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Buncrana-Luddan FRS

Environmental Constraints Study Report

Donegal County Council

Report No. W3639-ENV-R002
23 May 2022
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Comhairle Contae Dhún na nGall
Donegal County Council

OPW Oifig na nOibreacha Poiblí Office of Public Works

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Terms and Abbreviations

%	Percentage
I	One
II	Two
III	Three
IV	Four
V	Five
ACA	Architectural Conservation Area
AEP	Annual Exceedance Probability
AFA	Area for Further Assessment
AFAc	Area for Action
AlluviMIN	EPA geoportal code for mineral alluvium
AminDW	EPA geoportal code for deep well drained mineral (derived from mainly acidic parent materials)
AminPD	EPA geoportal code for deep poorly drained mineral (derived from mainly acidic parent materials)
AminPDPT	EPA geoportal code for poorly drained mineral soils with peaty topsoil (derived from mainly acidic parent materials)
AminSP	EPA geoportal code for shallow poorly drained mineral soil (derived from mainly acidic parent materials)
AminSW	EPA geoportal code for shallow well drained mineral (derived from mainly acidic parent materials)
AQIH	Air Quality Index for Health

BL	ByrneLooby
BminSP	EPA geoportal code for shallow poorly drained mineral soil (derived from mainly basic parent materials)
BminSW	EPA geoportal code for shallow well drained mineral (derived from mainly basic parent materials)
c.	Approximately
CDP	Council Development Plan
CEMP	Construction Environmental Management Plan
CFRAMS	Catchment Flood Risk Assessment and Management Study
Co.	County
COVID-19	Coronavirus disease 2019
DCCAE	Department of the Environment, Climate and Communications
DHLGH	Department of Housing, Local Government and Heritage
DCC	Donegal County Council
EC	Executive Council
EIA	Environmental impact assessment
EIAR	Environmental impact assessment report
Eir	Eircom Limited
EirGrid	EirGrid Group
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
EU	European Union
FAQ	Frequently asked questions
FRMP	Flood Risk and Management Plan
FRS	Flood Relief Scheme
GIS	Geographic Information Systems
GSI	Geological Survey Ireland
HLC	Historic Landscape Characterisation
IFI	Inland Fisheries Ireland
km	Kilometres
km^2	Kilometres squared
kV	Kilovolt
LAP	Local Area Plan
LCA	Landscape Character Assessment
Made	EPA geoportal code for made ground

m	meter(s)
mm/yr	Millimeters per year
NBDC	National Biodiversity Data Centre
NHA/ pNHA	Natural Heritage Areas / Proposed Natural Heritage Areas
NIAH	National Inventory of Architectural Heritage
NMS	National Monuments Service
NPWS	National Parks and Wildlife Service
NRA	National Road Schemes
NTA	National Transport Authority
NWNB CFRAM	North Western – Neagh Bann (NWNB) Catchment Flood Risk Assessment and Management (CFRAM) Study
NWRM	Natural Water Retention Measures
OPW	Office of Public Works
pe	Population Equivalent.
Pers. Comm.	Personal Communication
QI	Qualifying Interests
Q-value	Biological River Quality Classification System
RMP	Record of Monuments and Places
RPS	Record of Protected Structures
SAC	Special Areas of Conservation
SCI	Sites of Community Importance OR Species of Conservation Interest
SEA	Strategic Environmental Assessment OR Social and Environmental Assessment
SI	Site Investigation OR Statutory Instrument
SMR	Sites and Monuments Record
SPA	Special Protection Area
sp.	Species (singular)
spp.	Species (plural)
TII	Transport Infrastructure Ireland
UNESCO	United Nations Educational, Scientific and Cultural Organization
WFD	Water Framework Directive
WHS	World Heritage Site
WwTP	Wastewater Treatment Plant
ZAP	Zone of Archaeological Potential

Executive Summary

The objective of this project is the identification, design, and submission of a Flood Relief Scheme, to alleviate the risk of flooding for the communities of Buncrana (Bun Cranncha) and Luddan. The Scheme will be technically, socially, environmentally and economically acceptable to the standards of the EU Directive on the Assessment and Management of Flood Risk (Floods Directive 2007/60/EC) transposed into Irish Law as SI 122 of 2010.

The scheme identified for Buncrana (Bun Cranncha) and Luddan potentially comprises the construction of hard defences and associated works through the urban area of Buncrana (Bun Cranncha) and Luddan along the banks of the following water bodies: Crana River, Mill River, Buncrana River, and Ballycarry River. The preferred measures outlined in the CFRAM comprise:

Preferred measures outlined in the CFRAM comprise:

- Flood Defences along Crana River
    - Riverside Park
    - Straboe, Cockhill Road
- Flood Defences along Lough Swilly
    - Sea wall along Swilly Road
- Flood Defences along Buncrana River
    - Lisowen
    - Pairc Mor
- Flood Defences along Mill River (Owenkillew)
    - GAA Pitch (Buncrana GAA Club)
- Flood Defences along Ballymacarry Stream
    - Loch View

Additional works/investigations identified post CFRAM that may include:

- Investigate at Elm Park Housing Estate
- Investigate Blockage at Cockhill Bridge
- Investigate flood mechanism around Taobh an Sruthán housing estate and Causeway Road
- Investigate flood mechanism around Lisfannon industrial Estate including beach outlets

The aim of the project at preliminary design stage is to carry out a detailed evaluation of viable flood relief measures, select the best measure or combination of measures and carry out a preliminary design.

A summary of the key constraints identified for each of the environmental disciplines considered as part of the baseline constraints identification exercise is described below. They include:

- Resources and Materials.
- Population and Human Health.
- Hydrology.
- Soils, Geology and Hydrogeology.
- Ecology and Biodiversity.
- Cultural Heritage and Archaeology.
- Landscape and Visual.
- Air Quality.
- Climate Change.
- Noise and Vibration.

Resources and Materials
Impacts on services and utilities such as watermains, stormwater gas mains, underground powerlines etc. will all need to be considered during the design process. The possible interruption of these services and utilities should be minimised, where possible. Furthermore, impacts on road and rail infrastructure, public rights of way and land ownership will need to be considered.

Population and Human Health
Constraints on population and human health will depend on the final nature and extent of the scheme, as well as the duration and nature of the construction phase.
Public and tourist amenities and facilities should also be considered key constraints. Impacts on public amenity areas adjacent to and requiring access to the rivers such as riverside walks, parks. playgrounds and tourist features should be considered, with replacement mitigation proposed if necessary. Impacts on tourist facilities, recreation and amenity facilities in the area should be considered constraints, especially those requiring access to the watercourses in the area. Development of the proposed scheme must take into consideration ways for areas of commercial or tourist potential maintain their aesthetic and public attractiveness both during construction and operation of the scheme.
Development of the proposed scheme must take into consideration ways to complement and enhance public amenities including green spaces in the proposed scheme footprint. Measures to protect extant recreational areas and green public spaces should be developed within the proposed scheme. The proposed scheme design should ensure continuity of the public walkways within its footprint.
The scheme design should take into account the value (both cultural and economic) of any buildings (residential, retail, etc.) close to the edges of waterbodies likely to be adversely affected by the scheme within the scheme study area.
Regional and local roads in the project are likely to be congested at peak travel times. Some roads in the scheme area are narrow and may not be suitable for site access. Bridges provides road and pedestrian access within Buncrana and accesses to the bridges should be maintained throughout scheme construction and development. There is a potential for construction to make traffic more congested in the study area and vicinity in the short term. Construction works will have to be mindful of maintaining access for both pedestrians and cyclists. A traffic management plan will be required with the CEMP.
Any design proposals should ensure that any bridges over watercourses are maintained where feasible so that temporary or permanent disruption of local transport links and access to homes and businesses in the study area are minimised. Urban development may limit access and movement of vehicles/equipment during construction at the following locations: • Riverside • Cockhill • Elm Park • Causeway Road / Taobh an Struthán It is also likely that the existing embankments will form part of the new scheme (either as is or upgraded/replaced) such that a maintenance regime post-scheme will be put into place. These works will need to be mindful of the tourist and retail trades also.
During construction of the scheme, traffic restrictions could pose problems for deliveries and site access and traffic management measures will be considered as part of the environmental impact

Population and Human Health
assessment process. The traffic associated with construction works will need to be mindful of the tourist and retail trades.
Sensitive receptors e.g. homes, schools, medical facilities, places of worship, should be considered key constraints in the design of the flood relief scheme. The scheme design should take into account the value (both cultural and economic) of any buildings (residential, retail, etc.) close to the waterbodies' edges or likely to be adversely affected by the scheme within the scheme study area. Medical facilities in the scheme study area are sensitive receptors and must be given due consideration. Flooding events can cause devastation to homes, businesses and local facilities, with social and human health impacts. Their specific protection through adequate flood defences should be considered in the design of the scheme.

Hydrology
Surface water bodies in the study area are classed under the WFD as 'at risk' of not meeting the WFD objectives of 'good' Ecological Status. Further, on account of the upper reaches of the Mill River (Mill (Donegal)_010) being classified as High Status under the blue dot programme, the portion of the Mill River associated with the Scheme (Mill (Donegal)_020) is being considered an AFAc under the 3rd Cycle, with the potential with a potential blue dot label to be provided across both (if 50% or more of waterbodies within any proposed AFAc fall within the High-Status Objective). Under WFD and LAWPRO requirements, the development of the scheme should incorporate measures to ensure that the hydromorphological conditions of the water body is consistent with the achievement of the required ecological status.
Contamination potentially present on site from historical land use must also be considered. The CEMP for the scheme will include measures to avoid mobilising and/or creating pathways for any contaminants present on site to the surface where surface runoff can introduce contaminants to surface water during enabling and construction works. Contamination potentially present from illegal dumping in river sections must also be considered.
Measures to protect active national water monitoring stations and hydrometric gauges and avoid impacting their data collection processes should be considered during design and construction phases.
The scheme design and schedule will need to take into consideration the development of any WWTPs, water abstraction facilities or third party 'WFD' projects in the vicinity of the scheme area, including potential impacts to utilities and infrastructure.
Potential impacts on the hydrology and morphology of the study area watercourses during construction, maintenance and operations should be considered. It is recommended that the hydrological and morphological (physical condition) regime of all waterbodies which might be affected by the scheme are fully considered to ensure that the WFD hydro-morphological status is unaffected.
The scheme should take into consideration water quality sensitive protected species, including Annex II species and qualifying interests for the SAC, recorded in waterbodies in the scheme area and vicinity. Additionally, water dependant terrestrial ecosystems are present within the study area and downstream and should be considered. The scheme should take into consideration the presence of protected water resources in the study area (Lough Swilly SAC and Lough Swilly SPA).

Hydrology
Projects to improve the quality of surface waterbodies in the catchment are being undertaken by local groups and other third parties. Works include practical measures using nature-based solutions to improve hydromorphology in the River Crana. Coordination with these groups is advised to ensure the projects are not detrimentally impacted during works.

Soils, Geology and Hydrogeology
Made ground and/or contaminated ground: Depending on the scheme design and type of works, for areas where made ground is uncompacted and/or highly variable it may require to excavate and place this material and replace with suitable founding material. This material may also be a possible a source of contamination. As this material will be excavated during construction, it may require contamination testing be undertaken during the detailed site investigation.
Contaminated land: The scheme area is located in an area with industrial heritage and commercial properties. If intrusive works are required during construction at locations where known or unknown contaminated land may be present (e.g. from recorded historical land-use), an investigation may be required into determine if land contamination is present and, if present, to determine its nature and extent.
Soils and groundwater: Poor draining soils occurring within the scheme footprint are potentially soft and compressible and will likely require a detailed site investigation (SI) in order to design a suitable flood defence scheme. Appropriate environmental controls and management measures will be implemented for any advance SI works, this may include a requirement for AA screening, or an application/notification to NPWS for approval. A CEMP will be developed for construction activities. The CEMP will identify appropriate equipment and construction techniques that should be used in circumstances where there is a potential impact to the environment. Engineering design should minimise the impacts of the flood relief scheme on the sections of river within the study areas and the wide catchment.
Groundwater vulnerability to contamination: Depending on the design of the scheme, works may occur adjacent or within areas where groundwater is classified by the GSI as 'extremely vulnerable' to contamination. Appropriate environmental controls and management measures will be implemented for any advance SI works. A CEMP will be developed for construction activities. A CEMP will be developed for all site investigation works, construction activities and traffic management.
Karst features: GSI data indicated that there are no recorded karst features in the study area. However, despite the lack of carbonate lithologies in bedrock in the study area it is prudent to consider that karst features such as caves, swallow holes, weathered rock and dolines may be present and can lead to ground surface and ground instability and are a constraint to be considered in the engineering design of the scheme.

Ecology and Biodiversity
The most significant ecological constraint in Buncrana is Lough Swilly, given its status as an SAC and SPA, in addition to shellfish protected water status within the wider environs of Lough Swilly. For this reason, any works that are to be carried by adjacent to the lough, or on the banks of waterbodies that fed into the lough, to reduce flooding must take this sensitivity into account. Where at all possible, any in-river and coastal/marine works should be avoided and every effort must be made to minimise, if not avoid, any run off to it. Options to include the setting back of

Ecology and Biodiversity
hard defences from the watercourses/waterbodies will continue to be considered as the design options progress in order to minimise potential impacts on the protected sites.
All work that is to be carried out adjacent to waterbodies must be carried out in such a way as to minimise the potential for events such as diesel or concrete spillages, run off of water with suspended sediment loadings or any accidental spillages. If it considered necessary to re-build of build in river structures (e.g. culverts, wiers), the same sort of construction approach should be designed in to minimise resuspension and loss of concrete to the river.
Appropriate Assessment under Articles 6(3) and 6(4) of the EU Habitats Directive (Directive 92/43/EEC) will be required for the proposed scheme.
In ecological terms, the river corridor (including the river itself), the coast (including coastal mudflats) and transitional estuarine waters support a number of protected species. Any in-river and bankside works, and costal and estuarine works have to be designed to minimise potential impacts on these (and all other) species. All works should be planned wherever possible to be carried out at times of the year that are ecologically least sensitive e.g. outside bird nesting (March – September) and fish migration periods (Spring/Summer, depending on species).
As a European protected species, the otter is fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Any scheme option that may have the potential to disturb otters must be assessed. A full otter survey will be completed once the scheme extents are known. If otters are found to be present and disturbance is likely, then DCC will need to apply for a licence to allow proposed development works that might affect otters to proceed legally. The potential impacts on otter will be assessed and reported in the EIA. Otter mitigation works can potentially be conducted at any time of year but must avoid the breeding season (usually Spring but can be any time of year) if holts are present on site.
No badger setts or field signs were recorded during the site visit. Pre-construction badger surveys will be carried out to maintain the validity of species data. Should a badger sett be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Construction of new setts must be completed in Spring/Summer with blocking and destruction of existing setts completed in Autumn/early winter.

Ecology and Biodiversity
The scattered mature trees, bridges, architecture (churches, masonry) and areas of low water flow provide good foraging, roosting and commuting routes for bat species in the area. Options that require the removal of mature trees or works to bridges or other riverine structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats. Once more detail becomes available pertaining to the proposed structural alterations to the site (including the proposed methods of construction), the site should be re-visited for the purpose of: • Surveying key locations (e.g. where it is known that potential roosting habitat will be removed or disturbed); and • Obtaining more detailed information about any potential bat roosts (i.e. whether it is a maternity roost, hibernaculum, etc.) This information will inform any considerations of mitigation measures that may need to be implemented. The optimal time to conduct map surveys are May and August when bats are most active. If bats are found, they should not be disturbed during hibernation period (October to March) or maternity period (June to August). If a bat roost requires removal, then a licence would be required. Removal of roosts should be carried out during the summer months for hibernation roosts and during the winter months for maternity roosts. As all Irish bats and their roosts are protected under national and EU legislation it is an offence to disturb or interfere with them without a licence. Such a derogation (which must be given by the Minister for the Environment, Heritage and Local Government) can only be sanctioned where there is no satisfactory alternative and where it will not be detrimental to the favourable conservation status of the species concerned. Therefore, any felling of trees or work on bridges which provide suitable roost habitat for bats should be sought in advance of any development that may interfere with such roost sites.
A fish survey of suitable waterbodies in the study area should be competed on site to establish the presence/absence/abundance of fish species. This will involve netting and electrofishing surveys, where required (i.e. where instream works will cause disturbance to the river bed via structure or excavation) and where technically feasible. In terms of the construction programme, it should be noted that in salmonid catchments, in-stream works are not permitted between the months of January to April (migration) and October to December (spawning). This corresponds with guidance from Inland Fisheries Ireland (Murphy, 2016). Lamprey (both species) spawning takes place in the spring and early summer period in often the same habitats where salmon and trout spawn (O'Connor, 2017). The spawning season for brown and sea trout is November to February. If spawning grounds are found to be present in the construction zone for the scheme, then this period should be avoided. A full impact assessment and management plan for these fish species will be produced as part of the EIA report once full scheme details (including construction methods) are known.
Surface water bodies in the study area are classed under the Water Framework Directive (WFD) as 'At risk' of not meeting WFD objective of 'Good' Ecological Status and, additionally, a high status and 'Blue dot' river is present which is an indication that the waters contain a high diversity of flora and fauna that are sensitive to the water conditions. Under WFD requirements, the development of the scheme should incorporate measures not to worsen its status. All possible risks of point source pollution or runoff during construction and operation should be assessed and prevented. Works during the construction of the scheme could pose a threat to the water

Ecology and Biodiversity
quality of water bodies within and downstream of the study area though various mechanism, chiefly: • Increasing suspended solids in the water bodies through release or run-off of significant amounts of suspended solids during enabling works and construction; and • Unplanned events such as leaks/spills/runoff/accidental release or escape of fuels, oils and lubricants, bulk liquid cement, contaminated leachate, etc. Measures to protect surface water from leaks/spills, contamination, increased turbidity or input of suspended solid, etc, should be considered.
The Inishowen Rivers Trust (IRT) is currently undertaking a study, sponsored by OPW, LAWPRO and DCC, to bring about nature-based flood solutions in Donegal through implementation of Natural Flood Management (NFM) and Natural Water Retention (NWR) to improve water quality, restore riparian habitats, retain sediment nutrients and build community capacity (Inishowenriverstrust.com). These solutions are sponsored and supported by the OPW, LAWPRO and DCC and, as such, the Scheme should be aware of these intentions and implement NFM and NWR where possible. Further, the National Biodiversity Action Plan 2017 – 2021, and more particularly Objective 4 supports nature-based solutions in flood risk management as a biodiversity enhancement measure, with catchment-wide focus and non-structural measures preferred. The scheme should investigate options for the provision of such measures.
Japanese Knotweed, Himalayan Balsam and Giant Rhubarb have been identified as present within the study area. An Invasive Species Management Plan has been prepared separately (Report Ref (ByrneLooby, 2021 Ref: W3639-BLP-R-ENV-011)). An invasive species treatment and management plan will be implemented for the scheme during 2022 and on a continuous basis leading to construction and operation of the Scheme.

Cultural Heritage and Archaeology
All archaeological and historic sites/features and properties with statutory designation in the study area are the key considerations in the constraints study in relation to cultural heritage, these sites have been identified and mapped for the constraints study. In summary the following constraints have been identified. The scheme area may contain known and previously unknown underwater archaeological heritage that should be considered in any study to inform planning design and any potential EIARs.
There is a general riverine/coastal archaeological potential in Buncrana and Lough Swilly. All wrecks over 100-years old are protected under the 1987 and 1994 (Amendment) Acts of the National Monuments Acts. There are 27 Register of Protected Structures (RPS) sites within the constraints study area. These structures/features should be considered as cultural heritage constraints during the design of the proposed flood relief scheme and avoided where possible. There are 51 NIAH sites in the study area that have not been added to the RPS, however there is a potential that they may be added in the future. Every care should be taken in these locations to avoid direct impacts on protected structures or by means of careful design or by the application of appropriate mitigation measures. This includes development that might adversely affect the setting of the protected structure. Any

Cultural Heritage and Archaeology
design proposals in the vicinity of protected structures vicinity should be carried out in a way that will not materially affect the character, integrity, amenity and setting of these sites. An architectural conservation specialist may be required advise on appropriate measures mitigate any potential impact on this. In accordance with the Architectural Heritage Guidelines any work to or in the vicinity of a Protected Structure, NIAH sites require a conservation heritage impact assessment by a conservation architect.
There may be opportunities under Objective 4 of the County Donegal Heritage Plan Actions set out in the Heritage Council Strategy (2018-2022) to 'promote heritage education, training, tourism and outreach activities'.
O'Doherty's Keep, mill buildings, mill race, bridges, and weirs provide cultural, historical industrial and social amenity to Buncrana. Every effort should be made to retain or enhance this amenity. While change within the setting of an historic site or landscape may be acceptable, in certain instances development will be considered intrusive and inappropriate (such as large embankments, walls or similar permanent infrastructure). Specific mitigation requirements can only be identified as issues for development once the design options are defined. Further assessments such as archaeological testing, underwater archaeological assessments, structural architectural heritage appraisals or structural surveys, etc. may be required in the next phases of the assessment or as mitigation measures for the scheme.
Arranging Archaeological Licenses when working in the vicinity of monuments or possible areas of interest is a constraint to the Project and can be a time-consuming exercise.

