well as the species or birds which they might support. It is therefore recommended that the hydrological regime of all protected water features are fully considered to minimise impacts. Water quality impacts to important fishery habitats such as Kinvara Bay, has the potential to significantly impact protected species/habitats which may be present. Where works within important waterbodies cannot be avoided timing of works and best site practice should be incorporated into the physical design and construction of the Flood Relief Scheme to minimise pollution risk and alteration of hydrology.

4.2.6 Conclusions

A detailed review of the potential ecological constraints and ecological sensitivities is outlined above. This constraint assessment is based on desktop review and whilst every effort has been made to identify all ecological constraints it is considered that other local detailed ecological constraints will be identified as the project progresses. Further ecological assessments will be carried out as the development of the scheme is progressed and as viable options are identified.

The Flood Relief Scheme has the potential to negatively impact protected ecological sites and the sensitive species for which they are designated, leading to significant direct and indirect effects on the sites. However, the generation of detailed biodiversity constraints mapping will allow for these significant constraints to be considered in the identification of a cost beneficial scheme for the area.

4.3 Cultural Heritage

4.3.1 Introduction

ÆGIS Archaeology Limited was commissioned to carry out an Archaeological Constraints Study to identify all cultural heritage constraints (archaeology and architecture) within the study area and to make recommendations in the consideration of the cultural heritage in relation to any future flood relief scheme. The full report is provided in Appendix D. Cultural heritage features are presented in MMD-229100098-N001-DR-A00-007_Cultural_Heritage.

4.3.2 Background

Cultural heritage constraints reports are governed by a number of documents issued by regulatory and state bodies (for example EPA 2015; 2015a; NRA [now TII] 2005; 2005a; Eirgrid 2015).

The study is based on desktop assessment plus a number of visits by a qualified archaeologist to a number of the national monuments within the study area:

- The Record of Monuments and Places constraint maps and lists (RMP) and the sites and monuments record (SMR) were consulted.
- The NIAH was consulted and cross referenced with the RPS.
- A wide range of local historical and archaeological records were consulted, for a high-level background for the study area, which included for example the Down Survey maps, Ordnance Survey first edition six-inch map (c.1840), Griffith's Valuation map, the

Ordnance Survey twenty-five-inch map and aerial views. These are cited in the text individually where appropriate.

- National Museum of Ireland Topographical Files were consulted.
- The Underwater Archaeology Unit data of the NMS was consulted.
- Galway and Clare County Libraries were consulted.
- County Development Plans and other local area plans for counties Galway and Clare were consulted.
- A search and review of any archaeological investigations in the vicinity was undertaken.

4.3.3 Existing Constraints

By its nature a flood relief scheme will be associated with waterbodies. Bridges and crossing points on rivers and streams, and lakes and rivers more generally have a particular potential to yield material of archaeological and architectural interest. Furthermore, because of the underlying geology of much of the study area (carboniferous limestone) caves may be impacted by necessary works which also have a high potential to yield material of interest.

4.3.4 Key Constraints

The key constraints associated with the development of the Flood Relief Scheme within the study area in terms of potential to impact on cultural heritage are summarised below.

Table 6: Summary of Key Cultural Heritage Related Constraints

What is the Constraint	How is the Constraint Addressed in the Constraints Report
Impacts on identified cultural heritage sites	<p>At this stage of the project, cognisance should be taken of all recorded archaeological monuments and protected structures and ideally if possible National Monuments, recorded archaeological monuments and protected structures should be avoided and, in respect of recorded archaeological monuments, their zones of notifications should be allowed as a buffer zone free from development.</p> <p>Should this not be possible then archaeological investigations are recommended for cultural heritage that would be impacted by the scheme. Given the provisions of the National Monuments Acts, any impact on known archaeological sites cannot take place without first consulting the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht. The Works programme must include adequate time for survey and consultation in associated with same.</p>
<p>Impacts on identified cultural heritage sites: the next stage in scheme design is the identification of viable options for flood relief. Certain flood relief options have a greater potential to impact archaeology than others.</p>	<p>The National Monuments Service, the Architectural Advisory Unit and the Underwater Archaeological Unit of the Department of Arts, Heritage and the Gaeltacht should be consulted when determining viable options for flood relief and at further stages of scheme development and appropriate mitigation should be determined.</p> <p>Local archaeological and historical groups were consulted at public consultation. These groups should be further consulted during assessment of viable options in order to gain an understanding of the local importance of each archaeological / cultural feature.</p>
<p>Impacts on previously unrecorded archaeological features</p>	<p>Ground works must be monitored by an archaeologist. Any finding of archaeological items during construction</p>

What is the Constraint

How is the Constraint Addressed in the Constraints Report

must be documented and reported to the National Museum of Ireland and the National Monuments Service of the Department of Culture, Heritage, and the Gaeltacht.

4.3.5 Conclusions

The development of a flood relief scheme in this area has a relatively high potential to yield previously unrecorded cultural features of interest. All ground works must be monitored by an archaeologist.

4.4 Landscape

4.4.1 Introduction

Deirdre Black & Associates was commissioned to carry out a Landscape and Visual Constraints Study to identify landscape capacity and visual amenity within the study area which may be affected by possible flood alleviation measures, and/or which may impose constraints on the viability and/or design of one or more measures. The full report is provided in Appendix E. Landscape sensitivity mapping is shown in MMD-229100098-N001-DR-A00-003_Landscape_Sensitivity. Further detailed mapping is provided in the Landscape and Visual Constraints Study report in Appendix E.

4.4.2 Background

This Landscape and Visual Constraints Study includes an appraisal of international, national and local designated landscapes, county landscape character assessments and desktop analysis of topographical and other landscape mapping and datasets. This study identifies the significant features in the landscape which determine its character and includes an analysis of tourism and recreational use.

This Constraints study follows the broad methodology as set out in the 3rd and latest edition of the *Guidelines for Landscape and Visual Impact Assessment*.

A photo survey was also carried out in April 2018 focusing on the landscapes between Kinvara and Peterswell.

4.4.3 Existing Constraints

The study area encompasses a number of distinct landscape character areas, areas of high landscape value, notable views and prospects, and amenity areas and gardens. These features have been included in the constraints mapping.

The photo survey shows the flat landscapes of the western part of the study area gradually giving way to more undulating and wooded landscapes moving towards the highlands of Slieve Aughty.

4.4.4 Key Constraints

The key constraints associated with the development of the Flood Relief Scheme within the study area in terms of potential to impact on Landscape are summarised below.

Table 7: Summary of Key Landscape Related Constraints

What is the Constraint	How is the Constraint Addressed in the Constraints Report
<p>Landscape Character Areas and areas of high landscape sensitivity or value.</p> <p>The Galway County Development Plan contains information on the character of the county landscape and has set out focal points and views which are important at county level. The Plan makes recommendations in relation to the types of development permissible within areas of high landscape sensitivity e.g. <i>“Development should not block important long-distance views of the Burren or Slieve Aughty Mountains or local focal points as these views are of regional landscape value”</i>, and <i>“The sinuous coastline is scenic and is relatively undeveloped... protect this coastline and the panoramic views...”</i>. This is could constrain the type of flood defences permissible.</p>	<p>Landscape character areas and the associated recommendations under the Galway County Development Plan are identified in this report such that the design of the scheme can be empathetic to the sensitivity and value of the local landscape.</p> <p>Minimise disturbance to hedgerows and stone walls.</p>
<p>Coole Demesne/Coole-Garryland Nature Reserve</p> <p>The National Inventory of Architectural Heritage (Gardens) contains information on historic designed landscapes. The Coole Demesne is listed by the NIAH and has remnant historic features, including walled garden, stable, stone walls etc. Any flood relief measures should aim not to impose upon the integrity of these historic features.</p> <p>The Coole-Garryland Nature Reserve includes walks and trails through the woods, at the turlough, and walled garden. Any alteration of these features could degrade the amenity value of the area</p>	<p>The unique landscape and cultural features of the Coole Demesne/Coole-Garryland Nature Reserve must be recognised during scheme development.</p>
<p>Landscape and Tourism</p> <p>Important tourist sites in the area are intrinsically linked to the natural environment and to the cultural heritage of the area.</p>	<p>Conserve and enhance the characteristics of the landscape that are important to tourism.</p> <p>Where possible, enhance scenic routes, driving routes, walking routes and cycling routes.</p>
<p>The Lowlands and the Slieve Aughty Mountains</p> <p>The flat landscape of the lowlands area is dominated by agricultural land use, with stone walls a prominent feature on the landscape. The upland area of the Slieve Aughty Mountains is a forestry landscape. These distinct landscapes together give the area a uniqueness.</p>	<p>Recognise that the lowlands are made up of an agricultural landscape and the uplands of forestry landscape that are both critical resources for sustaining the economic and social wellbeing of the area.</p>

4.4.5 Conclusions

The design of the scheme must adapt to the receiving environment in any particular location in terms of materials, form, gradient, and new vegetation.

Opportunities to enhance the amenity value of the area should be explored during detailed design.