Landscape and Visual
The existing trees and planting within the study area provides both visual and recreational amenity for the residential and amenity areas within the study area and the wider districts. Additionally, the 'green' and coastal character of the landscape is considered to be a key component of local tourism development for the towns and the wider area. Such areas also provide a network of habitats, ecological 'corridors' and 'stepping stones' essential for wildlife. Accordingly, such feature should be retained where possible.
The proposed development of the subject site will result in a change to the landscape character which will be most noticeable locally, such as from the adjacent residential and tourist areas (including along the river banks and bridges). The potential magnitude of this change will be assessed when the details, scale and extent of the proposed interventions have been finalised. Historical landscape character and cultural heritage: Within the study area there are several designations and structures of national interest that need to be considered such as Protected Structures and Recorded Monuments, a Conservation Area, and Sites of Archaeological Interest.
Protecting the key landscape resource which underpins the Wild Atlantic Way and the Donegal Tourism brand generally from inappropriate development is recognised as a key planning challenge in Donegal. There are recreational amenities within the study area that need to be considered in relation to possible impacts on their accessibility, recreational and visual values: Walk/Cycle Pathways along the coast and banks of the rivers, Land use zoning objectives in county development plans – areas zoned as for Amenity.

Landscape and Visual

Key viewpoints will be selected when the details, scale and extent of the proposed interventions have been defined. There is a need to protect:
• Views towards the rivers, estuary and lough from business serving the tourism and recreational sector (e.g. cafes, etc),
• Recreational views – towards to and from the river, estuary and lough (e.g. public pathways),
• Public, recreational and residential views to and from the coast, rivers and bridges, with emphasis on area that may be visually impacted by the suggested hard defence proposals in CFRAM:
  ○ Towards and from Lough Swilly SAC and SPA
  ○ Towards and from Recorded Monuments and Protected Structures
  ○ Public pathways and amenity areas which pass through the study area
  ○ Other tourist amenities e.g. guesthouses, cafes, restaurants, seating areas

During the construction phase, the following elements of the proposed development have the potential to cause visual impacts, they will however be short to medium term in duration: • Temporary site works – hoarding, lighting, cranes, car parking, storage areas • Construction traffic – dust and emissions • Tree and vegetation clearance • Groundworks – cut and fill excavations • Laying of foundations
The principal elements which are likely to give rise to landscape and visual impact in the long term/operational phase are: • Removal of some existing trees • Height of proposed structures/ interventions • New structures/ interventions • Change of character – dependent on proposed interventions type and scale • Proposed tree and shrub planting Appropriate design, siting and mitigation measures are required to integrate the proposed scheme within the landscape.

Air Quality
The key constraints in relation to air quality are any sensitive receptors in proximity to the location of construction works. The scheme design should take into consideration any air/climate sensitive receptors such as residences, schools, businesses, and medical facilities located in proximity to works associated with the flood relief scheme.

Climate Change
The potential impacts of climate change will need to be considered in the design of the proposed scheme.
Carbon impacts in relation to flooding consist of a) the potential impacts associated with flood damages and b) potential impacts associated with the construction and operation of the flood defences themselves.

Through installing flood relief measures, the potential impacts associated with flood damages can be largely mitigated, however carbon impacts from construction and operation (the 'carbon cost' will be calculated as the scheme progresses.
The Climate Change Sectoral Adaptation Plan for Flood Risk Management (2019 - 2024) considers Flood Relief Schemes to be a key prevention strategy for effects of climate change, and as such, this Project is integral to the overall climate adaptation strategy. However, climate change is considered as a constraint on the design of the scheme, as higher rainfall and extreme weather events attributing to climate changes may lead to higher water levels, which would influence the design of the scheme.
The design should be mindful of the Donegal County Council Climate Adaptation Strategy which sets out strategic priorities, measures and responses for adaptation in the County over the next five years, as required by the Climate Action and Low Carbon Development Act 2015 (Donegal County Council, 2019). The risk of flooding and provision of sustainable protection infrastructure is noted as a key item in the Strategy. The WFD has also called for a shift in flood management approach away from site specific hard engineering solutions, towards an integrated assessment of water resources and flood management at the catchment scale. The assessment and design should be mindful of this and reference key climate change legislation.
As part of the Project, the foreseen 'Carbon Cost' of the tonnes of Carbon Dioxide (CO_2) the proposed scheme options will generate, and the financial implications of this CO_2 quantity will be undertaken, taking into account relevant guidelines from the EU.

Noise and Vibration
During the Options assessment it is recommended that the short-listed flood alleviation measures be assessed in relation to the impact of noise and vibration during the construction phase of the project.
Noise and vibration effects are expected to occur during the construction phase only. Construction noise is temporary in nature, and therefore the normal way of minimising the impact is to limit the working hours. The Local Authority may place noise limits on the construction works. The project CEMP will include measures to avoid or minimise the potential impacts of noise on sensitive receptors during construction.
Ground-borne vibration attenuates rapidly with distance. People are very sensitive to vibration and can feel vibration long before it becomes an issue in terms of cosmetic damage or structural damage to buildings. Assessment of potential for damage due to vibration should be carried out where vulnerable structures are located in close proximity to works such as sheet piling.
The scheme design and methods for works during construction should consider potential impacts to potential vulnerable structures and consider if there is a requirement for ongoing noise and vibration monitoring during construction.
Traffic along national route roads within the town is congested and traffic noise, particularly at peak times, and construction traffic should be managed to ensure cumulative or in-combination impacts from noise and/or vibration are avoided, where possible, or minimised.

1 Introduction

1.1 Overview

The Office of Public Works (OPW), working in partnership with Donegal County Council (DCC) and other Local Authorities, commissioned and have completed the North Western – Neagh Bann (NWNB) Catchment Flood Risk Assessment and Management (CFRAM) Study. The relevant CFRAM Study reports are available, for information purposes, from the publications section of www.FloodInfo.ie (CFRAM) (Office of Public Works, 2021b).

The NWNB CFRAM study area included Buncrana (Bun Cranncha) and Luddan as an Area for Further Assessment (AFA) and concluded that a flood relief scheme would be viable and effective for the communities. Possible solutions identified in the CFRAM were comprised mainly of construction of hard defences and associated works in locations along the Crana River, Mill River, Ballymacarry Stream and Lough Swilly. These measures, as well as other possible investigation areas, are being assessed within the project level assessment (see Section 1.5 for further detail). The potential for Natural Water Retention Measures (NWRM) is also being assessed as part of a NWRM Feasibility Assessment and may reduce the scale of the structural protection works required as part of the schemes. These measures may include catchment woodlands, land and soil management practises, agricultural and upland drainage modifications, overland sediment traps, river bank restoration and washlands and offline storage ponds.

All waterbodies included in the Scheme Area are mentioned in Table 1-1 below.

Table 1-1: Water Bodies in the Scheme Area

		Alternative Names		
Reach ID	**DB2 FRS Name**	**EPA**	**Local**	**CFRAM**
0141M	Crana River	Crana	-	Crana
0142M	Buncrana River	-	-	Buncrana
0139M	Mill River	Mill (Donegal)	-	Owenkillew
0139A	Millfield Millrace	-	-	Millfield Millrace
0138M	Ballymacarry River	Ballymacarry Lower	-	Ballymacarry
0140M	Gransha	-	-	Gransha
0141A	Tullyarvan Millrace	-	-	Tullyarvan Millrace
0143M	Umrycam	-	-	Umrycam
0144M	Lenynarnan	-	-	
0146M	Luddan Middle	-	-	
0147M	Luddan Upper	-	-	
0148M	Mouldy Hill	-	-	
0149M	Barnes	-	-	

0150M	Lisfannon	-	-	

The scheme area for the CFRAM study is shown in Figure 1.1, including measures proposed on the Crana River, Mill River, Ballymacarry Stream and Lough Swilly.

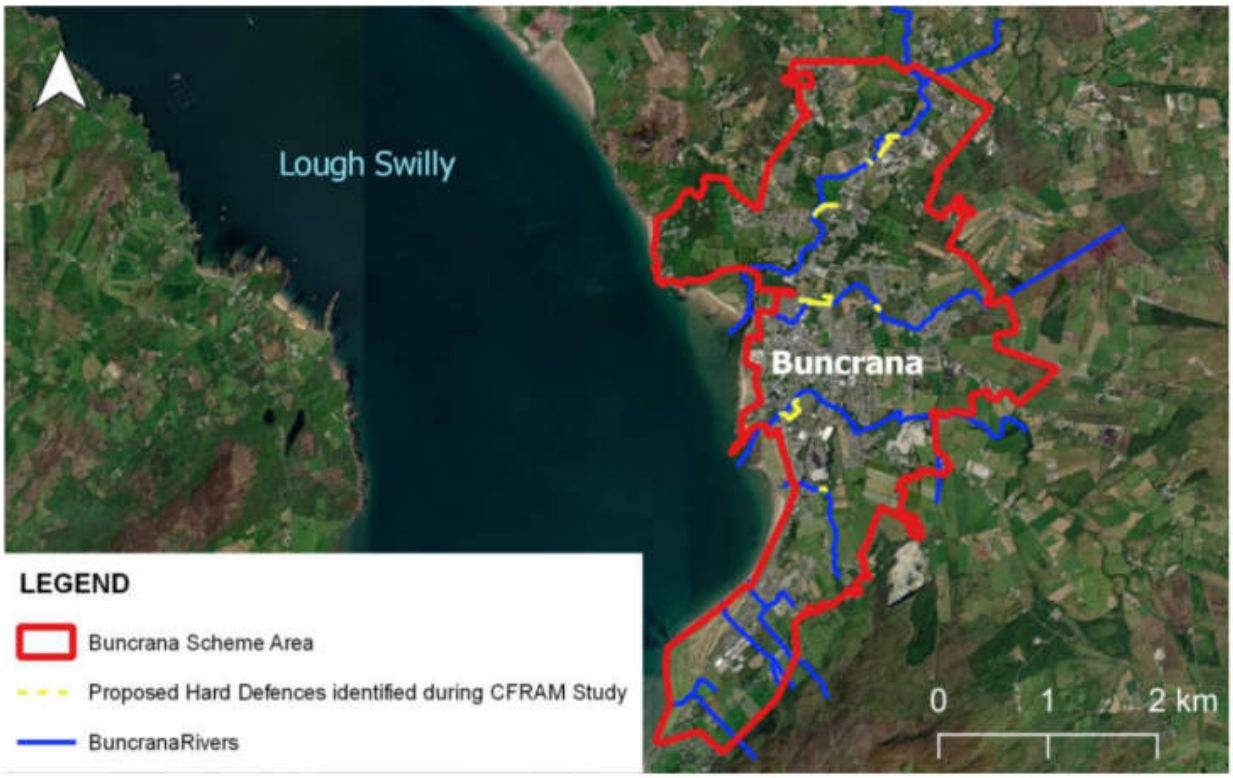

Figure 1.1 Scheme area with CFRAM measures and additional areas for investigation

Flood risk in Ireland has historically been addressed through the use of structural or engineered solutions (arterial drainage schemes and/or flood relief schemes). In line with internationally changing perspectives, the government adopted a new policy in 2004 that shifted the emphasis in addressing flood risk towards:

- Catchment-based context for managing risk.
- More pro-active flood hazard and risk assessment and management, with a view to avoiding or minimising future increases in risk, such as that which might arise from development in floodplains.
- Increased use of non-structural and flood impact mitigation measures.

Notwithstanding this shift, engineered solutions to manage existing risks are likely to continue to form a key component of the overall national flood risk management programme and strategy. A further influence on the management of flood risk in Ireland is the 'Directive on the Assessment and Management of Flood Risks 2007/60/EC' (also known as the 'Floods Directive'). The aim of this Directive is to reduce the adverse consequences of flooding on human health, the environment, cultural heritage and economic activity.

Typical proposed flood relief works could involve raising the flood defence levels of the river by constructing new flood defence walls incorporating flood gates and/or strengthening and raising existing ones, constructing new flood defence embankments and/or strengthening and raising existing ones, raising and repairing existing bridge parapets, work on weirs, work on channels and culverts, constructing storage ponds and/or strengthening and enlarging existing ones, installing new flap valves and repairing or replacing existing ones, installing new screens on culvert inlets and/or replacing existing ones, installing pressure manhole covers, and may include ancillary works such as pumping stations and/or storage tanks.

1.2 Environmental Study Area

Buncrana and Luddan are located on the eastern shore of Lough Swilly, a sea inlet, in north County Donegal. Outside of the urban centre at Buncrana the area is predominantly rural and agricultural in nature.

Buncrana is located in a basin bordered by Gory Hill to the north, Crocknamaddy to the north-east, Meenkeeragh Hill to the east and Mouldy Hill to the south. Lough Swilly borders the western edge of the town.

Luddan is a townland in Buncrana. Luddan is located to the south of Buncrana in a shallow basin between Hill Head to the east and Lough Swilly to the west and development of the areas is broadly linear in a north to south configuration with a sandy beach and golf links separating the village from the shore of the lough to the west.

The environmental constraints study area has been developed in consideration of the preferred option in the CFRAM study and additional areas for further investigation as identified by DCC and BL. The preferred measures identified in the CFRAM, their location(s), and overall project footprint may be liable to change as more information becomes available through project level assessment.

The environmental constraints study area includes the lengths of river channel / watercourse that have hydraulic influence on the area intended to benefit from, and be protected by, any feasible scheme as well as the catchment areas draining to the downstream ends of those river channels. The study area boundary for each environmental discipline will vary according to the location of receptors and individual topic best practice, appropriate statutory and/or specialist guidance, and applicable legislation and regulations.

The environmental constraints study area for each discipline topic is defined in each section, accompanied by a figure showing the extents of the study area for that topic.

The constraints study will consider the effects of the construction and operation of the scheme in the catchment area as a whole, where appropriate. Site surveys have been and will be undertaken to collect recent and site-specific baseline data to inform the scheme design, the scoping report, environmental impact assessment (EIA) and Appropriate Assessment (AA) for this scheme and data, where appropriate and available at the time of writing and, have been included in consideration of potential constraints.

1.3 Project Background and Need for the Scheme

Flood hazard is the potential threat posed by flooding to people, property, the environment, and our cultural heritage. Flooding only presents a risk however when people, property, businesses, farms, infrastructure, the environment, or our cultural heritage can be potentially impacted or damaged by floods.

Flood risk is the combination of the probability of flood events of different magnitudes and the degree of the potential impact or damage arising from a flood.

The objective of this project is the identification, design, submission (for planning consent) and construction of a Flood Relief Scheme (FRS), that is technically, socially, environmentally and economically acceptable, to alleviate the risk of flooding to the communities of Buncrana and Luddan in accordance with to the standards of the EU Directive on the Assessment and Management of Flood Risk (Floods Directive 2007/60/EC) transposed into Irish Law as SI 122 of 2010.

1.4 History of flooding

There is a history of flooding at Buncrana with the most recent event recorded in August 2017, impacting properties, disrupting local roads, and damaging local amenities including Swan Park and sports facilities. Prior to this, several flooding events have recently been recorded in Buncrana in 1985, 1987, 1989, 2011. A total of 6 reports of flood events have been cited and the timeline of these events and reported sources is displayed in Table 1-2 below.

Table 1-2: Flood History Overview Timeline

Date	Receptors	Source
22/08/2017	Road Flooded (Cockhill Bridge)	Fluvial (Blockage)*
22/08/2017	4 properties in Elm Park Flooded and Cockhill Football Pitch	Fluvial*
22/08/2017	6 properties in Taobh an tSruthan	Pluvial & Fluvial*
06/2012	Housing Estate at Elm Park	Fluvial*
10/2011	Flooding Reported	Fluvial*
03/2006	Road Flooded in Luddan	Pluvial & Fluvial*
10/1989	Roads Flooded	Fluvial*
09/1985	Commercial Premises Flooded	Fluvial*
10/1870	Main Road Bridge Flooded	Fluvial*

*Source of flooding was not reported upon however this assumption is made based on the details of the report text.

Historical flooding is noted from the Buncrana River where three discrete areas of fluvial flooding occurred due to insufficient channel capacity, resulting in overland flow and inundation of the floodplain. On the Crana River, out of bank flooding has also occurred due to insufficient channel capacity and blockage (Office of Public Works, 2021b).

1.5 Potential Flood Risk Management Measures

The scheme area for Buncrana includes four flood cells, three fluvial and one coastal. The measures proposed in the FRMP consist of a series of sea walls, flood embankments, flood walls and upstream storage, if required.

On the Crana river, linear defences are proposed at two locations namely Cock Hill and Riverside Park.

The housing estate, Elm Park located further upstream does not have defences proposed but was subject to flooding in 2012 and 2017. This area will be assessed for flood risk and option assessment to account for these flood events in the analysis. Cockhill Bridge will also require blockage analysis as part of the assessment.

Based on discussion with the local DCC area engineers, it is suspected that the culvert beneath Causeway Road on the Crana River has capacity and/or blockage issues. This caused back up in the watercourse and overland flow in the vicinity of Taobh an Sruthán housing estate before flowing south behind houses on Pairc Mor Road. The area will require further assessment to ensure proposed measures are appropriate to deal with the flooding mechanisms encountered.

On the Mill River (Owenkillew), linear defences are located adjacent to the GAA pitch of the Buncrana GAA Club and a sea wall along Swilly Road.

Flood risk to properties to the south of the Study area in the vicinity of Lisfannon industrial Estate will be assessed for flood risk and options assessment.

A viable scheme option for Buncrana and Luddan was identified in the CFRAM level of assessment and the preferred measures outlined in the FRMP consist of a series of sea walls, flood embankments and flood walls. The hard defences would provide an SoP of 0.5% AEP for coastal flood events, and an SoP of 1% AEP for fluvial flood events with an average height of 1m and a total length of 1.6km.

There are residential and business properties at risk of flooding within Buncrana. Social infrastructure assets including a leisure centre, social amenity sites and transport infrastructure assets including regional and urban local roads are situated within the floodplains. Crana River Water Treatment Plant is also at risk of flooding (Office of Public Works, 2021b).

Preferred measures outlined in the CFRAM comprise:

- Flood Defences along Crana River
    - Riverside Park
    - Straboe, Cockhill Road
- Flood Defences along Lough Swilly
    - Sea wall along Swilly Road

- Flood Defences along Buncrana River
    - Lisowen
    - Pairc Mor
- Flood Defences along Mill River (Owenkillew)
    - GAA Pitch (Buncrana GAA Club)
- Flood Defences along Ballymacarry Stream
    - Loch View

Additional works/investigations identified post CFRAM may include:

- Investigate at Elm Park Housing Estate
- Investigate Blockage at Cockhill Bridge
- Investigate flood mechanism around Taobh an Sruthán housing estate and Causeway Road
- Investigate flood mechanism around Lisfannon industrial Estate including beach outlets

A project-level options assessment will consider the scheme option outlined in the CFRAM and any other viable options arising out of project-level assessment. Development of the latter is ongoing and will be based on more detailed information than was available for the CFRAM, including detailed hydrological assessment, hydraulic modelling studies and environmental studies. Consequently, the type and location of measures outlined in the CFRAM and shown in Figure 1.2 are liable to change as further information becomes available through project level assessment and the level of flood risk both now and in the future is confirmed.

Figure 1.2 (overleaf) shows the location of hard defences in the preferred option in the CFRAM.

Figure 1.2 Project Scheme Area and Proposed Flood Defence Measures

2 Environmental Constraints

2.1 Stages of Work

Various stages of work are carried out in the completion of a flood relief scheme. There are five stages of work as outlined in Table 2-1 and the progression to each subsequent stage depends on the outcome of the previous stage.

Table 2-1 Flood Relief Scheme Stages

Stage	Environmental Assessment	Examples of the specific studies completed as the scheme progresses
I	Scheme Development	Data Gathering and review Topographical Surveys LiDAR surveys Drainage Surveys Ecology Surveys Archaeological Investigation Hydrology Study & Hydraulic Modelling Flood Defence Asset Surveys Site Investigations and site walkovers Conduct Flood Risk Assessments Prepare a number of Flood Risk Management Options Carry out a Cost Benefit Analysis Selection of a Preferred Option Flood Risk Management Plan Interference Notices Public Consultation
	Initial Consultation with Stakeholders	
	Constraint Study	
	Screening for Appropriate Assessment	
	Appropriate Assessment	
	Detailed Design	
	Scoping for EIA	
	Environmental Impact Assessment	
	Public Consultation	
	Preparation of Environmental Assessment of Options Report	
	Public Consultation on Preferred Scheme	
	EIAR for Preferred Option	
II	Preparation of Part X Planning Application	
	Submission of a Part X Planning Application to An Bord Pleanála	
III	Detailed Design Confirmation	
	Tender	
IV	Construction Supervision	
V	Handover to Client	

ByrneLooby have been appointed to bring the scheme from preliminary design (Stage I), assessing various options available, through public consultation, detailed design and environmental procedures (Environmental Impact Assessment and Appropriate Assessment) to planning application to An Bord Pleanála (Stage II).

Subject to successfully satisfying An Bord Pleanála requirements, the scheme will then be designed and tendered (Stage III), constructed (Stage IV) and delivered (completed) to the client (Stage V).

2.2 Scope of Constraints Study

The Environmental Constraints Study is the first step in the preparation of an environmental impact assessment report for the Buncrana-Luddan Flood Relief Scheme. The purpose of the constraints study is to identify the key environmental aspects which may be impacted upon by possible flood relief measures and/or which may impose constraints on the viability and/or design of these measures.

The scope of the Constraints Study has followed the guidelines prepared by the Department of Housing, Planning and Local Government: Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, August 2018 (Department of Housing, Local Government and Heritage, 2018).

Guidance contained with the Environmental Protection Agency's Guidelines 'Advice Notes on the Current Practice in the Preparation of Environmental Impact Statements' (2015) has also been considered (EPA, 2017).

This environmental constraints study has been reported under the following sub-discipline/topic area headings:

- Resources and Materials
- Population and Human Health
- Hydrology
- Soils, Geology and Hydrogeology
- Biodiversity
- Cultural Heritage and Archaeology
- Landscape and Visual
- Air Quality
- Climate Change
- Noise

For this study we have combined the human health, land use, traffic and population in the population and human health section. Similarly, other sections of the constraints study e.g. noise, air quality, etc. are also applicable to human beings. Air quality includes climate and noise includes vibration due to the nature and location of the scheme.

2.3 Methodology

ByrneLooby and its specialists have undertaken a series of desk studies and preliminary site visits as part of the constraints study. Further details on constraints are presented in the following sections of this report. Information has been gathered with due regard to the likely environmental impacts of the proposed scheme, and the statutory requirements for Environmental Impact Assessment and Appropriate Assessment as set out in the EU Directives and associated Irish legislation.

The constraints study has had regard in general to the following guidance and information sources as mentioned below. Specific guidance and information sources are referenced in individual specialist sub- sections.

2.3.1 General Guidance and background information

The following guidance and information sources were referred to in the preparation of this constrains study report:

- Department of Housing, Planning and Local Government, August 2018. Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Local Government and Heritage, 2018).
- Guidelines on the information to be contained in Environmental Impact Statements, 2002 (Environmental Protection Agency) and Draft Revised Guidelines, 2017.
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (Environmental Protection Agency, 2003) and Draft Revised Notes, 2015.
- Department of Environment, Heritage and Local Government (2010) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.
- European Communities (2000) Managing Natura 2000 Sites: The Provision of Article 6 of the Habitats Directive 92/43/EEC.
- EC Environment Directorate-General (2000) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.
- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.
- Department of Environment, Heritage and Local Government (2010) Circular NPW1/10 & PSSP 2/10 Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities.

- Flood Risk Management Plan for the North Western River Basin (UOM01) (Office of Public Works, 2021b).
- NWNB SEA Statement UoM01 (OPW 2017)[1].
- North Western-Neagh Bann CFRAM AA Screening report (OPW 2015)[1].
- NWNB AA NIS - UoM01 (OPW 2016)[1].
- AFA Final Designation Report (OPW 2012)[1].
- Appropriate Assessment Determination in accordance with Regulation 42(11) of the European Communities (Birds and Natural Habitats) Regulations 2011 – 2015 for Flood Risk Management Plan for the North-Western River Basin (UoM01) (OPW 2018)[1].
- Methodology for Classifying the Vulnerability of National Monuments from Flooding in The Republic of Ireland (OPW 2011)[1].
- National Pluvial Screening Project for Ireland (OPW 2010)[1].
- North-West and Neagh-Bann Flood Risk Review Final Report May 2012 (OPW 2011)[1].
- North Western - Neagh Bann CFRAM Study UoM 01 Hydraulics Report (OPW 2014)[1].
- North Western - Neagh Bann CFRAM Study UoM 01 Hydrology Report (OPW 2013)[1].
- North Western - Neagh Bann CFRAM Study UoM 01 Inception Report (OPW 2012)[1].
- NWNB Final Report UoM01 (OPW 2017)[1].
- NWNB POR UoM01 (OPW 2016)[1].
- NWNB SEA Environmental Report UoM01(OPW 2016)[1].
- NWNB SEA Scoping Report (OPW 2015)[1].
- PFRA Main Report (OPW 2012)[1].
- Preliminary Flood Risk Analysis Report - Waterways Ireland (OPW 2011)[1].
- Preliminary Flood Risk Analysis Report - Waterways Ireland – Appendices (OPW 2011)[1].
- Public Consultation on the Draft Flood Risk Management Plans - Summary Report (OPW 2017)[1].
- Weighting The Perceived Importance of Minimising Economic, Social and Environmental/Cultural Risks In Flood Risk Management (OPW 2015)[1].
- County Donegal Development Plan 2018-2024 (Donegal County Council, 2018).

- Donegal County Council Tourism Strategy 2017 – 2020 (Donegal County Council, 2017).
- Buncrana & Environs Development Plan 2014–2020 (Donegal County Council, 2014).
- Strategic Strengths and Future Strategic Direction of Buncrana, County Donegal (The International Centre for Local & Regional Development, 2020).
- Donegal County Council's Climate Adaptation Strategy 2019-2024. (Donegal County Council , 2019).
- National Biodiversity Action Plan 2017-2021. (Department of Culture, Heritage and the Gaeltacht, 2021)

Key guidance or references specific to specialist areas considered in this report are included in the discipline specific methodology sections, where appropriate.

2.4 Project Team

This environmental constraints report was drafted by the Byrne Looby: Fiona Symes (oversight, generalist inputs), Rhian Llewellyn (geology, soils, hydrogeology and hydrology and generalist inputs) and Paige Leresche (generalist inputs), Kagiso Selendi and David Moran (scheme information and hydrology) and Steven Tooher (ecology).

2.5 Consultation

Consultation has been carried out with the public and various stakeholders, the purpose of which was to engage with them, to gather local knowledge on flooding and environmental constraints and opportunities for addressing flood risk in the area.

Comprehensive communication and engagement plans have been developed and adopted by the team such as a project website, direct emails, local media, and public consultation among other approaches listed in Table 2-2. Consultation includes the establishment of a maintained project website and regular project newsletters.

At the time of writing consultation is ongoing and the views of statutory bodies, non-statutory bodies and interested stakeholders will be considered in the preparation of the EIA. Where stakeholders have provided inputs that have implications on the project constraints these have been considered.

Table 2-2: Consultation Plan

Communication Activity	Purpose / Correspondence
Project website	https://www.floodinfo.ie/frs/en/buncrana/home/ The website provides regular updates and information to stakeholders about the scheme. The website provides scheme information, scheme news and updates, a photo gallery, and resources section comprised of FAQ, glossary and contact subsections. Publicly available key project

Communication Activity	Purpose / Correspondence
	documents are provided for direct download from the project website, as they become available. The website is available in English language.
Direct Email	A dedicated project email address is the primary source of contact for all interested Parties (unless otherwise requested by a party): buncranafrs@byrnelooby.com. On the 01/10/21, project information letters were sent to 16 relevant authorities and stakeholders.
Local authority / community publications such as parish newsletters	Items in local authority / community group newsletters are likely to reach a wide range of citizens. A newsletter is published quarterly by ByrneLooby to the project website. The first newsletter to be published on the project's website was the September 2021 newsletter. A total of 550 information packs, questionnaires and pre-paid envelopes were delivered to properties within the 0.1% AEP flood extent boundary in Buncrana and Luddan by Donegal County Council on 23/09/21. The Public Information Pack is included under Appendix A. This information was also made available on the project website (https://www.floodinfo.ie/frs/en/buncrana/project-info/public-engagement/).
Social Media	Donegal County Council advertise any project information on their social media outlets.
Public Consultation Days / workshop	Consultation exhibitions / events offer a more extensive and open form of engagement on a personal basis. They provide opportunities for members of the public to express views on the consultation subject area, ask questions, and receive feedback on the issues they raise. Public consultation no. 1 (27th September 2021 to Friday 22nd October 2021) was held online due to COVID-19 restrictions. A questionnaire was issued via online survey for any interested parties to complete. A total of thirty-seven questionnaire responses were received for Buncrana. Donegal County Council provided the option of meeting a member of the project team in Buncrana on the 14th October 2021 from 6pm to 8pm. Six appointments were held and facilitated by DCC staff. Due to the COVID-19 Pandemic, alternative consultation methods, such as the above, will continue to be considered.
Collaborative Workshop	The Collaborative Workshop for Buncrana-Luddon was held on 8th December 2021. Stakeholders included – relevant departments from DCC, OPW, and Inland Fisheries Ireland. Feedback from the workshop was positive and all stakeholders agreed to continue collaboration throughout the project's timeline.

Three statutory bodies have responded to a stakeholder letter (sent via email during the first stakeholder engagement event) asking for their views on the proposed scheme. At the time of writing responses had been provided as outlined in Appendix B. Where communications have been received that advise the inclusion of specific third parties in consultation these requests have been actioned.

BL held an online introductory meeting with Inishowen Rivers Trust (IRT) (Date: 16/06/2021) who provided the following information:

- IRT are treating knotweed along the Glenagannon River through stem injection and also through fungal treatment on a trial basis. Further, IRT have also undertaken Himalayan Balsam bashing on the Crana River. They have been surveying and recorded IAS in the Crana catchment.
- The headwaters of the Mill River (Mill (Donegal)_010) is considered to be a High-Status Objective Waterbody and classified as Blue Dot[1]. The river is not salmonid but there is evidence of historic salmon presence. A fish pass been considered by IFI for Mill River.
- IRT are involved in riverbank protection through brash revetment and willow spiling downstream of Cockhill Bridge. IRT have implemented, through sponsorship by OPW, Natural Water Retention Measures (NWRM) in the Donagh Catchment (located in Clonmany, not the scheme area) following study by Trinity College. This same project reviewed opportunities for NWRM in the Crana Catchment, which is being considered as part of this study.
- IRT noted that upper Crana catchment comprised a lot of commonage with possible 100 landowners so getting agreement on Natural Water Retention Measures will be challenging.
- IRT suggested that scheme should include for ongoing monitoring of impacts and gains from implemented measures, and that potential environmental positives be emphasised in any public engagements.

2.5.1 Opening Public Stakeholder Consultation

The opening Public Stakeholder Consultation Event was held from Monday 27th September 2021 to Friday 22nd October 2021.

The objective of the public consultation was to make stakeholders and the general public aware of the project, to provide early engagement and to get the feedback on the flooding, environmental and other issues of concern to them.

Information packs were issued to residents and stakeholder groups including brief information leaflets, a questionnaire, and pre-paid envelopes for responses. This information was also made available on the project website (https://www.floodinfo.ie/frs/en/buncrana/project-info/public-engagement/) and promoted by Donegal County Council via press release and social media.

The PC event was advertised online through the scheme's website, local newspapers, and local radio:

[1] Note that this portion of the Mill River does not fall within the Scheme Area. The Mill River associated with the Scheme is Mill (Donegal)_020. However, both these rivers have been proposed together as an Area for Action (AFAc) in the 3rd Cycle, which is currently out for consultation, with a potential blue dot label to be provided across both (if 50% or more of waterbodies within any proposed AFAc fall within the High-Status Objective). This has been confirmed in email correspondence with LAWPRO (see Appendix B).

- Donegal Daily
- Donegal News
- Highland Radio
- Donegal County Council website and social media accounts

Donegal County Council provided the option of meeting a member of the project team in Buncrana on the 14th October 2021 from 6pm to 8pm. Six appointments were held and facilitated by DCC staff.

A total of 550 information packs (Appendix A) were delivered to properties within the 0.1% AEP flood extent boundary in Buncrana by Donegal County Council and ByrneLooby-Arcadis. Questionnaires were enclosed within the information packs, asking a series of questions regarding awareness of the CFRAM Study, personal experiences of flood events in the town and opinions on the importance of various environmental constraints. The questionnaire also provided space for any observations that the resident/stakeholder wished to bring forward.

A total of thirty-seven (nos. 37) questionnaire responses were received for the scheme, and useful general observations/requests/concerns were outlined in these responses, including:

- Elm Park was highlighted as a major concern area for flooding, severely impacted by 2017 flood – compounded with mica issues also
- More frequent cleaning of rivers, sewers, and drains was requested.
- A river level gauge was requested for Elm Park.
- Some residents highlighted inability to receive housing insurance due to flood risk.
- General request that sustainable flood management be considered in uplands, as opposed to hard engineering solutions.
- It was highlighted that the August 2017 Flood has had a negative impact on the public's mental health and that flood protection is needed urgently.
- Residents stated that the bridges in the town become clogged with tree branches during floods.
- More frequent maintenance of the town's riverbanks was requested
- Flooding in the upper catchment of the Crana was requested to be considered by the scheme also.
- Residents voiced concerns regarding potential impacts to their private land.

3 Resources and Materials

3.1 Introduction

This section describes the constraints relating to material assets within the scheme study area and identifies possible issues which have the potential to constrain the flood relief scheme design.

For the purposes of this report, the study is defined as the area shown in Figure 1-1 which includes Buncrana and Luddan and some of the surrounding rural area. Features outside of this boundary (up to an outer extent of 10 km) are discussed where relevant. Wastewater Treatment Plants and associated discharge points within the Catchment are considered up to 10 km from the scheme boundary due to their interaction with hydrology in the catchment (see section 5.3).

3.2 Methodology

The material assets within the study area were assessed by consultation with the following documents:

- EPA data base on waste licenced facilities within the study area.
- EPA data on Urban Waste Water Discharges in Ireland.
- Urban Waste Water Treatment in 2020 (EPA, 2020).

The methodology included:

- Identification of possible material assets within the scheme study area.
- Identification of locations where there may be existing sensitive receptors.
- Identification of material assets constraints.

3.3 Baseline / Receiving Environment

Material assets within the study area include:

- Wastewater infrastructure.
- Waste management facilities.
- Water supply networks.
- Electricity networks.
- Digital infrastructure.

- Land ownership and zoning.
- Roads and Transportation network.
- Pedestrian and cycling networks.

Gas infrastructure was assessed but not found in the scheme area.

3.3.1 Wastewater Treatment Plants

The town is served by the Buncrana Wastewater Treatment Plant with capacity Plant Capacity PE of 10,000. The treatment process comprises preliminary treatment and discharges into Lough Swilly (Irish Water, 2020).

EPA licenced waste water treatment facilities within 10 km of the scheme boundary and within the sub-catchment are described in Table 3-1 and their locations shown in Figure 3.1.

Table 3-1 Urban Wastewater Treatment Plants (WWTP) locations within 10km of the scheme

Facility name	License #	Facility type	Treatment type	Location of emission
Buncrana	D0125-01	Sewage Treatment >500pe	Preliminary Treatment	Discharge Outfall to Lough Swilly (emission ID TPEFF0600D0125SW001)
Rathmullan	D0345-01	Sewage Treatment >500pe	No Treatment	Discharge Outfall to Lough Swilly (emission ID TPEFF0600D0345SW001)
Burnfoot	D0531-01	Sewage Treatment >500pe	Secondary Treatment	Discharge Outfall to Burnfoot River (emission ID TPEFF0600D0531SW001)
Bridgend	D0532-01	Sewage Treatment >500pe	Secondary Treatment	Discharge Outfall to Skeoge River (emission ID TPEFF0600D0532SW003)
Fahan	D0535-01	Sewage Treatment >500pe	Preliminary Treatment	Discharge Outfall to Lough Swilly (emission ID TPEFF0600D0535SW001)
Inch Island Housing Scheme	A0447-01	Sewage Treatment <500pe	Secondary Treatment	Discharge Outfall to Lough Swilly (emission ID TPEFF0600A0447SW001)
Moness Housing Scheme	A0450-01	Sewage Treatment <500pe	Secondary Treatment	Discharge Outfall to Carrowen River (emission ID TPEFF0600A0450SW001)

Data source: EPA online data for Licensing and Permitting (EPA, EPA online data for Licensing and Permitting, 2021)

3.3.2 Wastewater Network

The foul network is operated and maintained by Irish Water. Data provided by Irish Water has been used to identify existing foul networks.

There are eight existing pumping stations throughout the scheme area (see Figure 3.2).

Irish Water has provided details of the following three projects currently under development:

- Irish Water has submitted a planning application to Donegal County Council for the Buncrana Sewerage Scheme Wastewater Project. Working in partnership with Donegal County Council, Irish Water plans to deliver the Buncrana Sewerage Scheme. This scheme is part of the Donegal Towns and Villages Sewerage Schemes project and includes upgrades to the sewer network in order to address flooding, overflow and capacity deficiencies. Stormwater storage will be provided in Buncrana to reduce the risk of overflows during storms (Irish Water, 2021).

- Buncrana Sewerage Network Project including gravity sewer, pumping station and storm tank (at design stage) [County Donegal Towns & Villages Sewerage Schemes].

- NW Region Sewer Rehabilitation Programme (Irish Water and Donegal County Council) [County Donegal Towns & Villages Sewerage Schemes].

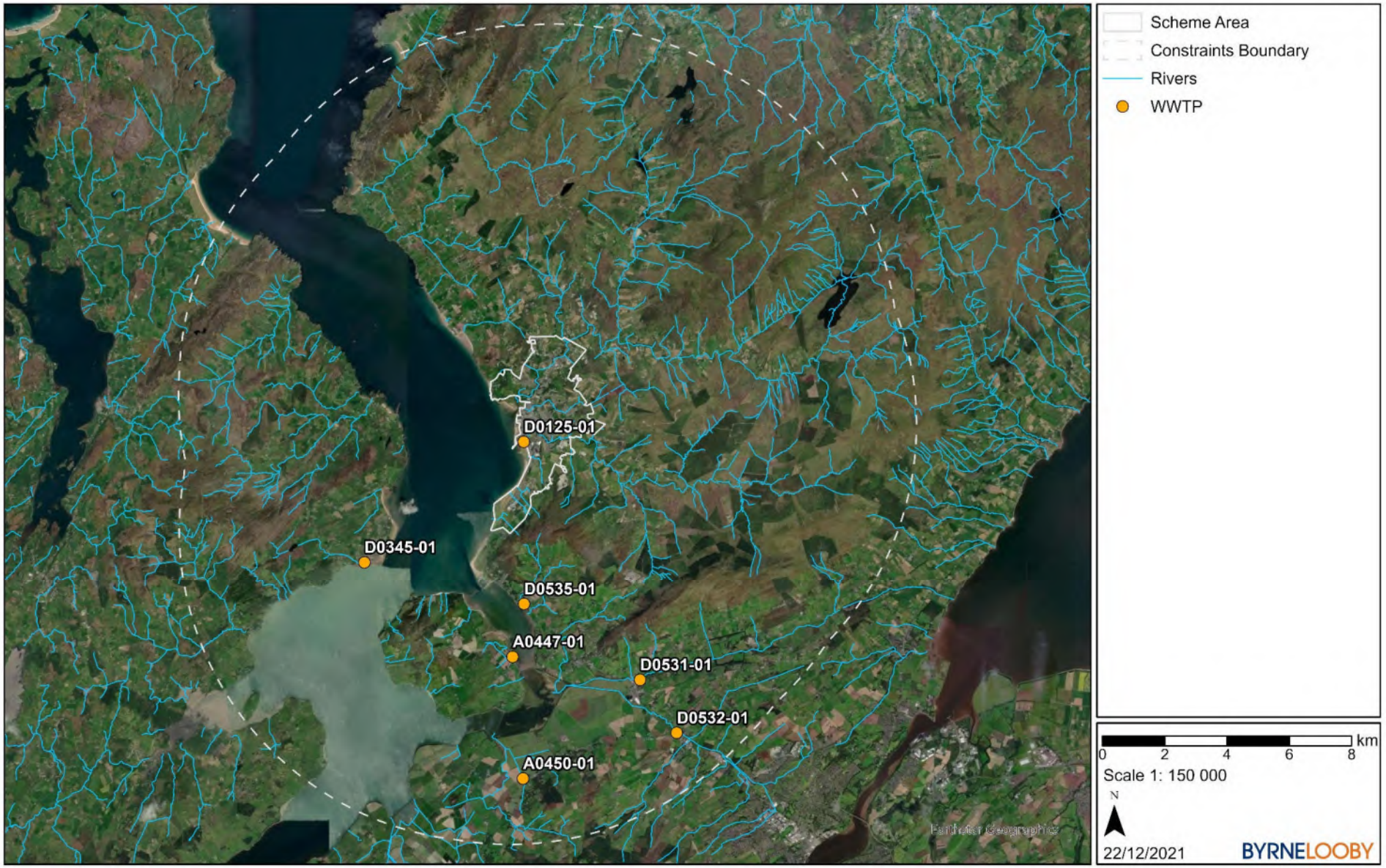

Figure 3.1 Urban Wastewater Treatment Plant (WWTP) locations within 10 km of the scheme area
(Data Source EPA online data for Licensing and Permitting (EPA, EPA Licensed Facilities, 2021)

Figure 3.2 Existing Wastewater Network

3.3.3 Waste Management

Recycling, domestic, commercial and industrial waste services are provided by commercial operators within the study area.

The EPA data map viewer for waste (EPA, 2021) indicates that the dump sites described in Table 3-2 are present within the study area.

Table 3-2 Dump Site Boundaries in the study area

Permit Number (Date of permit issue)	Permit Holder	Description of dump material	Location of Dumping Site
379 (2006)	Donegal County Council (Buncrana Harbour	Dredged material	Plough Dredging from within the approach channel and berths at Buncrana Harbour
S0011-02 (2014)	Donegal County Council	Dredged material	Plough Dredging at Buncrana Harbour

According to EPA data (EPA, 2021), there are no IPPC licensed waste facilities within the study area.

3.3.4 Water supply

Water for domestic, commercial and agricultural purposes is supplied to Buncrana and Luddan from the Lough Doo Water Supply. Lough Doo is located approximately 6km south-west from Buncrana.

3.3.4.1 Existing River Abstractions

The Eddie Fullerton Dam on the Crana River is Inishowen's largest reservoir, with a capacity of 4.6 million m^3 and is used for water supply to the local area by Irish Water, recently expanding to North Inishowen. The Dam is located approximately 9km south-west from Buncrana. No other records of surface water abstraction from waterbodies are noted within the study area (EPA, 2021).