4.5 Soils, Geology and Hydrogeology

4.5.1 Introduction

A detailed desktop assessment was undertaken to identify areas of constraint in relation to soils, geology and hydrogeology within the study area. Geological constraints will be considered further when defining the suite of viable options for flood relief.

4.5.2 Background

4.5.2.1 Legislative Requirements

The European Commission, in February 2012 published the Soil Thematic Strategy which was a proposal for European Law for the protection of soil. In May 2014, the Commission withdrew the proposal for a Soil Framework Directive. Thus, other than geological heritage sites (which include proposed Geological Natural Heritage Areas and County Geological Sites, and are identified in County Development Plans and County Heritage Plans), geological features (soils and bedrock) in Ireland are not afforded legal protection.

There is a statutory requirement placed on Local Authorities to have due regard for conservation of geological heritage features such as under the following legislation;

- The Planning and Development Act 2000 as amended;
- Planning and Development Regulations 2001;
- Wildlife (Amendment) Act 2000 [enabling Natural Heritage Areas].

It is of note that there are areas of bog (peatland) designated as NAHs in the Slieve Aughty Mountains. These are afforded legal protection from an ecological perspective rather than a geological perspective. These areas are addressed in the Biodiversity Section of this report.

4.5.3 Resources

A review of relevant local, regional and national geological datasets was carried out as part of the constraints study.

Full lists of the datasets used are provided in Appendix C. The key datasets utilised for the purposes of this chapter were sourced from the following organisations;

- Geological Survey of Ireland (GSI)
- Environmental Protection Agency (EPA)
- National parks and Wildlife Services (NPWS)

The key datasets utilised provided information on the following;

- Geological Survey of Ireland (GSI) databases for bedrock geology, geohazard locations such as landslides or karst features, soils and peat and bedrock data, mineral/quarry locations, groundwater mapping including aquifer vulnerability, location of Geological Heritage Sites and mines and quarries and Turlough locations
- EPA databases for soils and subsoils
- NPWS Turlough database

4.5.4 Existing Constraints

Constraints within the study area are addressed under the following headings:

- Bedrock Geology;

- Soils and Subsoils:
- Geological Heritage Sites
- Geohazards;
- Hydrogeology;
- Quarries and Mines

4.5.4.1 Bedrock Geology

The bedrock in the study area is broadly composed of limestone to the east, within the lowlands area, and sandstone to the west, within the Slieve Aughty Mountains. There are some occurrences of metasediments and volcanics, predominantly in the eastern uplands within the study area. The bedrock geology of the study area is presented in MMD-229100098-N001-DR-A00-005_Geology, Appendix B. The rock units in the study area are classified as follows:

- Limestones
 - Dinantian Lower Impure Limestones
 - Dinantian Pure Bedded Limestones
 - Dinantian Pure Unbedded Limestones
 - Dinantian Upper Impure Limestones
- Sandstones
 - Devonian Old Red Sandstones
 - Diantian (early) Sandstones, Shales and Limestones
- Metasediments and Volcanics
 - Ordovician Metasediments
 - Ordovician Volcanics
 - Silurian Metasediments and Volcanics

4.5.4.2 Soils and subsoils

Soils in the uplands of the Slieve Aughty mountains comprise blanket peat, which grade to peaty gleys and brown podzolics underlain by Devonian sandstone till at the toe of the mountain.

Soils in the Gort lowlands are dominated by grey-brown podzolics underlain by carboniferous limestone till. Much of the lowland area comprises karstified limestone bedrock at the surface.

Soils and subsoils in the study area are presented in MMD-229100098-N001-DR-A00-012_Soils and MMD-229100098-N001-DR-A00-013_Subsoils.

4.5.4.3 Geological Heritage Sites

The Irish Geological Heritage Programme (IGH), which is managed by the Geological Survey of Ireland (GSI) identifies geological sites that are considered to be of national importance and which are proposed for designation as proposed Natural Heritage Areas (pNHAs). The IGH programme also identifies sites of national or local geological heritage importance which are classed as County Geological Sites (CGS), although these will not receive the statutory protection of NHA sites.

An audit of County Geological Sites in Co. Galway is currently underway by GSI. The audit of County Clare is complete. There are 45 sites of geological importance located in County Clare. Only one site; Mullaghmore / Slieve Roe / Knockanes, occurs within the study area. The site is located in the far south-west corner of the study area within the Burren National Park.

Geological heritage areas within the study area are shown in MMD-229100098-N001-DR-A00-005_Geology.

It is an objective (Objective NHB 4) of the Galway County Development Plan 2015-2021 to protect and conserve important geological systems in the County from inappropriate development that would detract from their heritage value. The Plan will be updated with the output of the GSI audit at its next revision.

4.5.4.4 Geohazards

Geohazards are natural earth processes that pose a risk to human life. They can range from geological hazards such as landslides, bog-bursts, coastal erosion and subsidence to hydrometeorological hazards like floods and high tides. Soft ground areas are also considered to be geo-hazards. Such hazards are identified as part of this constraints assessment and will be considered throughout each stage of the scheme development.

Karst Features

Bedrock that is prone to extensive karstification may result in weaknesses below the ground surface and lead to fractures, faults and caves. These areas may cause subsidence if placed under pressure from the construction. Karst features within the study area were noted and mapped on MMD-229100098-N001-DR-A00-005_Geology.

A considerable number of karst features occur within the Gort lowlands area. A high number of turloughs occur within the study area, the distribution of the turloughs within the study area is discussed in more detail in the Water Resources Section of this report. Other karst features which occur within the study area include enclosed depressions, caves, boreholes, dry valleys, springs, superficial solution features, swallow holes and estavelles.

Peat and Slope stability

A large area of blanket peat occurs across the south-east of the study area. Peat has the potential to be geotechnically unstable and where it occurs on upland or in areas of high topography (and therefore slope), there is a greater risk of instability during both construction and operational phases of developments. Development in peat land and sloping or unstable ground can require greater technical intervention during design and construction.

Even though Ireland is not a high-risk zone for major landslides, landslides do occur and it is therefore important to undertake a landslide hazard and risk assessment. The Irish Landslides Group (ILWG) was established in early 2004 as a direct response to a number of landslides which occurred in Autumn of 2003. Data from GSI Landslide database indicates that two landslides have previously been recorded within the study area:

- Event ID – GSI_LS03-0073 occurred on the 16th October 2003 at Derrybrien Slieve Aughty Mountains. The head of the failure was located in the site boundary of the Derrybrien Windfarm.
- Event ID – GSI_LS08-0015 occurred at Sonnagh Old Toberaltan, on the edge of a windfarm site road. The date of the landslide is not recorded. Both landslide events occurred within blanket peat subsoil.

The locations of the landslide sites are illustrated on MMD-229100098-N001-DR-A00-006_Landslides.

Soft Ground and High Groundwater

Soft ground is also considered to be a geo-hazard, soft deposits are likely to proximate with alluvium deposits and coastal deposits. Alluvial deposits occur mainly along rivers and streams and along the coastal extent of the study area. Careful siting of structures and the use of detailed geotechnical and engineering design may be necessary during options appraisal and scheme design to reduce or avoid potential risk of consolidation of soils beneath structures and potential erosion in erodible soils.

The presence of high ground water is also considered a geo-hazard. Local hydrological drainage paths may be altered by the flood relief scheme. The effects of changing drainage patterns must be determined as part of the impact assessment.

4.5.4.5 Hydrogeology

Aquifer Classification

Aquifers are rocks that contain sufficient voids to store water and are permeable enough to allow water to flow through them in significant quantities. An aquifer which is considered to be vulnerable is one which occurs close to the surface or where a low permeability drainage path exists to the aquifer below. According to GSI data the Gort lowlands occurs over a Regionally Important Aquifer – Karstified. Poor Aquifer – Bedrock covers the majority of the eastern side of the study area (Slieve Aughty Mountains). Poor Aquifer is described as Generally Unreproductive except for Local Zones. A small area of Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones occurs in the centre of the study area.

Aquifer classification is presented in MMD-229100098-N001-DR-A00-004_Hydrology.

Aquifer Vulnerability

The overburden geology defines the vulnerability of the aquifer and a vulnerability rating is based on the subsoil type and thickness. The groundwater vulnerability is mapped in MMD-229100098-N001-DR-A00-015_Aquifer_Vulnerability. The Gort lowlands area has a high-extreme vulnerability rating and includes extensive areas of exposed karst. The Peterswell area (in the uplands) has an extreme vulnerability rating. The Slieve Aughty Mountains have a low-moderate rating.

Alterations to local hydrogeology can lead to contamination or drainage of groundwater, leading to pollution or loss of groundwater dependant habitats such as alkaline fens, turloughs, and bogs which occur within the study area.

A large number of borehole wells and springs occur across the western side of the study area (Gort Lowlands). Scheme design must ensure that there will be no effects on well yields or quality.

4.5.4.6 Commercial Geology (Quarries and Mines)

Ten mines / quarries occur within the study area, all located within County Galway. It is noted that there may be other sites which occur within the study area that are not currently registered. Ground investigations will be carried out as part of scheme development. Any unauthorised activities associated with commercial geology should be identified during survey and walkover.