3.3.4.2 Existing Groundwater Abstractions

Well card data produced by the Geological Survey of Ireland (GSI) indicates that there are 1, unknown extraction, 1 spring, 3 dug wells, and 54 boreholes within the study area (see detail in Table 3-3). The approximate locations are shown in Figure 3.3 (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

Table 3-3 Abstraction in the scheme area

Label	GSI Code	Type	Depth (m)	Drill Date	ITM Coordinates	
					Easting	Northing
1	2041NEW006	Borehole	32.0	-	225770	426360
2	2041NEW009	Borehole	114.3	-	229880	427620
3	2041NEW030	Borehole	10.0	2002-08-30	227060	422450

Label	GSI Code	Type	Depth (m)	Drill Date	ITM Coordinates	
					Easting	Northing
4	2041NEW032	Borehole	10.0	2002-07-30	228000	422140
5	2041NEW035	Borehole	0.5	2002-07-26	227270	426620
6	2043SEW007	Dug well	1.2	1962-07-08	228060	432990
7	2043SEW009	Borehole	41.0	1998-01-02	226910	436230
8	2043SEW010	Borehole	26.0	1997-12-06	225810	432950
9	2043SEW011	Borehole	19.0	1999-10-10	225290	434030
10	2043SEW018	Borehole	-	-	224780	437850
11	2043SEW019	Borehole	73.0	-	224940	437710
12	2043SEW020	Borehole	61.0	-	225670	434580
13	2043SEW021	Borehole	49.0	-	228170	434230
14	2043SEW022	Borehole	55.0	-	225260	433840
15	2043SEW023	Borehole	73.0	-	225310	433700
16	2043SEW024	Borehole	91.0	-	225350	433650
17	2043SEW025	Borehole	76.2	-	227460	435490
18	2043SEW030	Borehole	75.0	-	224880	433790
19	2043SEW031	Borehole	10.0	2003-05-22	225350	434200
20	2341NEW002	Borehole	66.0	-	245030	427750
21	2341NWW001	Dug well	4.9	1962-06-08	240890	423780
22	2341NWW003	Borehole	76.2	1976-09-28	234280	426440
23	2341NWW007	Borehole	55.0	1998-05-06	236840	424690
24	2341NWW008	Borehole	119.0	1999-01-04	238090	428820
25	2341NWW015	Borehole	55.0	-	230120	425280
26	2341NWW016	Borehole	70.1	-	232040	426210
27	2341NWW017	Borehole	12.2	-	233770	429260
28	2341NWW018	Borehole	-	-	236770	429780
29	2341NWW019	Spring	-	-	235000	427750
30	2341NWW020	Unknown	-	-	233990	429010
31	2341NWW021	Borehole	-	-	239540	429860
32	2341NWW022	Borehole	2.0	2002-08-09	235950	421720
33	2341NWW023	Borehole	8.0	2002-08-09	233790	423410
34	2341NWW024	Borehole	10.0	2003-05-21	236830	423150
35	2341NWW025	Borehole	66.0	2002-05-15	234810	427370
36	2341NWW026	Borehole	88.0	2003-12-10	239340	420510
37	2341NWW027	Borehole	61.0	2002-07-23	235600	427400
38	2341NWW028	Borehole	74.0	2002-01-15	237800	428800
39	2341NWW029	Borehole	68.0	2002-04-15	238010	424300
40	2341NWW030	Borehole	61.0	-	236530	427320
41	2341NWW031	Borehole	70.0	-	237410	424180
42	2341SWW022	Borehole	1.2	2002-08-25	233420	419240
43	2341SWW033	Borehole	80.8	-	234210	419350
44	2343NWW001	Borehole	43.0	1976-09-02	238550	443750
45	2343NWW002	Borehole	89.5	-	231910	442570
46	2343NWW003	Borehole	49.0	-	232110	442510
47	2343NWW004	Borehole	98.2	-	232350	442570
48	2343NWW005	Borehole	46.5	-	232320	442740
49	2343NWW006	Borehole	104.8	-	232110	442510
50	2343NWW007	Borehole	35.0	-	232060	442340
51	2343NWW008	Borehole	71.6	-	231870	442910

Label	GSI Code	Type	Depth (m)	Drill Date	ITM Coordinates	
					Easting	Northing
52	2343NWW009	Borehole	75.0	-	231890	442770
53	2343NWW010	Borehole	41.5	-	231950	442680
54	2343SWW007	Borehole	-	1984-08-01	238780	433300
55	2343SWW009	Dug well	1.8	2000-06-23	239430	437160
56	2343SWW010	Borehole	11.0	2002-08-07	238310	433990
57	2343SWW011	Borehole	4.2	2002-07-06	236010	431950
58	2343SWW012	Borehole	11.0	2002-08-07	236540	430790
59	2343SWW013	Borehole	11.5	2002-07-06	234820	430560

Figure 3.3: Groundwater abstraction locations

3.3.5 Electricity networks

The Electricity Supply Board (ESB) Networks maintains the distribution electricity infrastructure. Figure 3.4 (overleaf) shows the layout of the network. The electricity infrastructure consists of a mix of high and medium voltage overhead and underground lines.

3.3.6 Gas infrastructure

There is no gas distribution or transmission infrastructure reported within the scheme boundary of wider vicinity.

3.3.7 Digital infrastructure

Internet and landline services are provided by several commercial operators with available internet speeds averaging from 100 Mb to 500 Mb through 'part fibre' technology (Switcher Limited, 2021).

Eircom Limited ('Eir') own and maintain the telecoms network for the Area Mobile phone coverage for 2G, 3G, and 4G is provided by commercial operators in the study area with coverage classed as ranging from good to very good by the Commission for Communication Regulation (Commission for Communication Regulation, 2021).

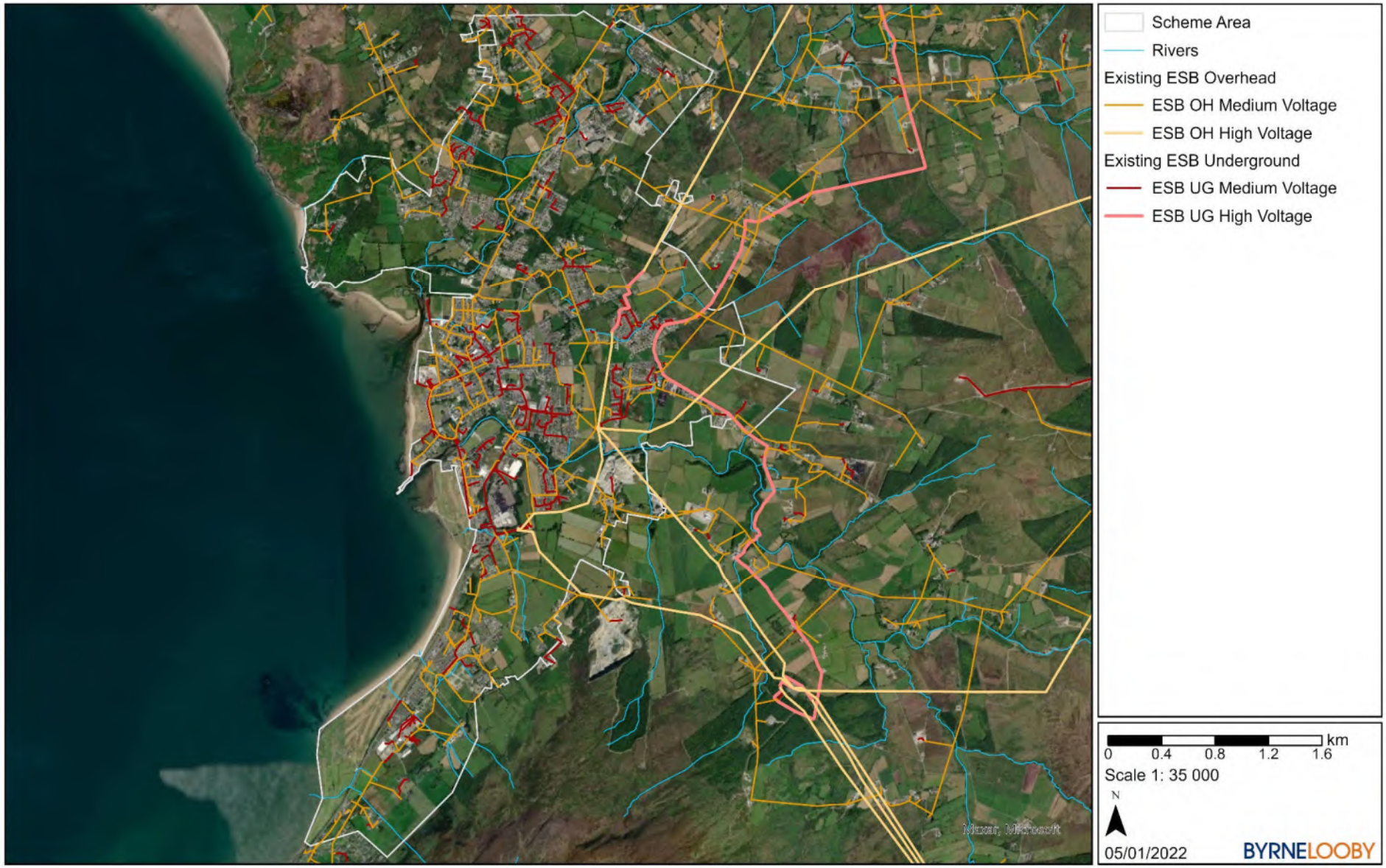

Figure 3.4 Electricity infrastructure in the scheme boundary and vicinity

3.3.8 Land Ownership and Zoning

Buncrana is classified as a Tier 2 town. It is the second-largest town in County Donegal and is one of four nodes in the North-West City Region, along with Derry, Letterkenny and Strabane (The International Centre for Local & Regional Development, 2020). Urban areas are surrounded by agricultural land with the towns being largely residential with supporting social amenities.

Access to privately owned lands may be required for construction and maintenance works, and land may also need to be acquired as a result of the scheme. Depending on the nature of the land use in the particular areas, there may be a land use change engendered by the proposed scheme.

Rural Area Types identified in the County Donegal Development Plan 2018-2024 are shown in Figure 3.5 (Donegal County Council, 2021).

Appendix D contains Land Use Zoning Maps for Buncrana reproduced from the County Donegal Development Plan 2018-2024 (Donegal County Council, 2021).

3.3.9 Roads and Transportation Network

Buncrana and Luddan are served, primarily, by the N13 which is located c. 15 km south of Buncrana which connects to the R238 which runs through both areas and connects to local roads. In recent years a Car Ferry has linked the town with Rathmullan, located across Lough Swilly. Public transport within Buncrana and Luddan is largely private with a Local Link bus service connecting areas to other towns. There are no railways or tramways directly serving the study area.

There are no projects in the study area in the Major Roads Projects Active List Transport Infrastructure Ireland (Transport Infrastructure Ireland, 2020).

All roads in the scheme study area are maintained by the County Council, however any modifications to National Primary and Secondary roads would require consultation with Transport Infrastructure Ireland (TII).

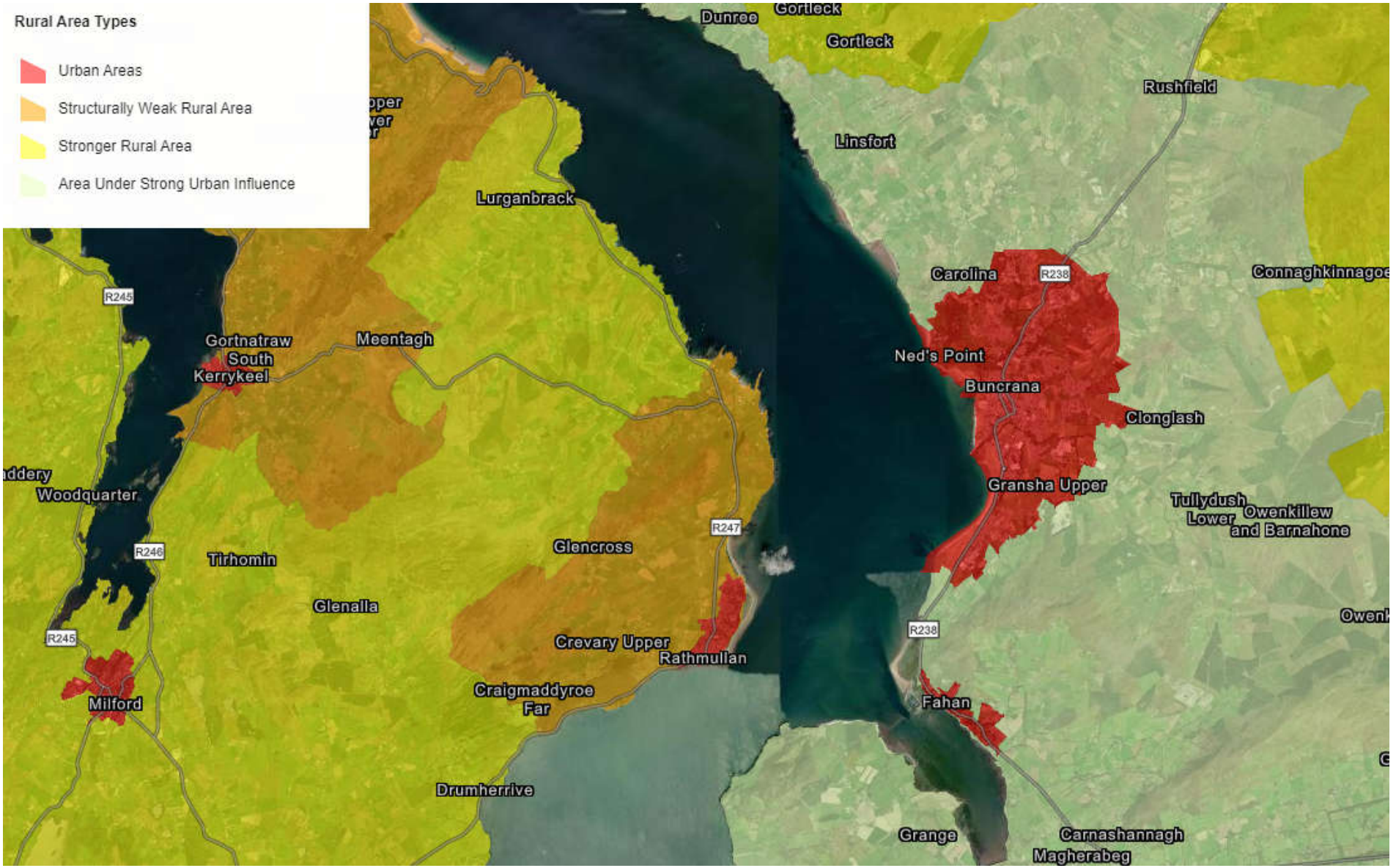

Figure 3.5: Rural area types in the study area

Data source: County Donegal Development Plan 2018-2024 ArcMap Viewer (Donegal County Council, 2021)

3.3.10 Pedestrian and Cycling Network

Various walking pathways are located along lengths of the rivers, along the beach, and within the town. Public amenity areas in the towns are connected by public walkways and bridges.

Buncrana has an active Walking and Cycling Group and walking and cycling are considered by DCC to be key components to movement and accessibility in towns and rural areas, as well as a tourism. They benefit the environment and the population by reducing pollution, noise and traffic congestion, as well as contributing to healthy more active lifestyles. Buncrana has a well-established network of popular cycle/walkways which primarily extends along the Shore Front into Swan Park (along the Crana River). It also extends along the shores of Lough Swilly to Ned's Point/Fr Hegarty's Rock and beyond to Stragill Strand. (Donegal County Council, 2014).

At the time of writing, no further information is available with regards to pedestrian and non-vehicular users of the study area (for example cyclists and equestrians). This data has been requested and will be considered as the scheme progresses.

Donegal County Council are proposing to develop a greenway between Buncrana and Derry under Route 1 of an INTERREG VA-funded project called the North West Greenway Network (see Figure 3.6). The proposed route corridor passed through Buncrana and Luddan along the coast. The timeline for construction is that DCC will appoint a contractor in 2022 to construct the greenway (Donegal County Council, 2021).

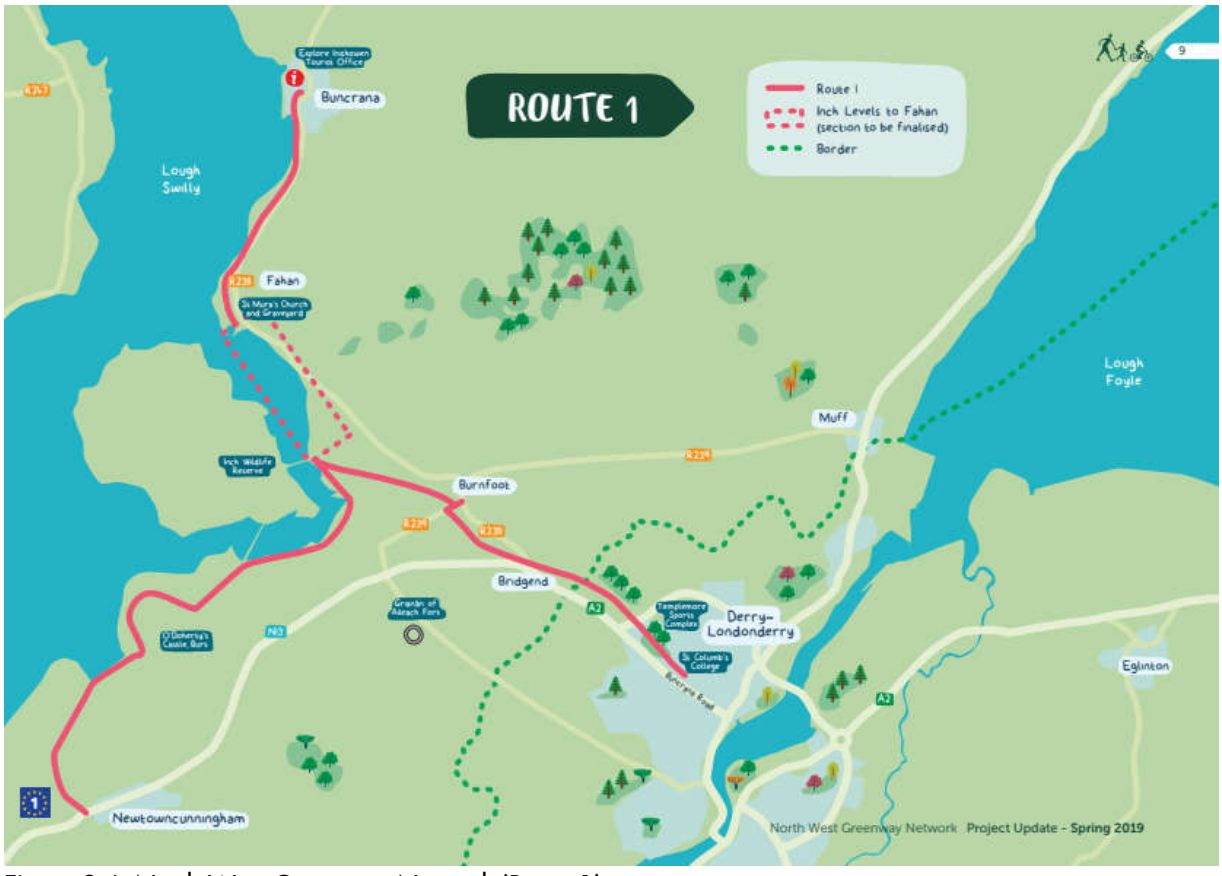

Figure 3.6: North West Greenway Network (Route 1)

Donegal County Council are proposing to extend the existing Buncrana Shore Path to link the Tourist Information Centre, adjacent to Amazing Grace Park, to the current path start point at Festival Play Park.

Third party infrastructure projects in the study area will be considered within the cumulative impact assessment in the EIAR to identify and determine the significance of any cumulative or in-combination effects.

3.4 Key Constraints

Impacts on services and utilities such as watermains, gas mains, underground powerlines etc. will all need to be considered during the design process. The possible interruption of these services and utilities should be minimised, where possible. Furthermore, impacts on road and bridge infrastructure and land ownership will need to be considered.

Third party infrastructure projects being developed in the study area will be considered within the cumulative impact assessment in the EIAR to identify and determine the significant of any cumulative or in-combination effects. Coordination between project developers/teams will be required where construction occurs within overlapping or similar timeframes or where working areas overlap or are located in nearby areas.

Additional general and site-specific constraints will need to be considered as the scheme progresses, including:

- During planning, development, and construction, the utilities infrastructure must be fully considered to ensure that disruptions to the utilities infrastructure are avoided.
- During the construction stage, measures may have to be taken in order to ensure the construction does not interfere in any of the underground or overground utilities services.
- It will be necessary to contact TII where the development could impact on primary and national roads within and outside of the scheme area. TII would be specifically concerned as to potential significant impacts the development would have on the national road network (and junctions with national roads) in the proximity of the proposed development.
- It will be necessary to conduct consultations with the relevant Local Authority/National Roads Design Office with regard to the locations of existing and future national road schemes in the area.
- Visual impact from existing national roads should be considered as part of the EIAR.
- The Project should consider the 'Environmental Noise Regulations 2006' (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority.
- Where new structures may be proposed on national roads, the requirements of the TII publication 'Technical Acceptance of Road Structures on Motorways and Other National Roads' (DN-STR-03001) should be referenced. This Standard specifies the procedures to be

followed in order to obtain Technical Acceptance for structures on motorway and other national road schemes and for the submission of as built records.

- An assessment of scour and other hydraulic actions on national road structures in accordance with UK BD 97/12 should be undertaken where necessary. Scour prevention measures will be required if the assessment illustrates the potential for scour beneath the foundations.