It is understood, from public consultation, that there is a history of extraction of sand deposits from the Kiltartan River (Ballylee River) at Polleelin. This will require further investigation as part of environmental impacts assessment for the scheme.

The use of an area as a quarry or mine could potentially restrict certain flood risk measures in that locality because of potential hydrological interaction and conflict of land use.

4.5.5 Key Constraints

The key issues associated with the Flood Relief Scheme on Geology, Soils and Hydrogeology are summarised below.

Table 8: Summary of Key Geological Constraints

What is the constraints	How is the key constraint addressed in the Constraints Report
Geological Heritage Sites and geological sensitive sites	<p>Flood relief works within Geological Heritage Sites and geological sensitive sites should be avoided where possible.</p> <p>An audit of County Geological Sites in Co. Galway is currently underway by GSI. This will document what are understood to be the most important geological sites within Galway and will propose them as County Geological Sites (CGS), for inclusion within the Galway County Development Plan, when it is next revised. Due regard should be had to the output of this study upon its availability.</p>
Removal of soils and bedrock - Permanent or temporary removal of soils / excavation of bedrock may be necessary during the construction of the Flood Relief Scheme which could potentially impact bedrock alter drainage patterns.	<p>Ground conditions within the study area will be identified through geotechnical investigation during the next stages of scheme development.</p>
Consolidation of Soils/ Erosion of erodible soils - Potential risk of consolidation of soils which could alter the infiltration and drainage characteristics of the soils reduce permeability of soils and increase risk of surface runoff and potentially erosion in erodible soils	<p>Ground conditions within the study area will be identified through geotechnical investigation during the next stages of scheme development.</p>
Peat Stability - Peat landscape may provide unsuitable construction conditions.	<p>Ground conditions and landslide risk within the study area will allow feasible site locations for the Flood Relief Scheme to be fully considered.</p>
Presence of geological features e.g. mines, springs, karst features.	<p>It is recommended that quarry and mine sites (historical and active), areas of peat and bedrock outcrop and areas where there is a significant number of recorded karst features (e.g. caves, springs) are avoided where possible. However, given the nature of the lowlands catchment, this may not be feasible. Site investigation will be necessary to inform the design of the scheme relative to the site specific geological background.</p>
Contamination of Soils, Geology, and Groundwater Potential risk of contamination of ground and water bodies through spills or leaks from hazardous substances used on site during construction.	<p>Aquifer vulnerability has been mapped within the study area and should be referred to identifying site locations for the flood relief scheme. Best site practice should be implemented on site and appropriate mitigation measures should be implemented where works are hydrologically connected to groundwater bodies.</p>
Changes in local hydrology/hydrogeology Local hydrology / hydrogeology drainage paths may be altered due to potential for increased runoff or blockages and excavation where groundwater is near the surface and high.	<p>The key issues are considered by the provision of the preparation of constraints mapping this will allow feasible site locations for the flood relief scheme.</p> <p>Research into the intermittent groundwater flooding of turloughs in the Gort lowlands area has been ongoing at the Department of Civil, Structural and Environmental Engineering in Trinity College Dublin</p>

What is the constraints	How is the key constraint addressed in the Constraints Report
	(TCD) since 2003. A model of the karst network has been developed, which is informed by LiDAR data, and which accounts for the net effects of climate change across the catchment. This model is currently undergoing development for application in the development of the South Galway (Gort Lowlands) Flood Relief Scheme. The model will interrogate a range of flood alleviation scenarios under consideration as part of the scheme development.

4.5.6 Conclusions

The most relevant geological constraints within the study area have been identified and mapped.

It is recommended that construction within Geological Heritage Sites and geological sensitive sites are avoided where possible. Where this is not feasible appropriate mitigation should be implemented to minimise impact.

Geotechnical investigation will be carried out once the potential flood alleviation measures are developed in order to identify local geology and ground conditions.

4.6 Water Resources

4.6.1 Introduction

A desktop review was carried out to identify the main constraints within the study area relating to water resources. This section identifies the areas that should be avoided, where possible, in order to minimise water related effects. Additional assessments will be completed through the various stages of scheme development, as the potential impact on local water features will be more readily identified as flood risk management options are developed.

This section should be read in conjunction with the assessments presented within the Biodiversity Soils Geology and Hydrogeology sections of this report.

4.6.2 Background

4.6.2.1 Legislative Requirements

Directive 2000/60/EC (the Water Framework Directive) was adopted by the European Parliament and Council in 2000. The Water Framework Directive (WFD) establishes a legal framework for the protection, improvement and sustainable management of inland surface waters, transitional waters, coastal waters and groundwater. The aim of the WFD is to prevent the deterioration in the existing status of waters (including the maintenance of “High Status” where it exists) and to ensure that all waters, with some limited exceptions, achieve at least “Good Status”.

There are eight River Basin Districts (RBDs) on the island of Ireland, established under law for the co-ordinated management of water resources. The study area is located wholly within the Western River Basin District.

4.6.3 Resources

A number of datasets were reviewed for the purpose of this constraints assessment. A full list of the datasets used are provided in **Appendix C**. The key datasets utilised for the purposes of this chapter were sourced from the following;

- EPA (Water Framework Ireland Map viewer) databases for information on surface water features within and adjacent to the study area and designated sites within and adjacent to the study area, including;
 - Rivers
 - Lakes and Turlough
 - Transitional and Coastal Water bodies
- Office of Public Works (OPW) Flood Risk Maps.

All major surface water features and details on the status of waterbodies were mapped on **MMD-229100098-N001-DR-A00-009_Water**. It should be noted that more detailed assessment of water resources will be carried out in the next stage of scheme development, which will account also for smaller waterbodies relevant to the scheme e.g. drainage ditches and ponds as relevant.

4.6.4 Existing Constraints

4.6.4.1 Water Quality / Status (Water Framework Directive)

The Minister for Housing, Planning and Local Government, launched the second-cycle 'River Basin Management Plan (RBMP) for Ireland 2018-2021' on 17th April 2018. The Plan will be assessed in greater detail at the next stage in scheme development during the assessment of viable flood risk management options.

Flood relief schemes have the potential to impact on the biology, water quality morphology and hydrology of waterbodies. The potential constraints to the scheme are identified hereunder in relation to water resources.

Rivers

There are three main river catchments within the study area AS FOLLOWS:

- The Kilchreest River (WFD Code Kilchreest_010) (also known as the Owenshree River);
- The Bolyneedorish River (WFD Code Bolyneedorish_010); and
- the Owendalulleagh River (WFD Code Owendalulleagh_010).

A number of smaller tributary rivers flow into these three river catchments.

The Kilchreest River flows to ground in proximity to Blackrock. The Owendalulleagh River flows in an east-west direction before discharging into Lough Cutra. The Beagh River (WFD Code Beagh_010) flows out of Lough Cutra at the north-west corner of the lough.

The Kilchreest river and its tributaries have an 'Unassigned' WFD status. EPA monitoring is not undertaken in the catchment. The source of the Bolyneedorish waterbody has a 'High' WFD status. The status then degrades to 'Moderate' status approximately 30km downstream in proximity to Farnaun. Similarly, the source of the Owendalulleagh River is assigned a 'High' WFD status. The watercourse then degrades to 'Moderate' WFD status approximately 20km downstream.

The rationale behind the classification of these waterbodies (i.e. whether status is due to biological assessment, physico-chemical assessment, or both) will be further analysed at the next stage in scheme development in order to fully assess the potential for effects on water quality within the study area.

Lakes/Turloughs

There several lakes/turloughs within the study area, which are illustrated in MMD-229100098-N001-DR-A00-009_Water. A number of the lakes/turloughs are also designated as European Sites (SACs and SPAs) and pNHAs as discussed in previously in this report, and are important habitats. Turloughs are identified as priority habitats under the EU Habitats Directive and are designated within a number of SACs within the study area. The larger turloughs and lakes within the study area are identified hereunder:

Lakes/Loughs	Location
Lough Cutra	County Galway
Lough Coole	County Galway
Ballynakill Lough	County Galway
Lough Mannagh	County Galway
Blackrock Turlough	County Galway
Hawkhill Turlough	County Galway
Garryland Turlough	County Galway
Caherglassaun Turlough	County Galway
Roo West Turlough	County Galway
Ballylee River Turlough	County Galway
Loughaunwee Turlough	County Galway
Newtown Turlough	County Galway
Lough Bunny	County Clare
Rockforest Lough	County Clare
Travaun Lough	County Clare
Skaghard Lough	County Clare
Castle Lough	County Clare
Aughrim Lough	County Clare
Lough Loum	County Clare
Lough Skeardeen	County Clare

Of the lakes identified above, five are assigned a status under the WFD, as per Article 5 of the Directive (i.e. lakes greater than 0.5 km²): Lough Bunny, Lough Cutra, Lough Mannagh, Lough Skeardeen and Rooaunmore Lake.

Lough Bunny has a 'Good' WFD status while Lough Cutra has a 'Moderate' WFD status. The other three lakes have an 'Unassigned' WFD status. The EPA has identified Lough Bunny and Lough Cutra as at risk from anthropogenic pressures.