- It will be necessary that, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site, with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's 'Traffic and Transport Assessment Guidelines' (2014) should be referred to in relation to proposed development, with potential impacts on the national road network.

- It will be necessary to consult the TSS Publications to determine whether a Road Safety Audit is required prior to construction.

- It will be necessary to clearly identify haul routes proposed and fully assess the network(s) to be traversed. Where abnormal loads are a feature of the proposed development, separate structure approvals/permits, and other licences may be required in connection with the proposed haul route. All structures on the haul route should be checked to confirm their capacity to accommodate any abnormal load.

- It will be necessary to contact ESB if there is a need for lines to be turned off for a period of time (e.g. for works or relocation of infrastructure) and to determine if the affected residences could be serviced from elsewhere.

- It will be necessary to contact Irish Water if there is a need for water utilities to be turned off for a period of time (e.g. for works or relocation of infrastructure) and to determine if the affected residences could be serviced from elsewhere.

- During planning, development, and construction, any proposals by the applicant to divert existing water services (watermains, service connections, rising mains, foul and surface water sewers, culverts, etc.) will need to be submitted to Irish Water prior to works commencing.

- During the construction stage, measures should be taken in order to ensure the construction does not interfere with underground services. Where works occur in proximity to electrical lines, some areas may have to be cut-off for the remainder of the work. This could cause an impact to local residents and business.

- Underground electrical lines in the study area may be at risk of flooding in extreme weather conditions causing power outages in areas of Buncrana. The location of the underground cable routes in the planning and construction stages of the scheme should be taken into consideration.

- Consideration of the designs effect on sewerage capacity in the event of hydrological changes or flooding.

- Impacts on road and bridge infrastructure and land ownership will need to be considered. Further, licenses for opening or forming openings in public roads, as required by the Scheme construction, should be made to the Road Management Office (RMO).

- Impacts on public rights of way, footpaths and cycle routes will need to be considered. The proposed scheme design should ensure continuity of the public walkways within its footprint and future plans for same.

- Bridges provide crossing of the local rivers and are a public right of way and access should be maintained throughout the project construction and operation phases.

- Coordination with third party projects may be required during the planning and development of the scheme to avoid or reduce the likelihood of potential cumulative and in combination impacts.

- As advised by the Minister of transport (Minister of Transport pers. comm. 20/10/2021), given that all of the hard measures identified and assessed in 2018 scored quite high with regards to negative environmental consequences, designers are advised to weigh nature-based criteria compared to hard defences when designing these flood relief schemes.

- As advised by the Minister of transport (Minister of Transport pers. comm. 20/10/2021), the designer of the scheme should ensure that the threat of flooding along the public road network (where it exists) is reduced by the proposed design and that the drainage of the public road network is improved where possible and not impaired by the proposed development.

4 Population and Human Health

4.1 Introduction

This section sets out the principal constraints in relation to the socioeconomic setting of the study area. These include population, recreation/tourism, and public health matters characterising the study area that may impact on the selection of the flood relief measures for the proposed scheme, and which relate to the main settlement areas near which any flood relief measures are likely to be undertaken.

For the purposes of this report, the study is defined as the area which includes Buncrana and Luddan, and some of the surrounding rural area. Potential constraints outside of this boundary (up to an outer extent of 10km) are discussed where relevant.

Currently, the impact of flooding is causing a multitude of socio-economic impacts to the community of Buncrana, including the inability to obtain housing insurance, the permanent loss of belongings, the permanent or temporary loss of livelihood for commercial properties, and the general social impact of angst in potential flood events. The intention of the Scheme is to provide flood defence measures for sensitive receptors in the town of Buncrana, which overall will provide positive impact to the towns, and in particular the individual commercial and residential receptors affected by historical flooding events.

4.2 Methodology

A desktop study was undertaken to identify the key population and human health constraints within the study area. The following sources of information were used in the preparation of this section:

- Google Maps (Google, 2021).
- Ordnance Survey Ireland (OSi), National Mapping Agency data accessed through the Geohive map veiwer (OSi, 2021).
- County Donegal Development Plan 2018-2024 (Donegal County Council, 2018).
- Donegal County Council Tourism Strategy 2017 – 2020 (Donegal County Council, 2017).
- Landscape Character Assessment of County Donegal (Donegal County Council, 2016).
- Census of Ireland 2016 (Central Statistics Office, 2021) .
- Donegal County Council Website (https://www.donegalcoco.ie).
- Draft River Basin District Management Plan 2021 (EPA, 2021).
- Buncrana Socio-Economic and Geo-Spatial Study (AIRO and ICLRD, 2020)
- Strategic Strengths and Future Strategic Direction of Buncrana, County Donegal. (Donegal County Council , 2020)

Sensitive receptors and potential constraints have been identified. Other environmental interactions with population and human health, e.g. noise, vibration, air quality, climate, and material assets are addressed in the relevant sections of this report.

4.3 Baseline / Receiving Environment

4.3.1 Population, land use, and human health

Buncrana is the second largest town in terms of population in Donegal after Letterkenny strategically located in the Inishowen peninsula, 23km from Derry City and 43km from Letterkenny. It is a Tier 2 Settlement Strategic Support Town and acts as the retail, commercial, educational and recreational centre for the local area and wider vicinity (Donegal County Council, 2014).

The ICLRD (2020) identified Buncrana's key strategic strengths as:

- Its location within the North West City Region (NWCR) and its relationship with the designated regional centre of the Metropolitan Area of Letterkenny inclusive of its proximity to Derry City (15km);
- Its coastal location on the 'Wild Atlantic Way', and the associated tourism and leisure opportunities;
- Its strong manufacturing and engineering heritage; and
- Its function(s) as the main service town for the Inishowen Peninsula, and as the gateway to North Inishowen.'

The town has 5 primary schools, 2 secondary schools and an Adult Education and Training Centre (Donegal County Council, 2014). Buncrana has a relatively high proportion of children and teenagers in its resident population. The proportion of the population aged 65 and over is above the national value and the population is ageing, particularly in the town centre (The International Centre for Local & Regional Development, 2020). Population data is shown in Table 4-1.

Table 4-1 Population data reproduced from Draft County Donegal Development Plan 2018-2024.

	2011 population	Estimated 2016 population	Projected additional population by 2024	Projected population by 2024
Buncrana	6,839	6,735	1,215	7,950

Table 4-2 Population by Nationality from Donegal Local Economic & Community Plan 2016-2022.

	Irish	United Kingdom	Polish	Lithuanian	Other EU 27	Rest of World	Not Stated	Total	% Other than Irish
Buncrana	5,869	288	233	55	145	74	49	6,740	11.8

Table 4-3 Socio Economic Groups & Labour Force Details from Donegal Local Economic & Community Plan 2016-2022.

	A	B	C	D	E	F	G	H	I	J	Z
Buncrana											
Labour force Participation Rate	57.8%										
Non-Labour force Participation Rate	42.2%										
Unemployment Rate	31.2%										
Labour Force	3,013										
A: Employers and Managers, B: Higher professional, C: Lower professional, D: Non-manual, E: Manual skilled, F: Semi-skilled, G: Unskilled, H: Own account workers, I: Farmers, J: Agricultural Workers, Z: All others gainfully occupied and unknown											

The town has a 7% share of Non-Residential Buildings, as advised in The Donegal Local Economic & Community Plan 2016 -2022.

As reported in the Strategic Strengths and Future Strategic Direction of Buncrana, County Donegal (Donegal County Council , 2020):

- There are 1,988 jobs based in Buncrana. Of these:
    - 1,027 (52%) are held by persons who reside in Buncrana
    - 961 (48%) are held by persons who live outside Buncrana and travel to the town to work
- There are 2,327 resident workers in Buncrana. Of these:
    - 1,027 (44%) work locally (in Buncrana)
    - 801 (34.5%) commute to work outside Buncrana
    - 499 (21.5%) commute to unknown and variable locations (may be inside / outside Buncrana)

Green spaces, residential and commercial properties and facilities for social amenities such as Buncrana GAA Club in Buncrana and golf courses are present in the study area. An industrial estate is located near Luddan. In Buncrana, further inland of Lough Swilly is mainly residential suburbs with a few supporting commercial and community services (such as stores, etc.) and further beyond the town is agricultural land.

Local services within Buncrana include banking facilities, health care facilities and Buncrana Garda Station. Land use and zonation is described in section 3.3.8.

A Place Standard survey of local stakeholders undertaken by DCC was administered in Buncrana between February and June 2020. It identified that the following dimensions scored most highly: ‘feeling safe’, care and maintenance’, ‘natural space’ and ‘community engagement/participation’ (The International Centre for Local & Regional Development, 2020).

4.3.2 Tourism and recreation

Two of the key objectives (S-O-4 and S-O-5) within the County Donegal Development Plan reference plans for economic growth and regeneration to support strengthened and vibrant communities. Tourism is a key driver of this (Donegal County Council, 2018a). Within the Plan, the Derry-Buncrana Greenway (initiated under the North-West Greenways Network Project) has been identified as a key tourism and recreation project, with the potential to provide a sustainable transport alternative, and enhance recreational opportunities. The Donegal County Council Tourism Strategy 2017-2020 further identifies intentions for the development of tourism infrastructure, with County Donegal being identified as 'Ireland's Hidden Gem'.

Buncrana's seaside location, natural and heritage resources, and proximity to, and connections with, Derry are among its strategic assets (The International Centre for Local & Regional Development, 2020). The area is a popular destination for tourists and has an established tourism and hospitality sector. The area also has shopping amenities, including national chain supermarkets. Local sports clubs include Buncrana GAA Club, Buncrana Golf Club and North West Golf Club.

There are no national waymarked trails present in the scheme area (Donegal County Council, 2021).The 2.3 km linear Buncrana Shore Path (see Figure 4-1) is a local walk present in the study area. Additional walking spaces include Swan Park, Festival Play Park, and Amazing Grace Park.

Figure 4-1 Buncrana Shore Path (Donegal County Council, n.d.)

Fishing under permit takes place within the study area. The Buncrana Angling Association controls the Crana River and Eddie Fullerton Dam.

From the old pier at Buncrana, float fishing will usually provide sport for mackerel in summer. Casting out over sandy ground will produce ray, dogfish, whiting and dabs. Sea trout is also caught in the area (Angling Ireland, 2021).

Bathing Water Areas designated under the EU Water Framework Directive located within the study area are:

- Lisfannon - bathing water had a 'Good' classification in 2020 (Beaches.ie, 2021a).
- Lady's Bay - bathing water had a 'Sufficient' classification in 2020 (Beaches.ie, 2021b).

4.3.3 Traffic

The TII Traffic Data website does not contain and count data for National Roads from within the Scheme area (TII, 2021). Traffic count data for Buncrana and Luddan has been requested and was not available at the time of writing.

The proportion of commuters using public transport (1%) in Buncrana is low and is associated with the absence of an in-town bus service. One-in-eight persons walk or cycle to work. This is low considering the town's size and the 'jobs to residents' ratio for the town. Residents commute out of Buncrana to access higher-value jobs than those that are available in the town and commuters exhibit a high level of dependence on the private car (The International Centre for Local & Regional Development, 2020).

Traffic data will be required to inform the traffic impact assessment for the construction phase of the scheme.

4.3.4 Regeneration Plan

Buncrana has been identified as a town of strategic importance to the North West Region and specifically to the Inishowen Peninsula, given its representation as one of four nodes in the North-West City Region along with Derry, Letterkenny and Strabane. Notwithstanding these core strategic advantages, the town has not developed to full potential and is now a focus of regeneration for Donegal County Council, formalised by the release of a report in 2020 to identify the functions of the town and how the strategic importance may be harnessed to benefit the town in the future (Donegal County Council , 2020). As part of this, a survey of local stakeholders was administered in Buncrana between February and June 2020 by the Donegal County Council to receive feedback and provide a basis to future recommendations and regeneration plans of Buncrana. In February 2022, the local area plan for Buncrana was given the 'go ahead' to progress further, moving forward with Bundoran and the Twin Towns (https://highlandradio.com/2022/02/24/buncrana-area-plan-moves-forward/).

The Donegal Daily released news of secured funding for the 'Repowering Buncrana' regeneration Project which provide focus to strengthen the shore front and alter the disconnect to Main Street, address vacancy and deliver new job opportunities to the town[2].

4.4 Key Constraints

Constraints on population and human health will depend on the final nature and extent of the scheme, as well as the duration and nature of the construction phase.

Public and tourist amenities and facilities should also be considered key constraints. Impacts on public amenity areas adjacent to and requiring access to the rivers such as riverside walks, parks. playgrounds and tourist features should be considered, with replacement mitigation proposed if

[2]https://www.donegaldaily.com/2022/01/07/repowering-buncrana-funding-paves-the-way-for-six-key-improvements/

necessary. Impacts on tourist facilities, recreation and amenity facilities in the area should be considered constraints, especially those requiring access to the watercourses in the area.

Development of the proposed scheme must take into consideration ways for areas of commercial or tourist potential maintain their aesthetic and public attractiveness both during construction and operation of the scheme.

Development of the proposed scheme must take into consideration ways to complement and enhance public amenities including green spaces in the proposed scheme footprint. Measures to protect extant recreational areas and green public spaces should be developed within the proposed scheme. The proposed scheme design should ensure continuity of the public walkways within its footprint.

The scheme design should take into account the value (both cultural and economic) of any buildings (residential, retail, etc.) close to the edges of waterbodies likely to be adversely affected by the scheme within the scheme study area.

Regional and local roads in the project are likely to be congested at peak travel times. Some roads in the scheme area are narrow and may not be suitable for site access. Bridges provides road and pedestrian access within Buncrana and accesses to the bridges should be maintained throughout scheme construction and development. There is a potential for construction to make traffic more congested in the study area and vicinity in the short term. A traffic management plan will be required with the CEMP.

Construction works will have to be mindful of maintaining access for both pedestrians and cyclists. A traffic management plan will be required during construction works.

Any design proposals should ensure that any bridges over watercourses are maintained where feasible so that temporary or permanent disruption of local transport links and access to homes and businesses in the study area are minimised.

Urban development may limit access and movement of vehicles/equipment during construction at the following locations:

- Riverside
- Cockhill Celtic Football Club
- Riverdale Park
- Crana Bridge River (adjacent to Cockhill Road)
- Elm Park
- Chair O'Doherty Avenue
- Castle Avenue
- Cockhill Road
- Gaelscoil Bhun Cranncha
- Supervalu
- Donegal Community Services Health Centre
- Residential estate in between Castle Avenue and Nailor's Row
- Inishowen Credit Union
- Roundknowe Road
- Pairc Mor

- Buncrana GAA Club
- Causeway Road / Taobh an Struthán
- Lower Main Street

During construction of the scheme, traffic restrictions could pose problems for deliveries and site access and traffic management measures will be considered as part of the environmental impact assessment process.

The traffic associated with construction works will need to be mindful of the tourist and retail trades.

Sensitive receptors e.g. homes, schools, medical facilities (i.e., Donegal Community Services Health Centre, Buncrana Community Hospital, Vadaliya Maternity Home), places of worship, should be considered key constraints in the design of the flood relief scheme. The scheme design should take into account the value (both cultural and economic) of any buildings (residential, retail, etc.) close to the waterbodies' edges or likely to be adversely affected by the scheme within the scheme study area. Medical facilities in the scheme study area are sensitive receptors and must be given due consideration. Flooding events can cause devastation to homes, businesses and local facilities, with social and human health impacts. Their specific protection through adequate flood defences should be considered in the design of the scheme.

Other impacts to population that are also concerned with human health, including material assets such as water supply, wastewater treatment, and utilities should also be given due consideration.

Constraints and considerations regarding the architectural conservation area are addressed in Chapter 8.

5 Hydrology

5.1 Introduction

This section of the report outlines the environmental constraints associated with the hydrology of the study area, inclusive of all surface water bodies (rivers, lakes, loughs, estuaries etc.) and their associated catchments and basins. Groundwater is addressed in Section 6.

The principal surface waterbodies in the scheme area are the Crana River and Mill River. The Buncrana River is present in the study area and joins the outflow of the Crana River to Lough Swilly near Gaelscoil Bhun Cranncha. Other rivers also present are outlined in Section 5.3.2 but include the Millfield Millrace, Ballymacarry River, Gransha, Tullyarvan Millrace, Umrycam, Lenynarnan, Luddan Middle, Luddan Upper, Mouldy Hill, Barnes and Lisfannon.

For the purposes of this report, the study is defined as an area approximately 3 km in radius from the scheme area (see Figure 5.2), with guidance taken from The Iinstitute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements to set this boundary. Features outside of this boundary (up to an outer extent of 10 km) are discussed where relevant to give greater context within the wider vicinity of the project area, where relevant (as they are considered unlikely to interact with the scheme). This 10 km extent for such features will be reviewed at scoping for EIA and EIA stages and when further details for the design and construction of the scheme become available to ensure adequate consideration of interactions, were relevant.

5.2 Methodology

A desktop study was undertaken to describe the overall hydrological regime and water quality within the study area and to define hydrological constraints. The sources of publicly available information consulted in order to identify possible hydrological constraints within the study area include:

- EPA geoportal website including map viewer and water quality database.
- OPW Database of Hydrometric Stations.
- Geological data available through the GSI data portal and map viewer series (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).
- Water Framework Directive website www.catchments.ie.
- The OPW's floodinfo.ie portal website.
- North Western River Basin District Management Plan (2009 – 2015).
- Draft River Basin District Management Plan 2021 (EPA, 2021).
- 3rd Cycle Draft Lough Swilly Catchment Report (HA 39) (Catchment Science & Management Unit Environmental Protection Agency, 2021)

- WFD Cycle 2 Catchment Lough Swilly Subcatchment Burnfoot_SC_010 Report (WFD Application, 2019a).
- WFD Cycle 2 Catchment Lough Swilly Subcatchment Crana_SC_010 Report (WFD Application, 2019b).
- Waterbody data for the sub catchments (EPA Catchments, 2021).
- Inishowen River Trust Nature Based Solutions on Inishowen Rivers (Murphy, 2021).
- The Opportunity for Natural Water Retention Measures in Inishowen (Bourke et al, 2020).

A number of other datasets are also relevant to hydrology due to their interactions, e.g. ecological sites and hydrogeological features. These have been dealt with in other relevant sections of this report.

The characterisation of the baseline in this section is based on desktop study.

Surface water abstraction is described in Section 3.3.4.1.

5.3 Baseline / Receiving Environment

5.3.1 The Lough Swilly Catchment

All rivers in the study area are located within the Lough Swilly catchment which drains a total area of 507 km^2. This catchment comprises the northern and eastern parts of the Inishowen Peninsula and is drained by several relatively small rivers which flow from the mountains in the centre of the peninsula (Catchment Science & Management Unit Environmental Protection Agency, 2021).

5.3.2 Waterbodies in the Study Area

The principal surface waterbodies in the scheme area are the Crana River and Mill River. The Buncrana River is present in the study area and joins the outflow of the Crana River to Lough Swilly near Gaelscoil Bhun Cranncha. Other rivers also present include the Millfield Millrace, Ballymacarry River, Gransha, Tullyarvan Millrace, Umrycam, Lenynarnan, Luddan Middle, Luddan Upper, Mouldy Hill, Barnes and Lisfannon. These are further outlined in Table 1-1.

A review of OPW arterial drainage schemes indicate there are no arterial drainage schemes or benefitting lands within the scheme catchment (Office of Public Works, 2021b).

5.3.3 Surface waterbody quality and status

The Water Framework Directive (WFD) was agreed by all individual European Union (EU) member states in 2000 and provides a comprehensive framework for water quality management across the EU. The directive requires that all member states adopt a comprehensive integrated basin-based approach to water management.

Rivers, lakes, estuaries and coastal waters can be awarded one of five statuses including 'High', 'good', 'moderate', 'poor' and 'bad' whereas groundwater can be awarded only 'good' or 'poor' status (see Table 5-2 and Figure 5.3 for those relating to the scheme area). The key rivers associated with the Project (Mill River, Buncrana River, Crana River) are associated with 'poor' water quality. Ecological status for surface water bodies is primarily driven by the Biological Quality Elements (BQEs) which includes fish, aquatic flora, macroinvertebrates and phytoplankton. Standards for general physico-chemical parameters, specific pollutants and hydromorphology are set at levels in order that they are sufficient to support the status of the BQEs (Catchments.ie, 2021).

The key objectives of the directive are to maintain a 'High' status of waters where it exists, prevent any deterioration in the existing status of waters and achieve at least 'good' in relation to all waters by 2015, latest by 2027. Those rivers classed as being 'at risk' relates to the potential of that watercourse meeting the 'good' Ecological Status. Those same key waterbodies in the Scheme Area (Mill River, Buncrana River, Crana River) are classed as such, as outlined in Table 5-2 and illustrated in Figure 5.4. Key pressures to all these rivers include agriculture, forestry, peat drainage, extraction, mines and quarries and hydromorphological barriers.

Under WFD requirements, the development of the scheme should incorporate measures to ensure that the hydromorphological conditions of the water body is consistent with the achievement of the required ecological status. A hydromorphology survey will be completed using the River Hydromorphology Assessment Technique (RHAT).

The River Basin Management Plan (RBMP) for Ireland 2022-2027 is currently out for public consultation[3], to be published later in 2022. The final plan will need to be considered in this flood relief scheme.

The EPA monitors survey water within the study area National water quality monitoring stations and their location are detailed in Table 5-1 (EPA, 2021).

Table 5-1 National water quality monitoring stations and hydrometric gauges within 3km of the scheme area

Map Label	Registration Number	Type	Name	Waterbody	Status/ Purpose	ING Coordinates	
						Easting	Northing
39002	39002	Hydrometric Gauge	Mill Farm	Mill River	Staff Gauge Only (Inactive)	234816	431673
39003	39003	Hydrometric Gauge	Tullyarvan	Crana	Recorder (Active)	234965	433064
1	RS39C010200	National WQ Monitoring Station	Bridge U/S Crana River Confluence	Cashelnacor	River Water (Operational)	235869	434597
2	RS39C020300	National WQ Monitoring Station	Druminderry Bridge	Crana	River Water (Operational)	238702	434161
3	RS39C020350	National WQ Monitoring Station	Br D/S Druminderry Br	Crana	River Water (PreWFD)	238011	434458

[3] https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/

Map Label	Registration Number	Type	Name	Waterbody	Status/ Purpose	ING Coordinates	
						Easting	Northing
4	RS39C020400	National WQ Monitoring Station	Bridge At Cock Hill	Crana	River Water (Operational)	235440	433786
5	RS39C020500	National WQ Monitoring Station	First Br D/S Br at Cock Hill	Crana	River Water (Operational)	234802	432857
6	RS39G110630	National WQ Monitoring Station	Gortyarrigan - Interstitial, Claggan Br.	Gortyarrigan	River Water (Investigative)	233568	435160
7	RS39G170760	National WQ Monitoring Station	Glack or Bohullion - Interstitial, Br North of Strahack	Glack or Bohullion	River Water (Investigative)	232777	425650
8	RS39L170710	National WQ Monitoring Station	Lisfannann - Br U/S From Lough Swilly	Lisfannan	River Water (Investigative)	233827	428919
9	RS39M020100	National WQ Monitoring Station	Bridge W. of Tullydush Upper	Mill (Donegal)	River Water (Operational)	238410	430166
10	RS39M020180	National WQ Monitoring Station	Glenside	Mill (Donegal)	River Water (PreWFD)	235368	431327
11	RS39M020200	National WQ Monitoring Station	Bridge Near Millfield House	Mill (Donegal)	River Water (PreWFD)	235165	431525
12	RS39M020300	National WQ Monitoring Station	D/S Old Rly Br S. Of Buncrana	Mill (Donegal)	River Water (Operational)	235053	431567
13	RS39O040400	National WQ Monitoring Station	Kinnagoe Bridge	Owenboy (Crana)	River Water (Operational)	237586	435518

Recent and publicly available surface water quality data is available for the study areas from the catchments.ie website (WFD Application, 2019a,b; EPA Catchments, 2021). Physicochemical surface water data is available from monitoring station codes in the scheme area and vicinity:

- RS39A010300
- RS39C010200
- RS39C020100
- RS39C020400
- RS39O020100
- RS39O020200
- RS39O040400
- RS39O050100
- CW06007049NW1001
- CW06007072LS2001
- GWIE_NW_G_05006000001

This data will be considered with of the environmental impact assessment.

The Catchments.ie website publishes waterbody status data for the sections of rivers within the study area (where works might be proposed) under their sub catchment classification system. An overview is provided in Table 5-2 (WFD Application, 2019a,b; EPA Catchments, 2021).

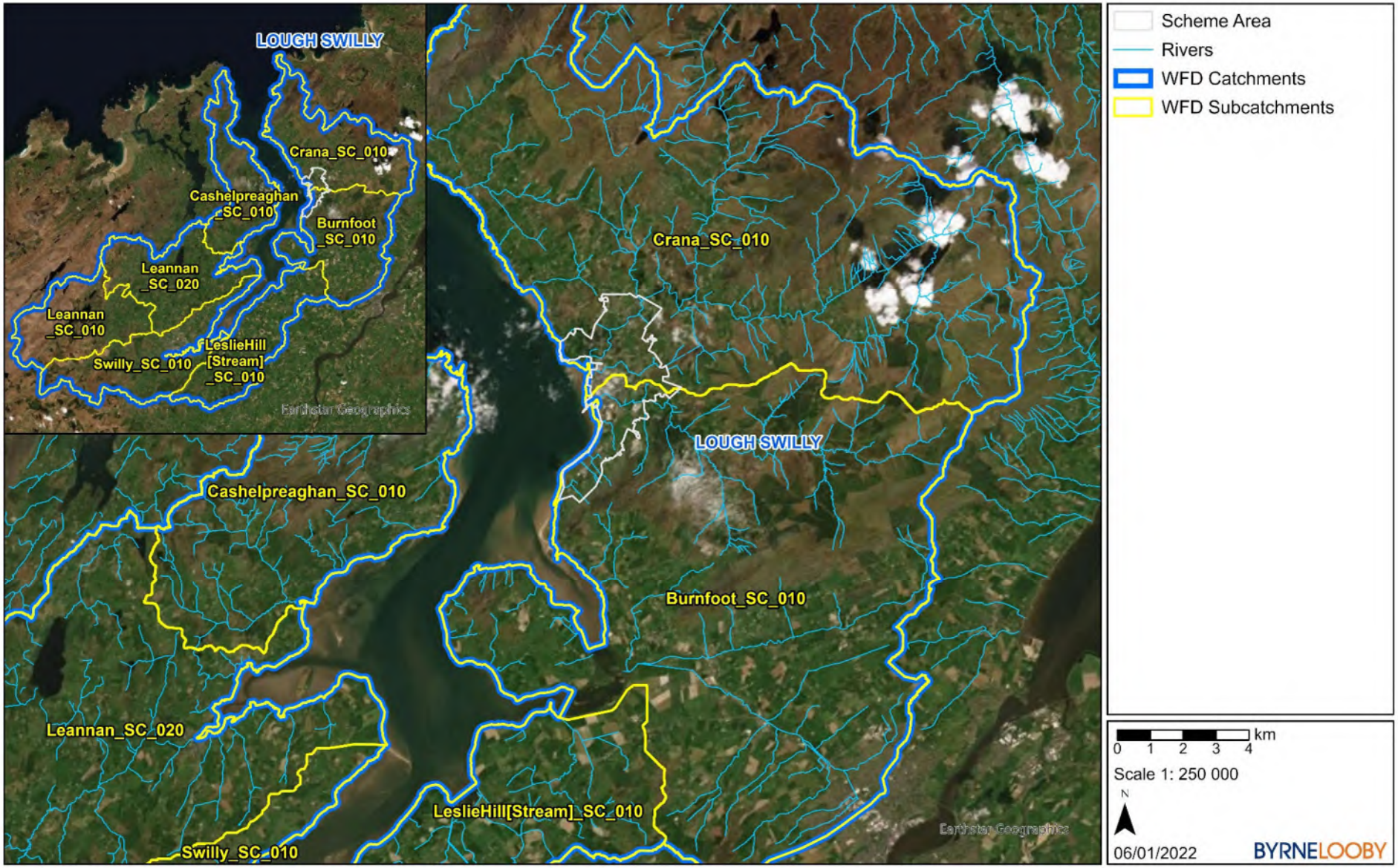

Figure 5.1 Lough Swilly Catchment and Subcatchments (WFD)
(Data source: EPA GeoPortal)

Figure 5.2 Hydrology constraints study area with locations of national water quality monitoring stations and hydrometric gauges

Table 5-2 Waterbody status data for the waterbodies within the study area

Waterbody (type)	Name	Code	Monitoring type of Waterbody	Water Quality Status (2013-2018) See Figure 5.3	WFD risk status See Figure 5.4	High Ecological Status Objective	Pressures
Ballymacarry Lower, Luddan River & Lisfannan River (river)	Lisfannan_010	IE_NW_39L170710	None	Unassigned	Review	No	N/A
Mill River (river)	MILL (DONEGAL)_020	IE_NW_39M020300	• Operational Monitoring • Supporting Chemistry Monitoring • Biological Monitoring	Poor	At risk	No	• Agriculture • Forestry • Barriers are the dominant hydromorphological sub-pressure category in the catchment • Peat drainage and extraction • Mines and Quarries with sediment impacts
Mill River (river)	MILL (DONEGAL)_010	IE_NW_39M020050	• Operational Monitoring • Biological Monitoring	High	Not at risk	Yes	N/A
Buncrana River and Crana River (river)	CRANA_030	IE_NW_39C020500	• Operational Monitoring • Supporting Chemistry Monitoring • Biological Monitoring	Poor	At risk	No	• Agriculture
Crana River (river)	CRANA_020	IE_NW_39C020300	• Operational Monitoring • Biological Monitoring	Poor	At risk	No	• Peat drainage and extraction • Agriculture • Other

Waterbody (type)	Name	Code	Monitoring type of Waterbody	Water Quality Status (2013-2018) See Figure 5.3	WFD risk status See Figure 5.4	High Ecological Status Objective	Pressures
Cashelnacor River (river)	CASHELNACOR_010	IE_NW_39C010200	• Operational Monitoring • Supporting Chemistry Monitoring • Biological Monitoring	Poor	At risk	No	• Agriculture • Domestic Waste Water
Owenboy River (river)	OWENBOY (CRANA)_010*	IE_NW_39O040400	• Operational Monitoring • Supporting Chemistry Monitoring • Biological Monitoring	Poor	At risk	No	• Agriculture • Domestic Waste Water • Illegal waste dumping
unnamed river (river)	GORTYARRIGAN_010	IE_NW_39G110630	None	Unassigned	Review	No	N/A
Crana Estuary (transitional)	Crana Estuary	IE_NW_220_0400	None	Unassigned	Review	No	Anthropogenic Pressures
Lough Swilly (coastal)	Lough Swilly	IE_NW_220_0000	• Operational Monitoring • Supporting Chemistry Monitoring • Biological Monitoring	Good	Not at risk	No	N/A
* Tributary of 'Crana_030'							

Source: WFD Application (2019a,b).

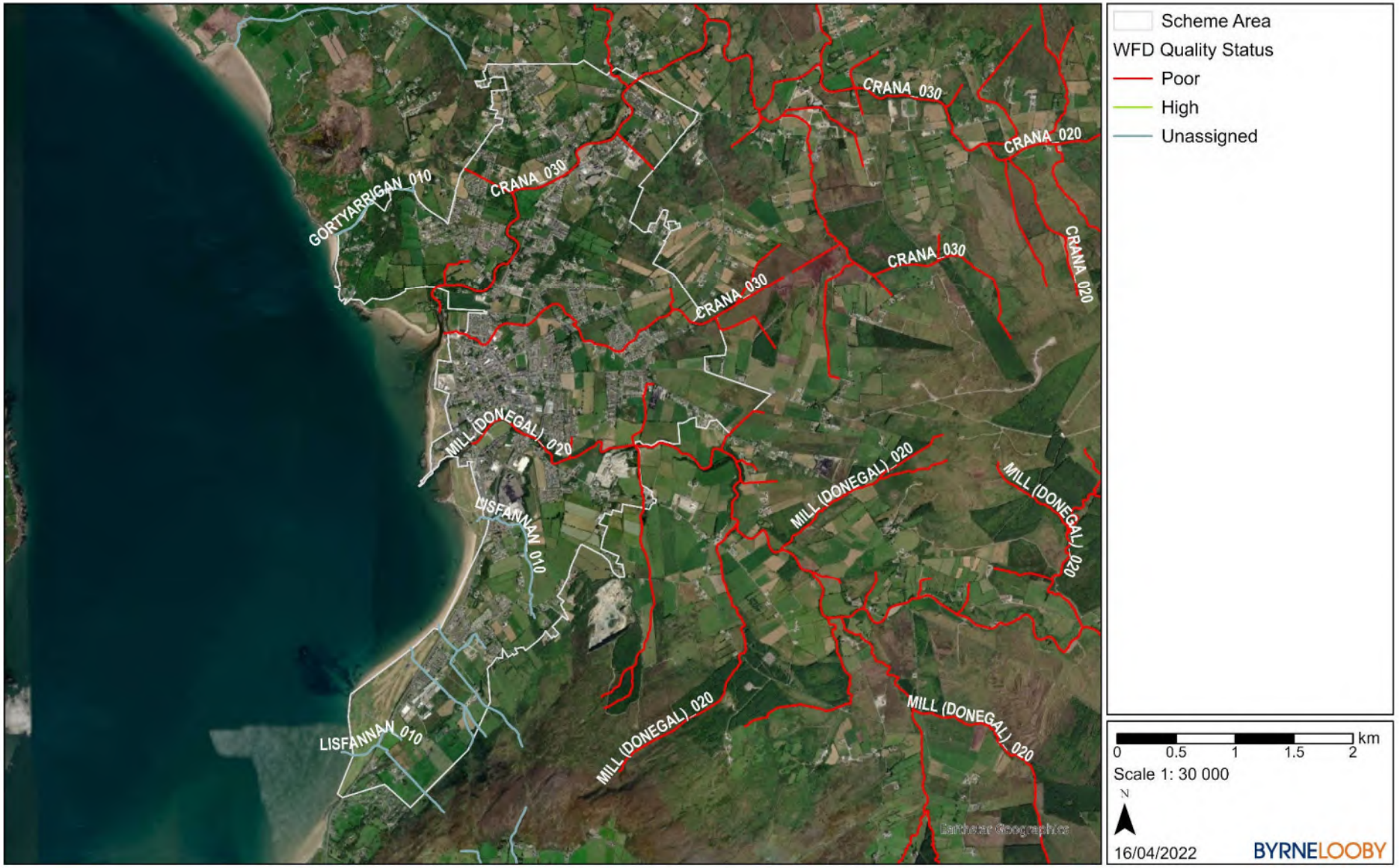

Figure 5.3 WFD River Water Quality Status

Figure 5.4 WFD River Risk Status

The Local Authority Waters Programme (LAWPRO)[4] identify sections on the River Crana (including Cashelnacor and Owenboy tributaries) and the Mill River in the study area as Areas for Further Action (AFAc) for restoration. The headwaters of the Mill River (Mill (Donegal)_010) is recognised as being of High Status Objective under the Blue Dot Catchments Programme which specifically targets the maintenance and restoration of high-status objective water bodies in the State (Department of Housing, Local Government and Heritage, 2021). This portion of the Mill River does not fall within the Scheme Area. The Mill River associated with the Scheme is Mill (Donegal)_020).

However, both these rivers have been proposed together as an Area for Action (AFAc) in the 3rd Cycle, which is currently out for consultation, with a potential blue dot label to be provided across both (if 50% or more of waterbodies within any proposed AFAc fall within the High-Status Objective). This has been confirmed in e-mail communications received from LAWPRO on 4th May 2022.

LAWPRO, as per communications received on 4th May 2022 (see Appendix B) confirmed that hydromorphology impacts from the old mill race are a likely pressure on the status of the Mill (Donegal)_020 waterbody where it drops to Poor status downstream of the old railway bridge in the town. The 2nd Cycle Characterisation report for the Burnfoot_SC_010 sub-catchment also states *"Siltation due to the impact of a weir was highlighted as contributing to the Moderate ecological status of Mill (Donegal)_020"* (Catchments.ie, 2021).

5.3.4 Local Groups

The Inishowen Rivers Trust (IRT) aims to support and organise projects that serve to enhance the quality of rivers in Inishowen and to engage with the public. Recent projects included clearing debris from Magee's Pool on the Crana River and re-using materials for revetment/habitat creation projects, where suitable. The groups also organised a 'Balsam Bashing' event in Autumn 2021 to remove Himalayan Balsam of a section along the River Crana (Inishowen Rivers Trust, 2021). IRT is also undertaking bank work such as fencing (Illies) and revetments, using brash material at various locations along the Crana River and its tributaries. IRT's leaflet on the Crana River is included under Appendix F.

The Mill River Conservation Group formed in Buncrana in 2021 and activities focus on supporting natural biodiversity in the 'Mill-Owenkillew' River.

5.4 Key Constraints

Surface water bodies in the study area are classed under the WFD as 'at risk' of not meeting the WFD objectives of 'good' Ecological Status. Further, on account of the upper reaches of the Mill River (Mill (Donegal)_010) being classified as High Status under the blue dot programme, the portion of the Mill River associated with the Scheme (Mill (Donegal)_020) is being considered an AFAc under the 3rd Cycle, with the potential with a potential blue dot label to be provided across both (if 50% or more of waterbodies within any proposed AFAc fall within the High-Status Objective). Under WFD and LAWPRO requirements, the development of the scheme should incorporate measures to ensure

[4] https://lawaters.ie/

that the hydromorphological conditions of the water body is consistent with the achievement of the required ecological status.

Measures to protect active national water monitoring stations and hydrometric gauges and avoid impacting their data collection processes should be considered during design and construction phases.

The scheme design and schedule will need to take into consideration the development of any WWTPs, water abstraction facilities or third party 'WFD' projects in the vicinity of the scheme area, including potential impacts to utilities and infrastructure.

Potential impacts on the hydrology and morphology of the study area watercourses during construction, maintenance and operations should be considered. A hydromorphology survey will be completed using the River Hydromorphology Assessment Technique (RHAT). It is recommended that the hydrological and morphological physical condition regime of all waterbodies which might be affected by the scheme are fully considered to ensure that the WFD hydro-morphological status is unaffected.

The scheme should take into consideration water quality sensitive protected species, including Annex II species and qualifying interests for the SAC, recorded in waterbodies in the scheme area and vicinity. Additionally, water dependant terrestrial ecosystems are present within the study area and downstream and should be considered. The scheme should take into consideration the presence of protected water resources in the study area (Lough Swilly SAC and Lough Swilly SPA).

Projects to improve the quality of surface waterbodies in the catchment are being undertaken by local groups and other third parties. Works include practical measures using nature-based solutions to improve hydromorphology in the River Crana. Coordination with these groups is advised to ensure the projects are not detrimentally impacted during works.

6 Soils, Geology and Groundwater

6.1 Introduction

This section of the report outlines the environmental constraints associated with the soils, geology and groundwater/hydrogeology of the study area.

The extents of the topic specific constraint boundaries/study areas are provided in the relevant figures in the following section and are:

- 1 km of the scheme area boundary for geology, karst features, geoheritage, geohazards, economic geology, and soil.
- 3 km of the scheme area boundary for groundwater.

In the absence of formal guidance on the establishment of a study area for this topic, the boundaries were selected using professional judgement to ensure that the local geological context could be considered at an appropriate scale to the features identified.

Features outside of these boundaries may be discussed in the following subsections to give greater context within the wider vicinity of the project area, where relevant. However, such features are not considered within the constraint boundary as they are unlikely to interact with the scheme.

6.2 Methodology

A desktop study was undertaken to describe the environmental constraints associated with the soils, geology and hydrogeology of the study area. The sources of publicly available information consulted in order to identify possible constraints within the study area include:

- The Geological Survey of Ireland (GSI) online database.
- Geological Survey Ireland (GSI) data and map viewer, including hydrogeology, geology, soils, geoheritage, and karst database. GSI is a division of the Department of Communications, Climate Action and Environment. Specific attribution statement: "This report contains Irish Public Sector Data (Geological Survey) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence".
- Department of the Environment, Climate and Communications OPALS Viewer (Mineral Exploration and Mining).
- Donegal County Council Planning Department (Quarries Register under Section 261 Planning and Development Act 2000).
- Teagasc Irish Soil Information System.
- EPA Map data and map viewer, including Water data, ENVision Mines Site, the EPA's online Historic Mines Inventory.

- Groundwater data hosted on Catchments.ie.
- 1st Draft Lough Swilly GWB Description (Geological Survey Ireland, 2004).
- 3rd Cycle Draft Lough Swilly Catchment Report (HA 39) (Catchment Science & Management Unit Environmental Protection Agency, 2021).
- WFD Cycle 2 Catchment Lough Swilly Subcatchment Burnfoot_SC_010 Report (WFD Application, 2019a).
- Irish Concrete Federation Members Directory (Irish Concrete Federation, 2021).

The characterisation of the baseline in this section is based on desktop study.

Groundwater abstraction is described in Section 3.3.4.2.

6.3 Baseline / Receiving Environment

6.3.1 Geology

Bedrock geology in the study area and wider catchment is comprised of Dalradian metasediments and Buncrana is underlain largely by schists. The formations and lithological descriptions of geology in the scheme area are presented in Figure 6-1 and Figure 6-2 (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021). Bedrock geology is detailed in Table 6-1.

Table 6-1 Bedrock geology in the study area

Formation	Lithology	Stratigraphical Unit
Fahan Slate Formation	The general lithology is of alternating pale-grey laminated pelites and thin bands of ripple-drift sandstone. There are several discontinuous marble units within the formation.	Dalradian, Precambrian
Fahan Grit Formation	The formation comprises of Pale grey grit with psammitic schist. Generally pale grey, thickly bedded grits and flags with subsidiary pelitic horizons. The grit bands vary in thickness and composition, commonly exhibit graded beds and are sometimes markedly feldspathic.	Dalradian, Precambrian
Culdaff Limestone Formation	The formation comprises dark grey marble with large black dolomite crystals interbedded with graphitic pelitic schists. As the formation is traced southwards its marbles have an increasingly pelitic component.	Dalradian, Precambrian

Formation	Lithology	Stratigraphical Unit
Upper Crana Quartzite Formation	The formation comprises an upward-coarsening sequence of graded pebbly grits. Grading is conspicuous and cross-stratification is also present. The lithology is Psammitic schists with pebbly grit beds.	Dalradian, Precambrian
Lower Crana Quartzite Formation	A lower fine grained unit comprises thick, rarely graded, beds of psammite interbedded with finely striped semi-pelitic schists. This is overlain by a unit of striped psammites with some thin marbles best seen southeast of the Leannan Fault.	Dalradian, Precambrian
Metadolerite	Hornblendic and sometimes schistose. The Metadolerite is green or grayish green to dark green in colour with ophitic or poikilitic textures, and rarely porphyritic textures. The primary minerals are plagioclase, brown hornblende, clinopyroxene, and opaque minerals	Dalradian, Precambrian

GSI data indicates that Quaternary geology in the study area is comprised of till derived from metamorphic rocks and alluvium (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

6.3.2 Karst features

Karst can form on any rock that is soluble in water and, within Ireland, most karst is found in Carboniferous limestones. Karsts features can cause structural instability to overlying and adjacent land and increase vulnerability to groundwater by creating a pathway for contaminants present on land or surface waters to enter the subsurface.