The rationale behind the classification of these waterbodies (i.e. whether status is due to biological assessment, physico-chemical assessment, or both) will be further analysed at the next stage in scheme development in order to fully assess the potential for effects on water quality within the study area.

The development of the Flood Relief Scheme has the potential to result in an alteration in both surface water and groundwater hydrology within the study area which has the potential to

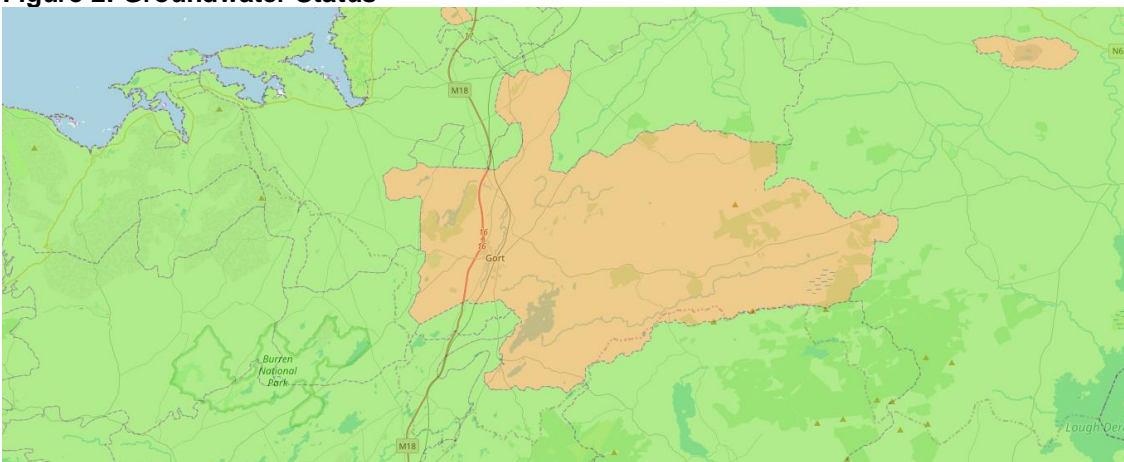
impact lake and turlough habitats. Works located within or with hydrological connectivity to waterbodies have the potential to impact water quality.

Groundwater

The main groundwater bodies within the study area are identified hereunder and their status is presented:

- IE_WE_G_0091 (GWDTE-Caherglassaun Turlough, SAC000238): Poor Status
- IE_WE_G_0092 (GWDTE-Cahermore Turlough, SAC002294): Good Status
- IE_WE_G_0098 (GWDTE-Lough Mannagh Turlough, SAC001926): Good Status
- IE_WE_G_0088 (GWDTE-Ballinaduff Turlough, SAC002295): Good Status
- IE_WE_G_0002 (Kinvara-Gort): Good status

Figure 2: Groundwater Status



Source: epa.ie

The poor status associated with groundwater body IE_WE_G_0091 has been attributed to forestry pressures by the EPA.

The EPA monitor nutrient and coliform concentrations in these groundwater bodies. This data will be further interrogated during the next stage of scheme development in order to assess potential for effects on water quality due to the scheme.

Transitional Waterbodies

Kinvara Bay comprises the inner, shallow parts of a large bay which is partially sheltered by the Aran Island. Kinvara Bay is also designated as a SAC (Galway Bay Complex SAC), SPA (Inner Galway Bay SPA) and pNHA (Galway Bay Complex). The bay is also designated as a shellfish area and is an important nursery and spawning fisheries site. The Kinvara Waste Water Treatment Plant (WwTP) is located within Kinvara Bay at the border of the study area (note this WWTP was upgraded in 2017, and is likely to result in improved water quality in the bay).

Kinvara Bay is assigned 'Moderate' WFD Status (2010-2015). Pressures within this area of the bay are identified by the EPA as from aquaculture, and domestic and urban wastewater discharges.

An area of the bay located 8km downstream of the study area, in proximity to Bridge Lough, is assigned 'Bad' WFD status. Pressures within this area of the bay are identified by the EPA as

from aquaculture, domestic and urban wastewater discharges, and other anthropogenic pressures.

The rationale behind the classification of these waterbodies (i.e. whether status is due to biological assessment, physico-chemical assessment, or both) will be further analysed at the next stage in scheme development in order to fully assess the potential for effects on water quality within the study area.

4.6.4.2 Water Framework Directive – Protected Areas

While the overarching objective of the Water Framework Directive is to achieve good status, some waterbodies require extra protection by virtue of their location in a protected area or their function as a water resource (e.g. bathing or shellfish water). In accordance with the requirements of the Water Framework Directive and the associated national regulations a register of protected areas has been established for each River Basin Districts in Ireland.

The protected areas are identified as those requiring special protection under existing National or European legislation, either to protect the surface water resource, or to conserve habitats or species that directly depend on those waters. The different protected areas included in this register are:

- Drinking waters
- Economically Sensitive Aquatic Species (Shellfish waters);
- Recreational Waters (Bathing Waters) and
- Water Dependent Habitats & Species (within European Sites).

Drinking Waters

The conservation of water resources is of huge importance at a county level and both Galway and Clare County Councils have set out policies in their County Development Plans regarding the conservation of its water resources.

There are a number of public drinking water abstractions within the study area, including the Kilchreest borehole which supplies the Kilchreest group water scheme and the Kinvara borehole that supplies the Kinvara public water scheme (near the Kinvara Springs). There are several other groundwater abstractions serving group schemes and also numerous agricultural wells. The Lough Cutra abstraction is the only surface water abstraction in the study area.

A more detailed desktop study and site assessment (site visits to areas of interest) will be carried out at the next stages of scheme development. This will include further investigation into wells and abstractions and Source Protection Zones. These should be avoided where possible.

Shellfish Waters

The Shellfish Water Directive 2006/113/EC requires Member States to designate waters that need protection in order to support shellfish life and growth. The Directive is implemented in Ireland by the European Communities (Quality of Shellfish Waters) Regulations 2006 (SI No 268 of 2006) (as amended). Kinvara Bay is a designated as shellfish area (IEWE_160_0000) as shown in MMD-229100098-N001-DR-A00-010_Aquaculture_Fisheries. Kinvara Bay hosts several licensed aquaculture activities. These activities are reliant on the water quality of the bay.

Cuan Beo, a community-based organisation with interests in Galway Bay raised concerns during public consultation that the flood relief scheme could alter the salinity of the Kinvara Bay.

Such an event could have detrimental effects for aquaculture. A salinity model will be developed as part of scheme development which will investigate the potential effects of increased freshwater flows to the bay during flood events.

Nutrient Sensitive Areas

Nutrient Sensitive areas as identified under the Urban Waste Water Treatment Regulations, Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment. No nutrient sensitive areas occur within the study area.

Recreational Waters (Bathing Areas)

The Bathing Waters Directive 2006 established numerical standards for bathing waters. Traught Beach (Bathing_Water_ID: IEWEBWC160_0000_0100) is the only bathing area in the study area and is shown on drawing MMD-229100098-N001-DR-A00-009_Water.

Data from www.beaches.ie shows that Traught Beach is classified as achieving Excellent Water Quality in 2017 based on the assessment of bacteriological results for the period 2014 to 2017. The latest water monitoring data for the beach also indicated 'Excellent Quality' (22/05/2018).

Water Dependent Habitats & Species (Designated sites)

All water dependent habitats designated within internationally and national designated sites are discussed in the Biodiversity Section of this report.

4.6.5 Key Constraints

The key constraints associated with the Flood Relief Scheme on water resources are summarised below.

Table 9: Summary of Key Water Related constraints

What are the constraints	How are these addressed in the Constraints Report
<p>Alteration of hydrology and quality – Flood relief works have the potential impact on the biology, water quality, hydrology, and morphology of watercourses.</p>	<p>Water resource constraints have been identified on the constraints mapping. The identification of the constraints within the study area will allow feasible site location options for the Flood Relief Scheme to be fully considered.</p> <p>It is recommended that the hydrological regime of all water resources which might be affected by viable flood risk management options are fully considered to ensure that the WFD hydromorphological status is not affected by the scheme.</p> <p>Trinity College Dublin has developed a model of the karst network within the study area. This model is currently undergoing development for application in the development of the South Galway (Gort Lowlands) Flood Relief Scheme. The model will inform the hydromorphology impact assessment.</p> <p>The design and construction methodology for the scheme must be such that it does not jeopardise the waterbody-specific objectives of the Water Framework Directive.</p> <p>The design should also consider the presence of protected water resources and water dependent terrestrial ecosystems.</p> <p>The hydrology of Kinvara bay will be assessed and a salinity model developed to determine the changes likely to occur in the bay should there be an increase in freshwater flows to the bay associated with the scheme. Any change in hydrology / salinity that would jeopardise the productivity of licensed aquaculture activities in the bay and / or the ability of the bay to meet the requirements of</p>

What are the constraints	How are these addressed in the Constraints Report
	the European Communities (Quality of Shellfish Waters) Regulations 2006 must be avoided.
	The design of the proposed scheme should consider the water requirements (both quality and yield) of existing and future water abstractions (both surface and groundwater).

4.6.6 Conclusions

All significant water features and catchment based water status within the study area has been identified and mapped on associated constraints drawings.

Where significant watercourses cannot be avoided, best site practise and appropriate mitigation measures should be implemented to minimise impacts and pollution risks. This is particularly important in designated sites and sensitive areas.

4.7 Population and Land use

4.7.1 Introduction

A detailed desktop assessment was undertaken to identify the land use and settlement patterns within the study area. The study area extends over two administrative areas, County Galway and County Clare. The study area is primarily rural in nature with the largest urban area, Gort, located towards the centre. A number of smaller villages also occur within the study area which include Kinvara, Ardrahan, Peterswell and Kilchreest.

4.7.2 Background

This section of the report identifies the population and settlement patterns that exist in the defined study area for the project. The study area is approximately 469.12km² in size and extends over two separate administrative areas.

4.7.3 Resources

The material sources consulted as part of this desktop study are as follows:

- National Planning Framework 2040
- Regional Planning Guidelines (2010 – 2022)
- Regional Planning Guidelines for the West Region (2010 – 2022)
- A review of the local authority Development Plans to identify any other settlement and land use characteristic and activities regarded as significant was also undertaken of the following plans:
 - Galway County Development Plan 2015 – 2021
 - Clare County Development Plan 2017 – 2023
 - Gort Local Area Plan 2013 – 2019 and
 - Kinvara Local Area Plan 2005 – 2011
- An examination of Central Statistics Office (CSO) data
- A review the Geodirectory database as supplied by An Post and the Ordnance Survey Ireland maps
- A review of the EPA Corine 2012 Land use Dataset
- A review of Fáilte Ireland in relation to tourism as well as websites on local tourism organisations and enterprises within County Galway and Clare.

4.7.4 Existing Constraints

This section provides a consideration of population, settlement patterns and land use within the study area. An understanding of the spatial and land use constraints within the study area will allow feasible site locations for the Flood Relief Scheme to be fully considered. The key constraints are discussed in detail under the following broad headings;

- Population and Settlement Patterns, and
- Land use Constraints.

4.7.4.1 Population and Settlement Patterns

Population Profile

The study area extends over two administrative areas which include County Clare and County Galway. Both counties within the study area have undergone growth in population. The 2016 Census results indicate a population increase of 1.2% in County Clare and an increase of 2.2% in County Galway. The current population figures are set out in *Table 10: Population Profile* as according to 2016 Census.

The study area is predominately rural in character with small settlement areas. The largest settlement area within the study area is Gort which has a population of 2,994, followed by Kinvara which has a total population of 734³. The rest of the study area is located in Small Areas within the Census 2016 Boundaries. The study area has a relatively low population density, with ribbon development occurring along road network and with some scattered rural housing as shown in MMD-229100098-N001-DR-A00-008_Population, Appendix B.

Table 10: Population Profile

County	Population Numbers
Galway	258,552
Clare	118,627

Source: www.cso.ie

4.7.4.2 Land Use Constraints

An understanding of the land use characteristics at the constraints stage will inform the development of feasible site locations for the flood relief scheme.

The land use zoning set out in the County Development Plans and Local Area Plans relevant to the study area will be assessed in greater detail at the next stage of the scheme development, which is the assessment of viable options, in order to determine the appropriateness of options to zoned lands.

For the purpose of this assessment this section is divided into following headings;

- Natural and Non-Natural Land use;
- Community and Residential Facilities; and
- Tourism and Recreational land use and activities.

Natural and Non-Natural Land use

The study area is characterised by a variety of landcover types which were extracted from the Corine 2012 dataset and mapped on MMD-229100098-N001-DR-A00-001_Corine. The majority

³ Census 2016 [<http://census.cso.ie/sapmap>]

of the land use in the study area is agricultural. Coniferous forests and transitional woodland as well as peat bogs make up the next largest land use within the study area, and are predominantly associated with the Slieve Aughty Mountains. Artificial surfaces occur at large settlements areas i.e. Gort and Kinvara. The study area also comprises a diverse network of lakes and watercourses including Lough Cutra, Lough Coole and Lough Bunny. There are also areas of inland marsh located towards the centre of the study area. The mapping also provides details of the locations of extractive quarries and mine sites located within the study area.

Community and Residential Facilities

Residential properties, health care facilities and community and education facilities within the study area were determined from the Geodirectory database and the Health Service Executive (HSE) website.

There are approximately 4,549 properties⁴ located within the study area (this figure only represents properties located within County Galway). The majority of properties are located within urban areas like Gort and Kinvara and along road networks.

Galway County Council have noted that approximately 136 residential properties have previously flooded within the study area, within county Galway.

Health Facilities

There are number of health facilities/centres located within the study area which are situated in proximity to Gort, Kinvara Bay and Ardahan. There are no hospitals located within the study area.

Education

There are approximately 19 schools (primary and post-primary) located within the study area. There are also a number of nursery and crèche facilities scattered throughout the study area. A number of school located within the study area are listed below:

- St Joseph's National School;
- Seamount College;
- Gort Boys National School;
- Lurga National School;
- Gort Community School;
- Gaelsoil na bhFili;
- South Galway Education Centre;
- Scoil Eoin;
- Convent primary School;
- Kilbeacanty National School;
- Kiltartan National School;
- Saint Colma's National School;
- Lough Cutra National School;
- Derry Brien Nationa School;
- Ballyturin National School;

⁴ Geodirectory points include all properties with a postal address

- Kilchreest National School;
- Peterswell National School;
- Ardrahan National School;
- Northhampton National School

Community Facilities

The study area supports a network of community facilities and services such as shops, post offices, playgrounds, churches, youth clubs, and sport facilities.

Tourism and Recreation Activities

Tourism is an important sector of the local economy and has potential for substantial future growth. County Galway is included within the West Tourist Region while County Clare is included in the Shannon Tourist Region as according to the Fáilte Ireland Regional Tourism Performance in 2015 (2016). Galway had a total of 1,449,000 overseas tourists in 2016 which was an increase of 6.5% from 2015, while County Clare had a total of 635,000 overseas tourists in 2016 which was an increase of 6% from 2015.

As noted within this report, there are a wide range of landscape, natural, cultural and heritage assets within the study area, many of which are major tourist attractions to the area. A high-level list of tourist attractions which occur within the study is provided below:

- Galway:
 - Dunguaire Castle
 - Kinvara Harbour
 - Rathbaun Farm
 - Kiltartan Gregory Museum
 - Coole Park
 - Thoor Ballylee
 - Kilmacduagh Tower

- Clare:
 - The Burren National Park
 - Burren Nature Sanctuary
 - Burren Perfumery and Floral Centre

It is recommended that the identification of feasible site locations for the Flood Relief Scheme within the study area should take consideration of the identified tourist facilities.

4.7.5 Key Constraints

The key constraints associated with the Flood Relief Scheme in relation to population, settlement and land use is summarised below.

Table 11: Summary of Key Population and Land Use Constraints

What is the constraint	How is the key constraint addressed in the Constraints Report
Settlement Patterns, proximity to residential and sensitive receivers - Settlement patterns and population density will present challenges for site selection of the flood relief scheme.	Settlement areas and population density within the study area have been identified on the accompanying constraints mapping. Geodirectory points, which includes previously flooded properties, within the study area have also been identified and mapped. All settlement areas will need to be considered when selecting site locations

What is the constraint	How is the key constraint addressed in the Constraints Report
Land Use – The development of flood relief infrastructure could potentially result in changes in land use and character.	<p>for the Flood Relief Scheme to aim to ensure that properties are not negatively impacted.</p> <p>The proposed scheme should have consideration of the zoning objectives set out in the Local Area Plans and County Development plans.</p>
Community and Recreational Facilities - The development has the potential to directly, or indirectly impact recreational and community facilities located within the study area.	<p>Landcover types based on the Corine land cover dataset across the study area have been identified on the accompanying constraints mapping. There is potential for agricultural and forestry lands in particular to be affected by the scheme given that these are the dominant land uses in the study area. Scheme design should aim to be sympathetic to the existing land uses.</p> <p>Residential properties, health facilities, educational facilities and community centres have all been identified (as geodirectory points). It is recommended that the location of all properties / facilities, in particular health centres and schools, within the study area are considered to ensure services are not interrupted.</p>
Tourism - The development of the Flood Relief Scheme in the study area has the potential to affect the integrity of the major tourist attractions and amenity sites.	<p>Known tourist attractions, high amenity areas have been identified within the study area.</p> <p>It is necessary to ensure that the Flood Relief Scheme will not adversely affect the value and visual qualities of tourist attractions within the study area, and enhancement opportunities are implemented where appropriate.</p>

4.7.6 Conclusions

The study area extends over two separate administrative areas, covering approximately 469.12km². The study area is mostly rural in nature with a low population density.

The settlement areas within the study area may present constraints to the Flood Relief Scheme. All properties have been identified and mapped as part of this constraints assessment. Tourist attractions and community and recreational facilities may also present significant constraints within the study area, and should be considered when identifying flood risk management options.