GSI bedrock mapping data indicates that Carboniferous limestone is not present within the study area. Karst feature data compiles by the groundwater unit at the Department of the Environment, Climate and Communications (DCCAE) indicates that there are no karst features reported from the scheme area or vicinity. There are no karst features reported in proximity of the lower catchment (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

Culdaff Limestone Formation is comprised of carbonate meta-sediments (e.g. marbles with dolomite crystals) and this lithology may contain karst features.

6.3.3 Soils and sediments

Teagasc data indicates that made soils are present in urban areas and, outside of these areas, alluvial soils, acid brown earths and podzolic soils are present within the scheme area (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

DCCAE provide high level soil permeability data that is not available throughout the whole of the constraints boundary area of scheme area. The available data indicates that subsoil permeability is largely moderate in the study area (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

Historical site investigation data for soils, including reports outlining the presence of any soil contamination that may be present in the scheme area, were not available at the time of writing.

A licenced waste facility, Buncrana Wastewater Treatment Plant, is present in the study area (see Section 0) and could be a potential source of contamination. However, the location and nature of any contaminated soils, if present in the scheme, may not be recorded, particularly where caused by historical events.

EPA data indicates that there are marine dumpsite boundaries within the scheme area for dredge material in the harbour. Soils in the scheme area and vicinity are shown in Figure 6.2.

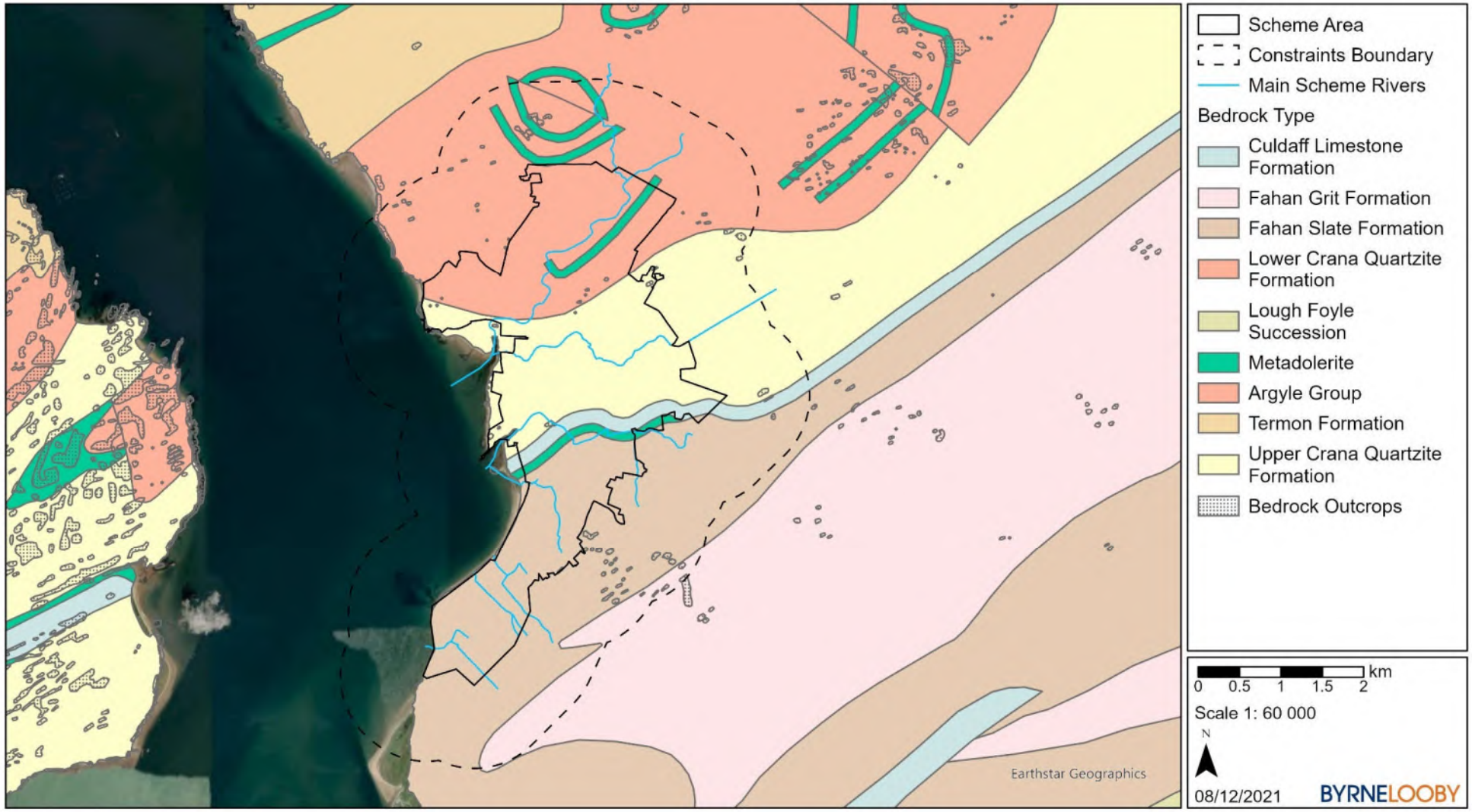

Figure 6.1 Bedrock geology

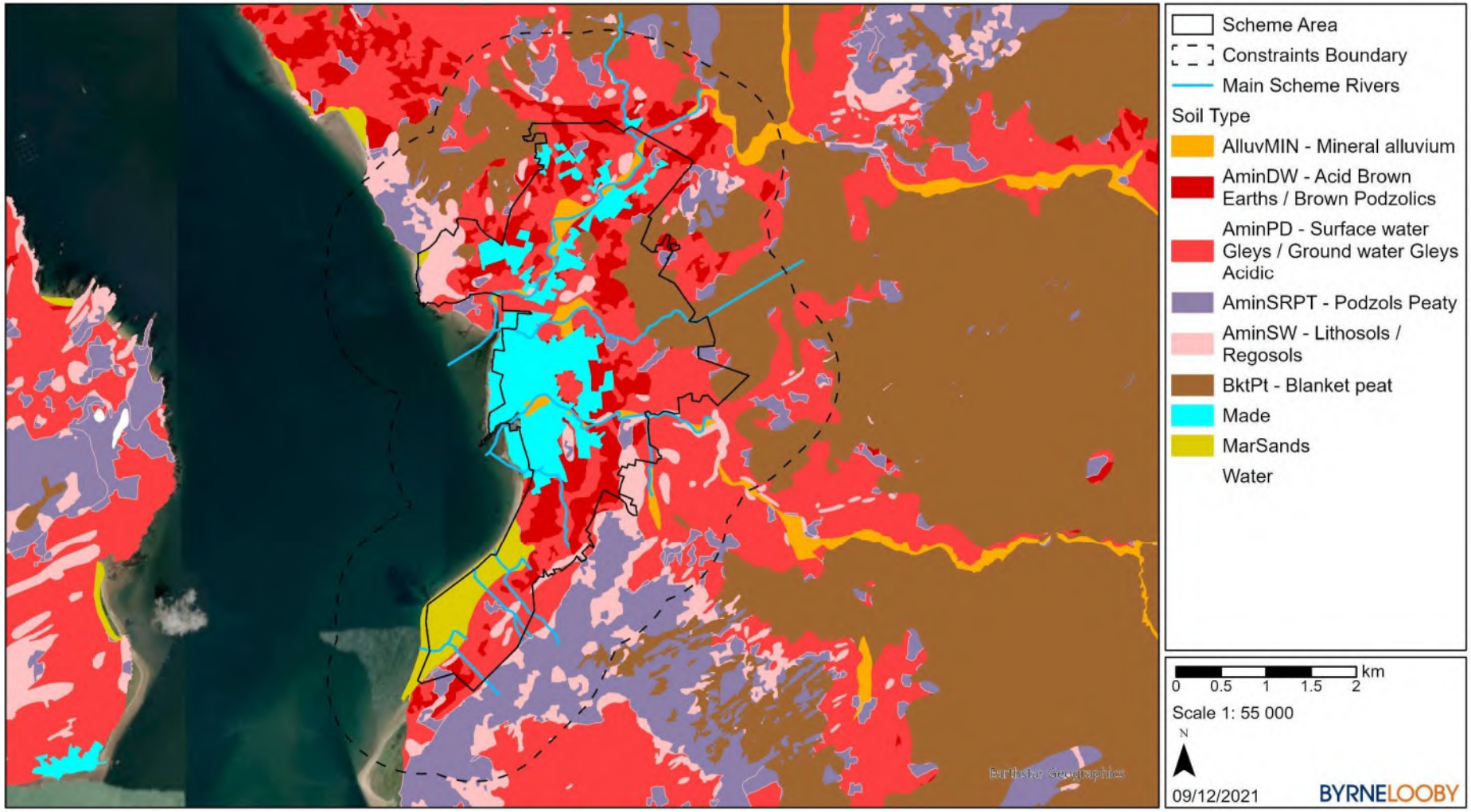

Figure 6.2 Soils in the scheme area and vicinity.

(Source: EPA GeoPortal).

Abbreviations for soil categories: AlluviMIN = mineral alluvium; AminDW = deep well drained mineral (derived from mainly acidic parent materials); AminPD = deep poorly drained mineral (derived from mainly acidic parent materials); AminSRPT= shallow, lithosolic or podzolic type soils potentially with peaty topsoil (derived from non-calcareous rock or gravels; AminSW = shallow well drained mineral (derived from mainly acidic parent materials); BkPt = blanket peat; Made = made ground, MarSed = marine sand and gravel

6.3.4 Geoheritage

GSI data indicates that The Loch Súilí (also known as Lough Swilly) Irish Geological Heritage site is present within the study area.

Lough Swilly is one of Ireland's few glacial fjords and the cliffs, beaches, mudflats, salt marshes, polders and headlands at the Lough make this County Geological Site a classic textbook locality for coastal erosion and deposition features. Lough Swilly is the only fjord on Ireland's north coast. The lough contains a range of sedimentary environments, including intertidal and salt marsh areas, some of which have been reclaimed for agricultural use. Parts of the site include Lough Swilly SAC (002287) and pNHA (000166), the North Inishowen Coast SAC and pNHA (002012), and Ballyhoorisky Point to Fanad Head SAC and pNHA (001975) (Geological Survey Ireland, 2019).

6.3.5 Geohazards

GSI data indicates that there are no landslides reported from the study area. The closest records (all landslips) are peat flows that have been recorded in high areas at Scalp Mountain, Eskaheen Mountain, Aught, and near Adderville.

6.3.6 Economic geology

Section 261A of the Planning and Development Act (2000 – 2011) details the registered quarries within Buncrana are detailed in Table 6-2.

Table 6-2 Section 261A of the Planning and Development Act - Quarries in the study area

Reference code	Townland of quarry
EUQY52	Glenard, Buncrana
EUQY14	Gransha, Buncrana

There are no other records of extractive industries within the study area (Geological Survey Ireland, 2021).

6.3.7 Groundwater

Aquifer categories are intended to describe both resource potential (Regionally or Locally important, or Poor) and groundwater flow type and attenuation potential (through fissures, karst conduits or intergranular). The aquifer code is made up of the aquifer resource value and how the groundwater flows in the bedrock or sand & gravel aquifer. They are as follows (Geological Surveys Ireland, 2022):

Regionally Important (R) Aquifers:

- Karstified bedrock (Rk)
- Fissured bedrock (Rf)
- Extensive sand & gravel (Rg)

Locally Important (L) Aquifers:

- Sand & gravel (Lg)

- Bedrock which is Generally Moderately Productive (Lm)
- Bedrock which is karstified to a limited degree or limited area (Lk)
- Bedrock which is Moderately Productive only in Local Zones (Ll)

Poor (P) Aquifers:

- Bedrock which is Generally Unproductive except for Local Zones (Pl)
- Bedrock which is Generally Unproductive (Pu)

The catchment is largely mountainous and is entirely underlain by metamorphic rocks that provide limited groundwater resources (Catchment Science & Management Unit Environmental Protection Agency, 2021). Hydrostratigraphic rock unit groups in the constraints area broadly fall into Precambrian quartzites, gneisses and schists and Precambrian marbles. The Buncrana scheme is underlain by "Locally important gravel aquifer", "Locally Important Aquifer-Bedrock which is Moderately Productive only in Local Zones", "Poor Aquifer-Bedrock which is Generally unproductive", and "Poor Aquifer-Bedrock which is Generally Unproductive except for Local Zones" (see Figure 6-3) (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021).

The Geological Survey Ireland (GSI) classes groundwater vulnerability as 'Moderate' to 'High' throughout much of the study area. Other areas are either classed as 'Low', 'Extreme', or 'Rock at or near karst surface' (see Figure 6-4) (Geological Survey Ireland, Department of the Environment, Climate and Communications, 2021). Groundwater vulnerability represents the characteristics of the geological and hydrogeological features at a site that determine the ease of contamination of groundwater, or in other words how easy can contamination infiltrate into subsurface materials and contaminate the groundwater.

The groundwater body (code: IEGBNI_NW_G_059) that underlies the study area and its Water Framework Directive waterbody status is shown in Table 6-3 and classified as not at risk (WFD Application, 2019a; WFD Application, 2019b).

Table 6-3 Ground Waterbody WFD Status 2013-2018 for the study area

Chemical	Overall Groundwater Status	Quantitative Groundwater Status
Good	Good	Good

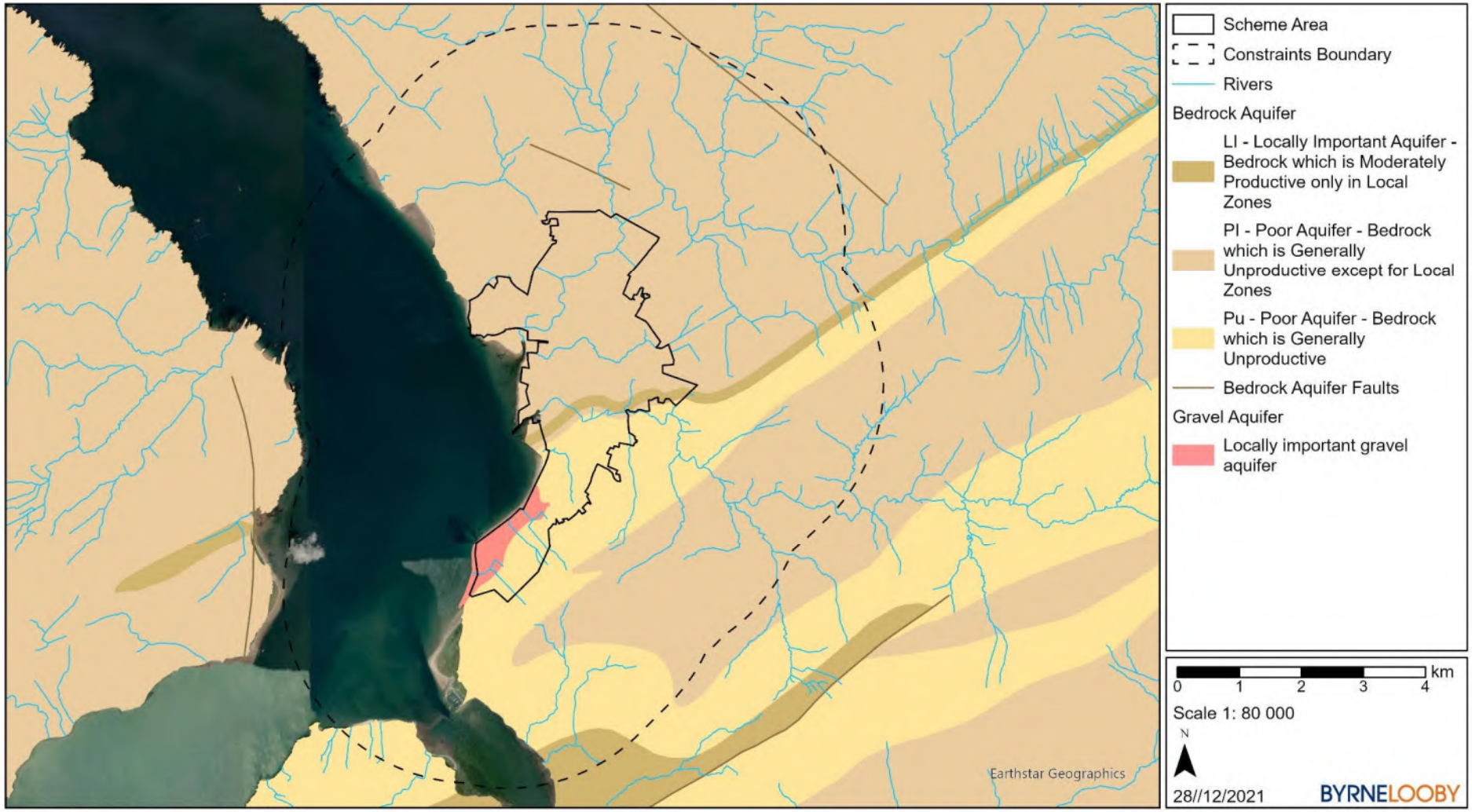

Figure 6.3 Aquifers in the study area.

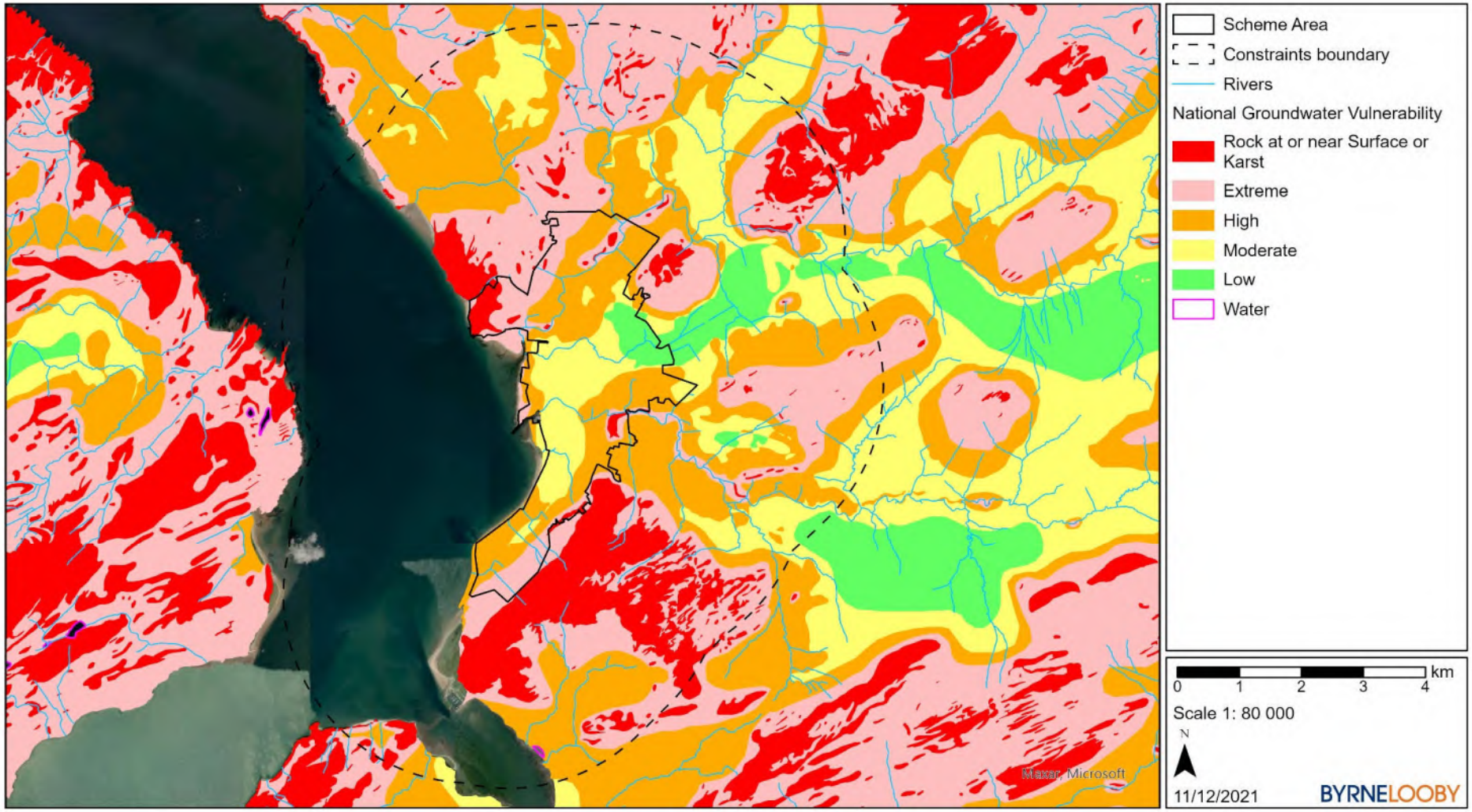

Figure 6.4 Groundwater vulnerability in the study area

6.4 Key Constraints

Key constraints associated with the soils, geology and hydrogeology of the study area include:

- Made ground and/or contaminated ground: Depending on the scheme design and type of works, for areas where made ground is uncompacted and/or highly variable it may require to excavate and place this material and replace with suitable founding material. This material may also be a possible a source of contamination. As this material will be excavated during construction, it may require contamination testing be undertaken during the detailed site investigation.