4.8 Material Assets

4.8.1 Introduction

A desktop review was carried out to identify the main constraints within the study area relating to material assets. Material assets have been divided into three separate headings and are discussed below;

- EPA / Local Authority licensed facilities
- Transport infrastructure;
- Utilities;

4.8.2 Background

Existing material assets located within the study area are considered in this constraints assessment because flood risk management options can potentially lead to disruption to utilities and infrastructure and would have potential to impact on the human population within the study area.

4.8.3 Resources

A number of datasets were reviewed for the purpose of this constraints assessment. The key datasets utilised for the purposes of this chapter were sourced from the following;

- EPA licensed facilities from <https://gis.epa.ie/EPAMaps/>
- Open street map for utility infrastructure
- Galway County Council roads mapping.

4.8.4 Existing Constraints

4.8.4.1 Licensed Facilities

There are two Wastewater Treatment Plants located within the study area which are licensed by the EPA under the Water Discharge (Authorisation) Regulations 2007: Gort Wastewater Treatment Plant and Kinvara Wastewater Treatment Plant. The locations of the Wastewater Treatment Plants are shown on drawing MMD-229100098-N001-DR-A00-009_Water.

There is one IPC facility (P0808-01) within the study area which is licensed by the EPA in accordance with the EPA (Integrated Pollution Control) (Licensing) Regulations, 2013. This facility is located within the town of Gort.

There is one facility licensed by the Local Authority under Section 4 of the Local Government (Water Pollution) Acts 1977 to 2007: Gort Co-Op Mart Ltd (W326/99). This facility is located in Ballybaun, south of Gort.

4.8.4.2 Transport Infrastructure

Transport infrastructure within the study area includes road and rail networks. The majority of transport routes within the study area are focused around Gort Town. The primary access route to the study area is the M18 motorway which traverses the centre of the study area. It provides access to Limerick to the south and Galway to the north. A number of national and regional roads also occur throughout the study area. The R353 regional road enters the study area from the east before connecting to the R380 in proximity to Gort. The R460 regional road enters the study area from the south-west corner of the study area, heading north-east towards Gort. The N67 coastal road passes through Kinvarra. The R458 links Crusheen to Gort.

Galway County Council have noted that approximately 53 roads have previously flooded within the study area, within county Galway. These roads are illustrated on drawing MMD-229100098-N001-DR-A00-008_Population.

A railway line also traverses the study area running parallel to the M18 motorway, and is subject to flooding. Both the Ardrahan Railway Station and the Gort Railway Station occur on the railway line within the study area.

There are no airports or runways located within the study area. There are also no ports located within the study area. The closest fishing port is located south of Galway City approximately 27km north-west of the study area.

4.8.4.3 Utilities

Utilities in the Study Area include water supply networks, telecommunications, storm and foul sewers, electricity supply and gas pipelines. The potential for conflict with such utilities will be investigated during assessment of viable options and scheme design.

4.8.5 Key Constraints

The key issues associated with the Flood Relief Scheme on Material Assets are summarised below.

Table 12: Summary of Key Material Asset Constraints

What is the issue	How is the key constraint addressed in the Constraints Report
<p>Licensed facilities and associated infrastructure</p> <p>The development of the flood relief scheme has the potential to interfere with the facilities or impact the watercourses which the facilities discharge into.</p>	<p>Interference with licensed facilities has the potential to affect economic productivity and / or environmental quality.</p> <p>It is recommended that licensed facilities are kept operational and are not impacted during the development of the flood relief scheme. It is also recommended that any proposed changes in the hydrological regime of receiving waters in to which the licensed facilities discharge are assessed in relation to the assimilative capacity of the watercourses.</p>
<p>Transport Infrastructure – There are a number of important transport networks located across the study area. The development of the flood relief scheme has the potential to interfere with the existing transport routes during construction, however it is of note that one of the objectives of the scheme is to improve connectivity during flooding such that infrastructure can remain open.</p>	<p>All transport infrastructure within the study area has been identified and mapped within the study area. It is recommended that Transport Infrastructure Ireland (TII) and the relevant local authority are consulted in relation to traffic management on exiting transport routes.</p> <p>Scheme design should ensure that road and rail links within the town and surrounding hinterland are maintained so that temporary disruption on local transport links and on the tourist routes are minimised. Galway County Council, TII and the NRA should be consulted with regard to potential effects on road infrastructure.</p> <p>Emergency flood relief work has previously taken place in the study area. The effects of such historic work on access and on flood extents should be assessed as part of scheme development, and the need to augment any previous works determined.</p>
<p>Utilities</p>	<p>It is recommended that that the location of the overhead lines and underground services are determined and considered in scheme design as part of the Engineering Study.</p>

4.8.6 Conclusion

The existing material assets within the study area should be considered in relation to site location the flood relief scheme.

Regard must also be had to future changes that are likely to take place in the study area e.g. through the Water Services Investment Programme, investment by the National Roads Authority / Transport Infrastructure Ireland, Irish Rail, Eirgrid etc.

5 Public Consultation

5.1 Consultation Objectives

The primary objective of consultation at the Constraints Study stage of environmental assessment is to:

- explain the need for the scheme clearly and consistently to all stakeholders and key interest groups
- seek initial views from stakeholders / the public / interested parties in relation to the key issues that the study should address
- provide members of the public with a place to ask questions
- identify and address, where possible, concerns of members of the public
- identify points of local importance / sensitivity that may constrain the design of flood alleviation measures

5.2 Stakeholder Consultation – Statutory Consultees

Consultation was carried out with statutory consultees as part of the constraints study. The consultation letter issued to the bodies identified in Table 13 is included in Appendix A.

Table 13: Statutory Consultees

An Bord Pleanála	Inland Fisheries Ireland
An Comhairle Ealaíon (The Arts Council)	Irish Aviation Authority
An Taisce - The National Trust for Ireland	Galway County Council
Commission for Regulation of Utilities	Clare County Council
Department of Agriculture, Food and the Marine	Office of Public Works
Department of Culture, Heritage and the Gaeltacht	Transport Infrastructure Ireland (TII)
Department of Communications, Climate Action & Environment	Córas Iompair Éireann (Irish Rail)
Department of Housing, Planning, and Local Government	Northern and Western Regional Assembly
Department of Justice and Equality	Irish Water
Department of Rural and Community Development	The Heritage Council
Department of the Business, Enterprise and Innovation	Health and Safety Authority
Environmental Protection Agency	HSE West
Fáilte Ireland	National Parks and Wildlife Services

As part of the initial consultation process, key stakeholders (by virtue of their statutory roles in relation to constraints in the study area) were engaged with early in the constraints assessment process as follows:

- Inland Fisheries Ireland (IFI)
- Local Authority Waters and Communities Officer
- Development Applications Unit (DAU)
- Coillte & Forest Service
- National Parks and Wildlife Services (NPWS)

Outputs of consultation are as follows:

Inland Fisheries Ireland (IFI)

On 05th April 2018, initial contact was made by phone with David Harrington of IFI to provide an overview of the scheme and to discuss key fishery constraints. This was followed up with an email on 13th April providing an overview of the study area and a description of flood risk management measures under consideration for the area. IFI noted that the lowlands are dominated by turlough features and as such there is limited fishery value in the area. The importance of Kinvara Bay as a fishery and aquaculture area was highlighted.

Local Authority Waters and Communities Officer

A meeting was held with Catherine Seale on 10th April 2018. Discussions were had on the importance of Kinvara Bay for aquaculture. The value of the turloughs for tourism and amenity was also discussed.

Development Applications Unit (DAU)

A pre-planning consultation letter was issued to DAU on 19th April 2018. Receipt was acknowledged on 19th April and the reference code G Pre00083/2018 was assigned to all future correspondence.

Coillte & Forest Service

The Project Team (including representatives from Ryan Hanley, Galway County Council and Mott MacDonald) met with the Forest Service, Coillte, and members of the South Galway Flood Relief Committee on 25th April 2018 and carried out a site walkover of forestry activities within the Slieve Aughty Mountains. The purpose of the walkover was to understand the possible effects of current forestry practices (in particular drainage and felling) on runoff rates from the Slieve Aughty Mountains. Discussions were had on historic drainage practices and on best practice to be employed going forward. Coillte identified 'biodiversity areas' within the forestry in the Slieve Aughty Mountains which are set aside to act as natural flood plains.

National Parks and Wildlife Services (NPWS)

A meeting was held between the Project team and Enda Mooney and Julie Fossitt of NPWS on 26th April 2018 at NPWS offices, Druid's Lane, Galway. An overview of the scheme was presented and key ecological constraints were discussed. The turlough habitats of the lowlands were the particular focus of the meeting and the need to assess the implications of hydrological change on these protected habitats.

5.3 Public Consultation – Non-Statutory Consultees

5.3.1 Public Information Day

In line with the OPW 'Customer Action Plan 2017 – 2019', a Public Information Day (PID) on the South Galway (Gort Lowlands) Flood Relief Scheme was held on the 3rd May 2018 in Sullivan's Royal Hotel, Gort. The Open day ran from 3pm to 9pm.

Advertising

The Public Information Day was advertised a week in advance of the event through local media (radio: Galway Bay FM and Clare FM, and newspaper: Connacht Tribune, Clare Champion & Galway Advertiser), parish newsletters (Saint Colman's in Gort, Kinvara Church, and Kilchreest / Ardahan), and the project website: <http://southgalwayfrs.ie/>. Additionally, the South Galway Flood Relief Committee placed a notice on their Facebook page.

An information brochure was made available to the general public and posters advertising the event were posted in local service stations. Copies of same are included in Appendix A.

In addition, local groups and Councillors were notified directly of the event 2 weeks in advance and were provided an opportunity to comment on the scheme in advance of the PID as follows:

Table 14: List of Councillors Contacted

Councillors
Councillor Joe Byrne
Councillor Shane Donnellan
Councillor Michael Fahy
Councillor Gerry Finnerty
Councillor Pat Hynes
Councillor Michael "Moegie" Maher
Councillor Jimmy McClearn
Councillor Ivan Canning

Table 15: List of Local Groups Contacted

Local Groups
An Óige
Ardrahan GAA
Ballindereen GAA
Beagh GAA
Burren Beo
Burren Lowlands
Burren National Park
Coole FC
Coole Park
Cooley Collins Festival Committee
Cuan Beo
Fleadh na gCuach Festival Committee
Gort Chamber of Commerce
Gort GAA Club
Gort Golf Club
Gort Online
Gort Rugby Football Club
Gort Tidy Towns
Hen Harrier Scheme
Irish Farmers Association (Galway Mayo Branch)
Kilbeacanty GAA
Kiltartan Gregory Museum and Millennium Park
Kinvara Community Centre
Kinvarra GAA
South Galway Flood Relief Committee
St. Thomas's GAA
Thoor Ballylee Yeats Tower

Public Consultation Exhibition Posters

The format of the PID was informally structured around exhibition posters which addressed each of the environmental themes/topics under consideration as part of the constraints study and included constraints mapping. Other posters highlighted the importance of public consultation, provided an overview of potential flood risk management measures for the area, and detailed the public exhibition process at scheme design. Copies of the posters are included in Appendix A.

Number of Attendees

Members of the public visiting the PID were invited to sign an attendance sheet to enable a record of the number of attendees to be maintained. It should be noted that not all attendees signed the sheet. A total of 55 attendees signed the sheet at the event.

Questionnaires and Feedback

In addition to seeking general feedback / information from the public on the scheme during the PID, a specific questionnaire was developed and attendees at the PID were encouraged to complete and return same within a defined timeline (by 12th May). Stamped addressed envelopes were provided to those who wished to return questionnaire. A blank copy of the questionnaire is included in Appendix A.

Verbal Feedback

Attendees at the PID were given an overview of the processes involved at each stage in scheme development and in particular were provided with a clear description of their important role in the constraints study stage.

A dedicated station was set up in the exhibition room which held digital mapping data for the study area and allowed members of the public to zoom in on their property. Staff also has an iPad on hand which allowed mapping data to be demonstrated in a more mobile fashion within the exhibition area. GIS software was used which allowed data entry against a mapped background. The use of live mapping as a data management tool assisted in focusing the conversation towards key concerns of each individual and facilitated the taking of accurate accounts of flooded areas and features of public concern.

Some members of the public brought photographic evidence of flood events with them, copies of which were taken by the PID team.

Comments received generally related to the level of flooding in the past and the hardships that were endured as a result:

- damage to property
- isolation due to roads flooding for lengthy periods (months)
- contamination of drinking water for livestock due to flooding of septic tanks and farm buildings
- inhibition of agriculture due to access issues
- constant stress and worry

Anecdotal evidence of the locations of caves, springs and swallow holes was also provided which will be investigated as relevant by the Project Team.

Almost all attendees indicated that it would appear that something has changed in the catchment in recent years which is resulting in flooding happening much faster than ever before. The perception from the public is for the need to slow the flow in the upper catchment.

A number of people had concerns about the road raising at Termon and the intentional blocking of the pipe which had been installed to relieve flooding. Also, concerns were raised about the swallow hole being historically blocked.

Several attendees raised concerns about the possibility of an overland flow path between the turloughs and the sea. Particular concerns related to a reduction in available areas of land for farming, and a change in salinity / water quality of Kinvara Bay affecting aquaculture.

The South Galway Flood Relief Committee (SGFRC) made verbal representation in relation to the scheme. SGFRC contend that the scheme that would be required to provide flood alleviation in the area must comprise measures to slow the flow in the upper catchment in combination with measures to decant excess water from the turloughs (i.e. a channel to sea). SGFRC raised concerns that the economic appraisal of the proposed South Galway (Gort Lowlands) Flood Relief Scheme will be in accordance with the *'Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal'* (also known as the *'The Multi-Coloured Manual'*) as *"this manual is more applicable to an urban setting"*. Thus, cost benefit for a scheme comprising upland and lowland measures will be difficult to demonstrate.

Written Feedback (Questionnaires Returned)

A total of 36 questionnaires were returned by the deadline of 12th May 2018. All submissions were from persons living or working in the study area and which have been affected by flooding in the past or could be affected by a flood relief scheme.

In accordance with GDPR, the questionnaires are held in a secure location in the offices of Mott MacDonald (Environmental Consultant for the scheme). A summary synopsis of the questionnaire responses is presented below.

5.3.2 Synopsis of PID Feedback

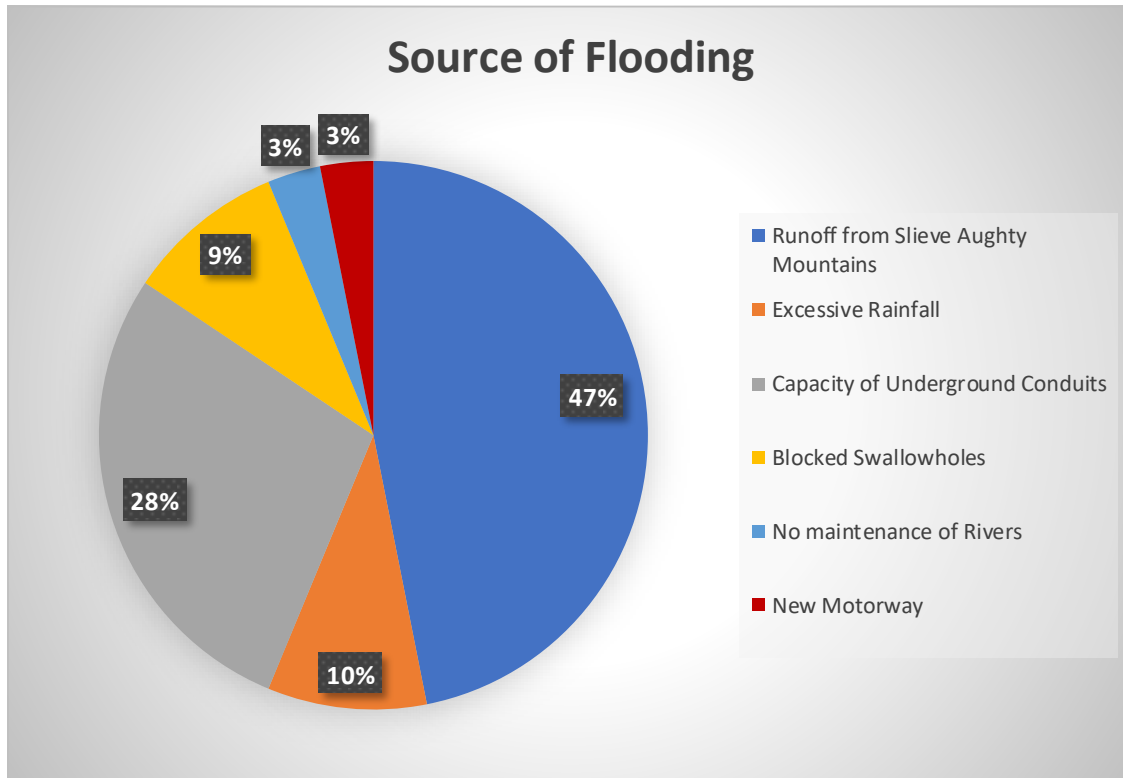
The below synopsis is based on questionnaires returned from the Public Information Day. It should be noted that not all sections of the questionnaires were completed in all cases. The output of the questionnaires is summarised broadly under the headings below.

5.3.2.1 Flooding and Flood Alleviation

Participants were asked about their experience of flooding, how often they had flooded, and whether flooding affected their property, access or both. This section was completed on 34 of the 36 submissions received. Of these 21 of the submissions related to property which had flooded and 13 were from members of the public whose property did not flood, however most had their access cut off by flooding. The frequency of flooding ranged from twice to more than 5 times, with the majority of properties (8 nr.) having flooded four times. Of the properties flooded, all were residential with associated agricultural lands.

The majority of responses returned identified runoff from the Slieve Aughty Mountains to be the primary cause of flooding (*Figure 3: Public Perception of Source of Flooding*). The finite capacity of the underground karst conduits is also recognised as a significant contributor towards flooding in the lowlands, with transport of silt due to increased erosion in the uplands raised as a concern. Generally, those who noted the limitations of the underground karst system as a contributing factor, also identified the runoff from the Slieve Aughty Mountains as a contributory factor.

Figure 3: Public Perception of Source of Flooding



Source: Questionnaires Submitted from PID

Participants were asked to rank, in order of preference, their opinion of which flood relief options are most appropriate for the area. For the purpose of this report the top 5 preferences identified in each questionnaire has been extracted and is presented in *Figure 4: Public Opinion on Appropriate Measures for the Study Area*. It should be noted that not all participants presented a top 5.

Flow reduction (primarily prescribed in the submissions to be slowing the flow from the Slieve Aughty Mountains) and flow diversion (primarily prescribed in the submissions to be a channel from the turloughs to the sea) were identified as the most preferable options for the area. Relocation of properties was also strongly presented as a preferred option: however, it should be noted this was primarily by those opposed to the diversion of flows to the sea.

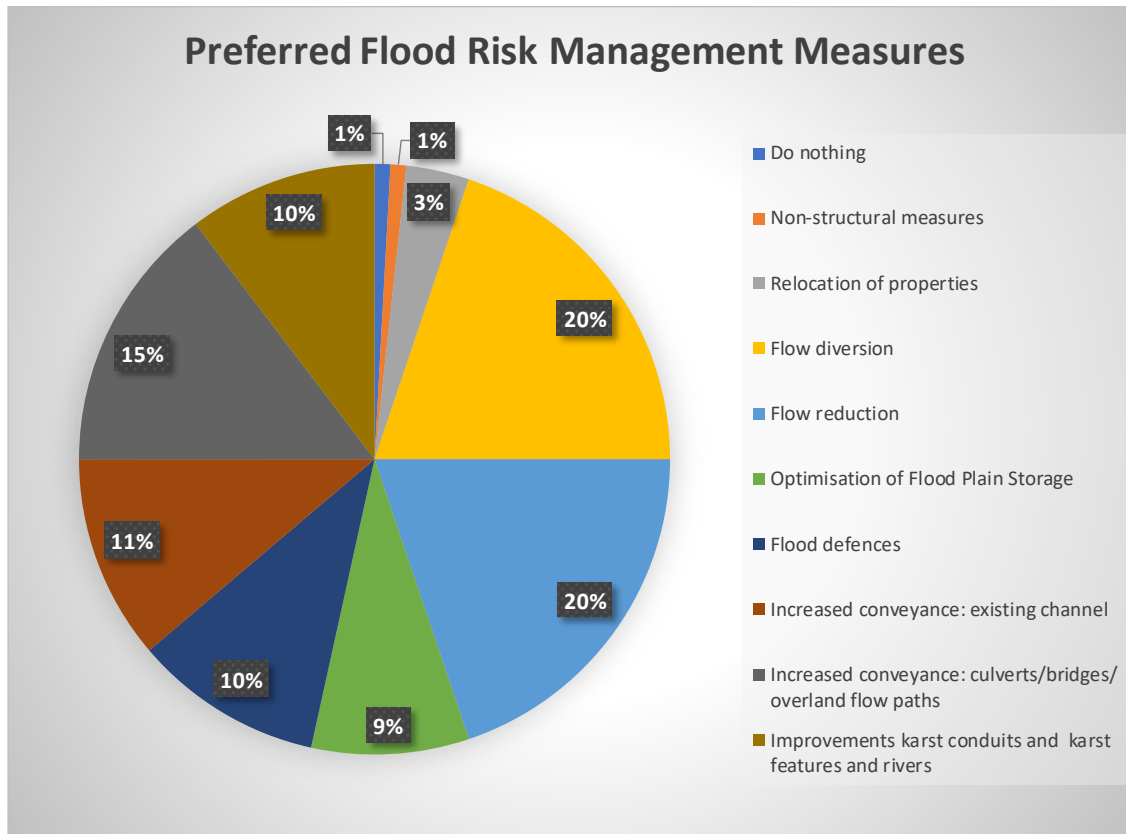
Several attendees requested that flow diversion at Killchreest to the Dunkellin River be considered as an option.

A number of submissions stipulated the need for shorter term action in the absence of the scheme, including:

- river clearing / dredging at Blackrock / Peterswell to Castleboy /Roxboro
- Measures should focus on correcting inappropriate landuse / management practices including in relation to blocked swallow holes

It was strongly communicated that whole catchment management is required to address flooding issues.

Figure 4: Public Opinion on Appropriate Measures for the Study Area



Source: Questionnaires Submitted from PID

5.3.2.2 Environmental Constraints

Respondents were asked to rank in order of importance 19 environmental topics. The results are presented hereunder. Cells highlighted in blue represent the weighting of importance most often selected by respondents against each environmental topic.

Ref	Objective	Not Important	Slightly Important	Important	Fairly Important	Very Important
A	Risk to local economy			6	4	12
B	Risk to transport infrastructure			7	3	9
C	Risk to utility infrastructure		1	9	4	5
D	Risk to agriculture / forestry			5	4	15
E	Risk to human health and life of residents			3	2	15
F	Risk to high vulnerability properties			1	2	15
G	Risk to social infrastructure		1	9	4	7
H	Risk to local employment		2	5	2	9

I	Risk to flood-sensitive social amenity sites			5	5	9
J	Risk to water-bodies			5	4	16
K	Risk to environment			4	5	16
L	Risk to protected sites and habitats		1	5	2	15
M	Risk to protected and endangered species		1	5	2	13
N	Risk to fisheries habitat / shellfish areas		2	4	3	11
O	Risk to visual amenity and views of the river	3	4	4	5	1
P	Risk to architectural features	1	7	2	5	2
Q	Risk to archaeology		5	4	5	2
R	Risk of soil erosion		2	4	4	10
S	Risk to impacts of climate change	1	1	4	5	8

Additional environmental concerns / comments raised are as follows:

1. The Yeats Thoor Ballylee Society stated that a flood relief solution should aim to ensure protection of important cultural landmarks; however, it is recognised that the protection of family homes / farms must come first. It was suggested that education of the local community / stakeholders on best land use practices to ensure no exacerbation of flooding is important.
2. *“Discharging freshwater into Kinvara Bay could destroy shellfish fisheries though change in salinity and water pollution”*. Works already carried out on the Ballinamana and Clarin rivers are increasing freshwater flows to the bay, and also the proposed changes in flows of fresh water into the bay from the Dunkellin river and Kiltiernan – Ballinderreen flood relief scheme. It is of utmost importance that all the above changes in fresh water flows are included in the environmental impact assessment and modelling of the receiving waters if it is proposed to change the flow of water into Kinvara Bay.

5.3.2.3 Summary of Public Concerns

From the feedback received it is generally interpreted that the proposal for a flood relief scheme for the South Galway (Gort Lowlands) area has been met with recognition of the need for the scheme. However, there are number of concerns regarding the scheme which have become apparent through public consultation as follows:

- Runoff from the Slieve Aughty Mountains is seen as the greatest contributor to flooding in the catchment. There is concern that methods to hold back / slow the flow in the upper catchment will not be cost beneficial and / or will take a long time to implement as a land use management practice
- The flood relief scheme may not resolve flooding of access roads and may not protect against land flooding (as such schemes are directed towards property protection)
- An overland flow channel to the sea could result in agricultural land (in the Caherawoneen area) being inundated and unavailable for use
- An overland flow channel to the sea could result in salinity and water quality changes in Kinvara Bay which could be detrimental to shellfish farming.

6 Conclusion

6.1 Introduction

This constraints assessment has identified the principal environmental constraints within the study area. These constraints have been illustrated on a set of constraints drawings which accompany this report. The constraints drawings were prepared utilising ArcGIS v 10.2. The drawings were prepared in order to best represent the constraints under the following principle headings:

- Biodiversity;
- Cultural Heritage;
- Landscape;
- Soils Geology and Hydrogeology;
- Water Resources;
- Population and Landuse; and
- Material Assets.

The constraints identified through this process will be used in the identification of viable flood risk management options.

The Project Team is confident, that the relevant recorded constraints have been identified and mapped (as relevant) which may influence the identification of viable flood risk management options. However, while we are confident that an extensive database of all 'recorded constraints' has been collected and collated, it is also recognised that local knowledge is critical to allow us to identify unrecorded constraints. Thus, the extensive input from members of the public at the Public Information day has been invaluable to the development of the constraints report. It is expected that further local knowledge will arise from the ongoing consultation process which is inherent to the environmental assessment and engineering design of the scheme.

This Constraints Report is now available to public, statutory and non-statutory stakeholders for their review and comment. The report has been developed through:

- Face to face meetings with stakeholders;
- A public information day, widely advertised in the study area; and
- The production of constraints mapping for presentation at the public information day; and

This report, plus any additional constraints identified following publication of this report on the project website will be considered during the next stage of scheme development: assessment of viable options for flood alleviation in the South Galway (Gort Lowlands) area.

Appendices

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