- Contaminated land: The scheme area is located in an area with industrial heritage and commercial properties. If intrusive works are required during construction at locations where known or unknown contaminated land may be present (e.g. from recorded historical land-use), an investigation may be required into determine if land contamination is present and, if present, to determine its nature and extent.

- Soils and groundwater: Poor draining soils occurring within the scheme footprint are potentially soft and compressible and will likely require a detailed site investigation (SI) in order to design a suitable flood defence scheme. Appropriate environmental controls and management measures will be implemented for any advance SI works, this may include a requirement for AA screening, or an application/notification to NPWS for approval. A CEMP will be developed for construction activities. The CEMP will identify appropriate equipment and construction techniques that should be used in circumstances where there is a potential impact to the environment. Engineering design should minimise the impacts of the flood relief scheme on the sections of river within the study areas and the wide catchment.

- Groundwater vulnerability to contamination: Depending on the design of the scheme, works may occur adjacent or within areas where groundwater is classified by the GSI as 'extremely vulnerable' to contamination. Appropriate environmental controls and management measures will be implemented for any advance SI works. A CEMP will be developed for construction activities. A CEMP will be developed for all site investigation works, construction activities and traffic management.

- Karst features: GSI data indicated that there are no recorded karst features in the study area. However, despite the lack of carbonate lithologies in bedrock in the study area it is prudent to consider that karst features such as caves, swallow holes, weathered rock and dolines may be present and can lead to ground surface and ground instability and are a constraint to be considered in the engineering design of the scheme.

- Geoheritage: It is good practice to inform the Geological Survey Ireland (GSI) (contact: Beatriz.Mozon@gsi.ie) where:
    - construction works temporarily or permanently uncover significant outcrop;
    - were reports detailing any site investigations can be made available to the GSI;
    - a digital photographic record of any significant new excavation can be produced and provided to the GSI.

7 Ecology and Biodiversity

7.1 Introduction

This section assesses data on flora, fauna and habitats within the study area in order to identify receptors potentially sensitive to flood risk management options, or which may constrain the implementation of certain options.

For the purposes of this report, the constraints study area is defined as an area approximately 15km in radius from the scheme area where potential measures are proposed. This is shown in Figure 7-1 below.

The extent of the study area is based on best practice guidance (Chartered Institute of Ecology and Environmental Management, 2018 (updated 2019)) which advises that a 'zone of influence' is established which includes the area of which ecological features may be affected as a result of the scheme and (DoE, 2009) (DoE, 2009) which recommends that all Natura 2000 sites within 15km of a project be initially screened for impacts.

7.2 Methodology

A desktop assessment and a Preliminary Ecological Assessment (PEA) were carried out to identify features of ecological importance which have potential to be affected by the proposed development. It compromises of both a desk study and a walkover survey. A PEA (as described by the Chartered Institute of Ecology and Environmental Management (CIEEM) (Chartered Institute of Ecology and Environmental Management, 2017) is the term used to describe a rapid field assessment of the ecological features present, or potentially present, within a site of the surrounding area based on a visit to the site at a suitable time of the year. It involves describing the habitats and species present at the site based on visual and photographic surveys. The PEA is undertaken also to make a preliminary assessment of the likely impacts of a development. The assessments included an examination of aerial imagery and other available datasets to investigate the potential for connectivity to designated and ecologically sensitive areas, as well as a review of available literature e.g. NPWS data on European sites.

7.2.1 Desktop Study

During the desktop study, information was collated from readily available sources including:

- National Parks and Wildlife Service (NPWS) (https://www.npws.ie/maps-and-data/habitat-and-species-data (accessed September 2021)
- Development Applications Unit of the Department of Housing, Local Government and Heritage
- Birdwatch Ireland
- Inland Fisheries Ireland.

- The Atlas of Breeding Birds in Britain and Ireland (Sharrock, 1976)
- The New Atlas of Breeding Birds of Britain and Ireland (Gibbons et al., 1993)
- NPWS site synopses, satellite images of the area and OPW Discovery Series maps.
- Information on the Lough Swilly Catchment was sourced from websites of and publications from the following organisations:
    - National Parks and Wildlife (National Parks and Wildlife Service, 2016); (National Parks and Wildlife Service, 2014)
    - The Environmental Research Unit (Environmenal Research Agency, 1992, p. 507)
    - The Environmental Protection Agency (Environmental Protection Agency, 2018)
    - Inland Fisheries Ireland.
- The European Eel in Inishowen (Inishowen Rivers Trust, 2021).
- Review of fish stocks and associated habitat in the Crana catchment (Inland Fisheries Ireland, 2019).

7.2.2 Site Walkover

Habitats which might be affected by the development were identified and their suitability to support sensitive, rare and protected species was assessed (having regard to the typical ranges of species known to occur in the locality).

The walk over survey (September 2021) involved examining and recording the habitats and flora and fauna that are present along the river bank, in the vicinity of the locations of proposed measures, and areas for investigation and photographing representative elements of these. All identifications were made in the field and binoculars were used to identify birds.

1.2.3 Legislation and Guidance

In assessing the potential impacts on the prevailing biodiversity, due regard was had to relevant legislation and guidance including:

- EIA Directive (2014/52/EU);
- Planning and Development Acts 2000 – 2018 and Planning and Development Regulations 2001-2019;
- Wildlife Act 1976 and as amended;
- Flora (Protection) Order 2015;
- Inland Fisheries Act 1959 – 2010;
- EU Water Framework Directive 2000/60/EC;

- European Communities (Birds and Natural Habitats) Regulations 2011 (as amended);
- Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (Chartered Institute of Ecology and Environmental Management (CIEEM, 2018 (updated September 2019));
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Union, 2013);
- Ireland's National strategy for Plant Conservation: progress towards 2020 (Smyth, N. Cole, E. Kelleher, C, Jebb, M & Lynn, D., 2019);
- Ireland's Marine Strategy Framework Directive Article 19 Report Initial Assessment, GES and Targets and Indicators (Marine Institute, October 2013);
- National Biodiversity Action Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht, 2011); and,
- Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016).

This section of the report has been compiled from a preliminary ecology report based on a site walkover and desktop assessment.

A number of other factors that are also relevant to ecology due to their interactions, e.g. hydrology, hydrogeology and population and human health, are detailed in the relevant sections of this report.

7.3 Baseline / Receiving Environment

7.3.1 Natura 2000 sites

The National Biodiversity Action Plan 2017 – 2021, and more particularly Objective 6 supports the expansion and improved management of protected areas and species.

- *Objective 6: Expand and improve management of protected areas and species*
    - *Target 6.1 – Natura 2000 network designated and under effective conservation management by 2020.*

Natura 2000 is an ecological network composed of sites designated under the Birds Directive (Special Protection Areas (SPA)) and the Habitats Directive (Sites of Community Importance (SCI), and Special Areas of Conservation (SAC)).

Best practice guidance (DoE, 2009) recommends that all Natura 2000 sites within 15km of a project be initially screened for impacts.

There are 4 Special Protection Area (SPA) and 5 Special Areas of Conservation (SAC) within 15km of the scheme are as listed in Table 7-1 and shown on Figure 7.1 (NPWS, 2021).

Table 7-1 Natura 2000 Sites within 15km of the scheme area

Type	Site Code	Site Name	County
SAC	001975	Ballyhoorisky Point to Fanad Head SAC	Donegal
SAC	002012	North Inishowen Coast SAC	Donegal
SAC	002159	Mulroy Bay SAC	Donegal
SAC	002176	Leannan River SAC	Donegal
SAC	002287	Lough Swilly SAC	Donegal
SPA	004075	Lough Swilly SPA	Donegal
SPA	004087	Lough Foyle SPA	Donegal
SPA	004148	Fanad Head SPA	Donegal
SPA	004194	Horn Head to Fanad Head SPA	Donegal

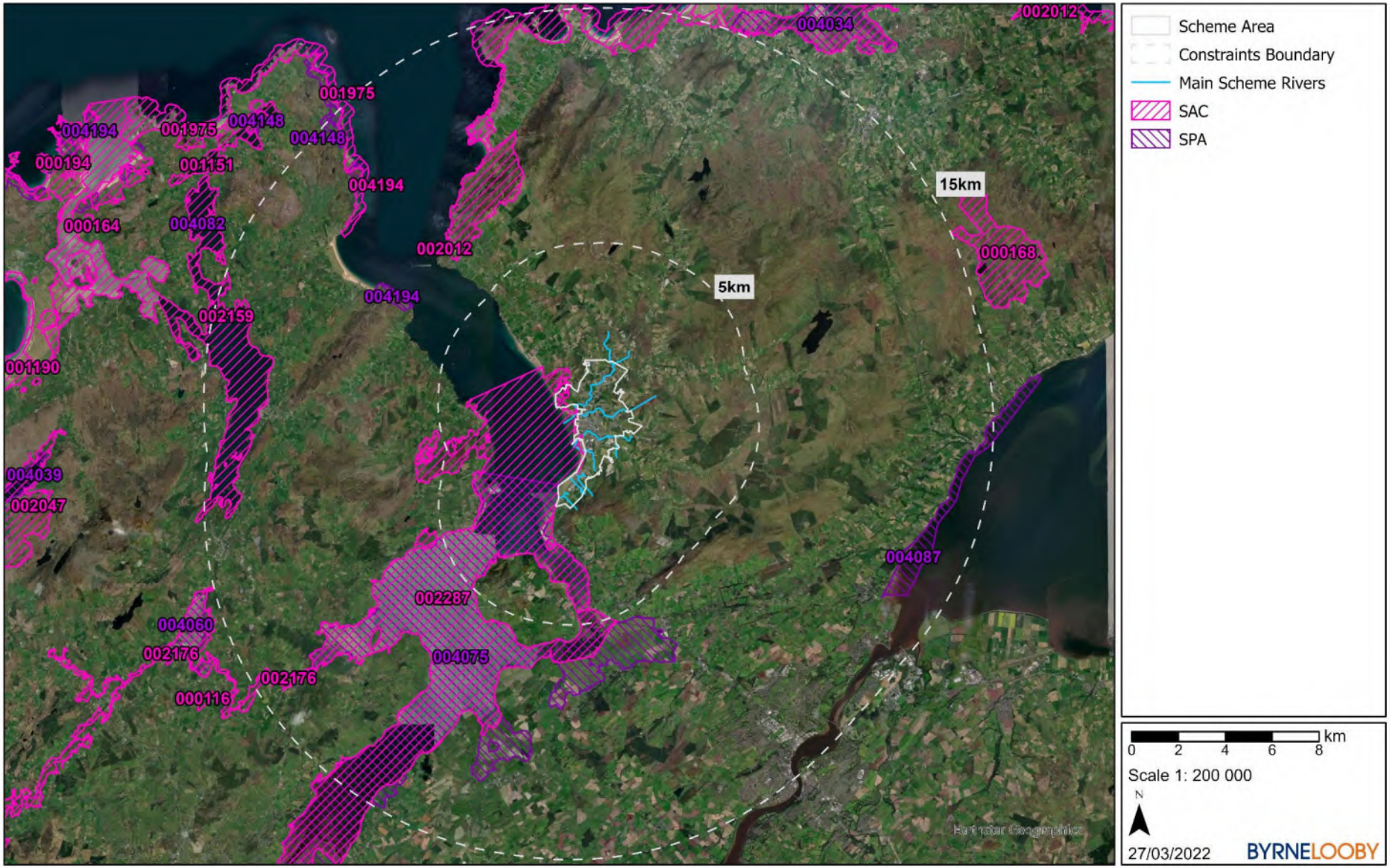

Figure 7.1 Natura 2000 Sites within 15km of the scheme area

7.3.1.1 Lough Swilly Special Area of Conservation

The great majority of Lough Swilly lies within Lough Swilly Special Area of Conservation (SAC) (site code 002287). This SAC is of high conservation value for the following Qualifying Interest (QI) habitats and plant and animal species:

Habitats

- 1130 Estuaries
- 1150 Coastal lagoons
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

Species

- 1355 Otter (*Lutra lutra*)

The SAC contains protected water dependent habitats or species.

7.3.2 Lough Swilly Special Protection Area

The Special Protection Area (SPA) includes protected water species as qualifying interests and specific water supporting conditions have not been identified for the dependent bird species (Catchment Science & Management Unit Environmental Protection Agency, 2021). Qualifying Interests of the SPA are:

- A005 Great Crested Grebe (*Podiceps cristatus*)
- A028 Grey Heron (*Ardea cinerea*)
- A038 Whooper Swan (*Cygnus cygnus*)
- A043 Greylag Goose (*Anser anser*)
- A048 Shelduck (*Tadorna tadorna*)
- A050 Wigeon (*Anas penelope*)
- A052 Teal (*Anas crecca*)
- A053 Mallard (*Anas platyrhynchos*)
- A056 Shoveler (*Anas clypeata*)
- A062 Scaup (*Aythya marila*)
- A067 Goldeneye (*Bucephala clangula*)
- A069 Red-breasted Merganser (*Mergus serrator*)
- A125 Coot (*Fulica atra*)

- A130 Oystercatcher (*Haematopus ostralegus*)
- A143 Knot (*Calidris canutus*)
- A149 Dunlin (*Calidris alpina*)
- A160 Curlew (*Numenius arquata*)
- A162 Redshank (*Tringa totanus*)
- A164 Greenshank (*Tringa nebularia*)
- A179 Black-headed Gull (*Chroicocephalus ridibundus*)
- A182 Common Gull (*Larus canus*)
- A191 Sandwich Tern (*Sterna sandvicensis*)
- A193 Common Tern (*Sterna hirundo*)
- A395 Greenland White-fronted Goose (*Anser albifrons flavirostris*)
- A999 Wetland and Waterbirds

7.3.3 Natural Heritage Areas and proposed Natural Heritage Areas

There are 4 Natural Heritage Areas (NHA) within 15km of the scheme and 13 proposed Natural Heritage Areas (pNHA) are within 15 km of the scheme (see Table 7-2).

Table 7-2 Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA) within 15 km of the scheme area

Type	Site Code	Site Name	County
pNHA	000120	Bulbin Mountain	Donegal
pNHA	000166	Lough Swilly Including Big Isle, Blanket Nook & Inch Lake	Donegal
pNHA	000180	Port Lough	Donegal
pNHA	001089	Ballymastocker Dunes	Donegal
pNHA	001098	Carndonagh Wood	Donegal
pNHA	001161	Lough Fad West	Donegal
pNHA	001162	Lough Fern	Donegal
pNHA	001196	The Point, Mulroy	Donegal
pNHA	001975	Ballyhoorisky Point To Fanad Head	Donegal
pNHA	002012	North Inishowen Coast	Donegal
pNHA	002055	Carlan Isles (Mulroy Bay)	Donegal
pNHA	002056	Old Rectory, Fahan	Donegal
pNHA	002057	Ramelton Mill	Donegal
NHA	001127	Illies Hill Bog NHA	Donegal
NHA	002322	Slieve Snaght Bogs NHA	Donegal
NHA	002405	Camowen River Bog NHA	Donegal
NHA	002406	Umrycam Bog NHA	Donegal

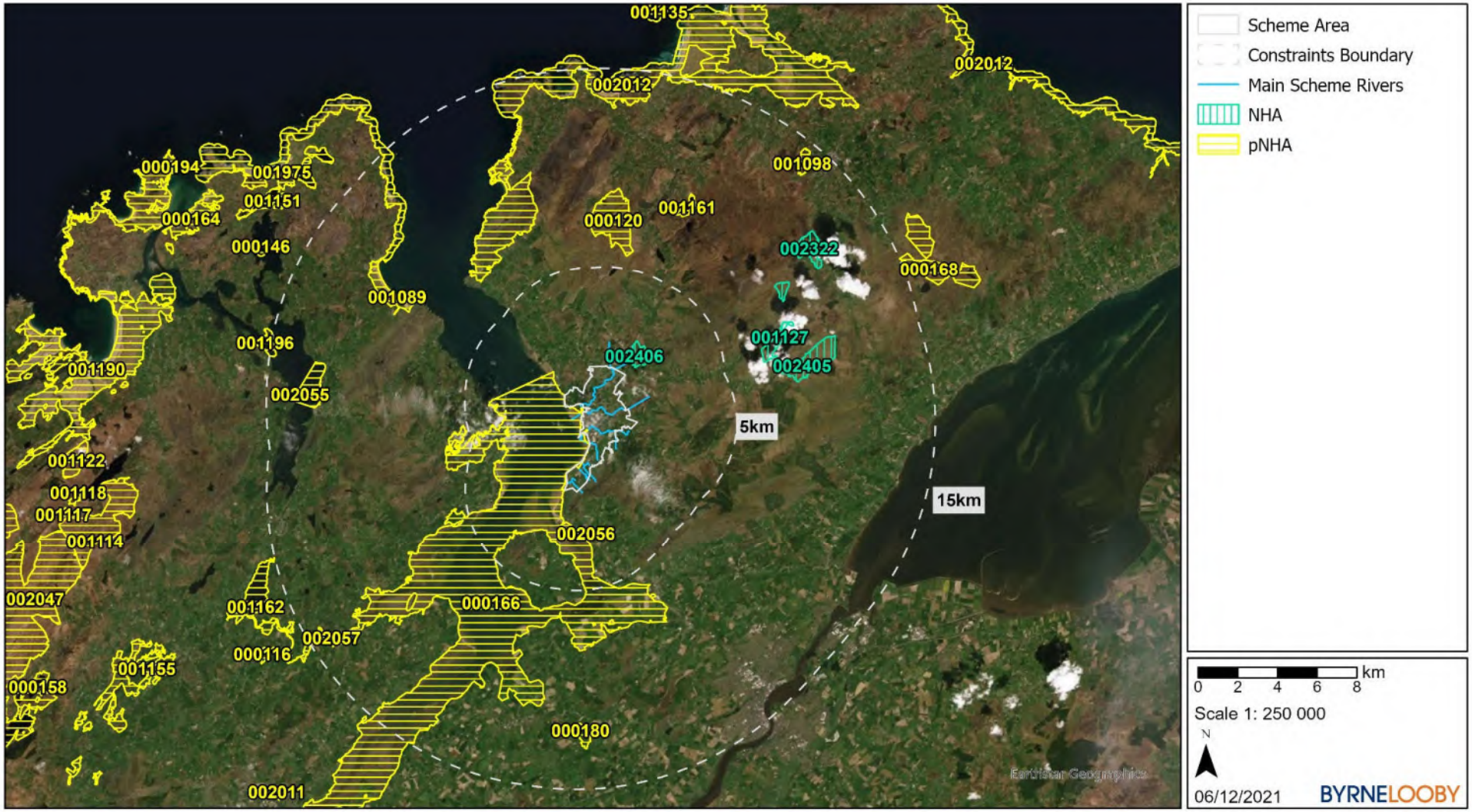

Figure 7.2 Natural Heritage Areas (NHA) proposed Natural Heritage Area(pNHA) within 15km of the scheme area

7.3.4 Shellfish Classified Areas

The Shellfish classified areas in Lough Swilly are protected WFD Shellfish Areas under the EU Water Framework Directive. The Lough Swilly Live Bivalve Mollusc Classified Production Area is Class B and extends from Fanad Head to Dunaff Head and includes all oyster beds.

Figure 7.3 Lough Swilly Designated Shellfish Protection Area

7.3.5 Ecology and Water Designated Statuses

Figure 5-1 provides a map showing the extents of the Lough Swilly Catchment and the Scheme Area.

7.3.5.1 Water Framework Directive

The Water Framework Directive (WFD) was agreed by all individual European Union (EU) member states in 2000 and provides a comprehensive framework for water quality management across the EU. The directive requires that all member states adopt a comprehensive integrated basin-based approach to water management.

The key rivers associated with the Project (Mill River, Buncrana River, Crana River are classed under the WFD as having 'poor' water quality (see Figure 5.3) and are 'at risk' of not meeting the WFD objectives of 'good' Ecological Status (see Figure 5.4). Key pressures to all these rivers include agriculture, forestry, peat drainage and extraction, mines and quarries and hydromorphological barriers.

The River Basin Management Plan (RBMP) for Ireland 2022-2027 is currently out for public consultation[5], to be published later in 2022. The final plan will need to be considered in this flood relief scheme.

7.3.6 Nutrient Sensitive Areas

There are no designated Nutrient Sensitive Areas in the catchment. However, species sensitive to water quality are present in the scheme area and pressures on water quality have been identified within the catchment (see Table 5-2 for details).

7.3.7 Nature Based Flood Solutions

The Inishowen Rivers Trust (IRT) is currently undertaking a study, sponsored by OPW, LAWPRO and DCC, to pilot nature-based flood solutions in Inishowen through implementation of Natural Flood Management (NFM) and Natural Water Retention (NWR) to improve water quality, restore riparian habitats and build community capacity (Inishowenriverstrust.com). A series of community engagement campaigns, awareness raising events and a scoping Project with Trinity College have been intrinsic in increasing public knowledge and awareness. 'The Opportunity for Natural Water Retention Measures in Inishowen' (Bourke et al, 2020) was the product of the Trinity College scoping exercise, where opportunities for NFM was explored in a number of locations including the River Donagh, Ballywilly Brook, the Glennagannon River, the Tullanree River, the Crana River and the Ballyhallan River were explored. The study focuses on NFM and NWR as methods of reducing flooding, but with further benefits of improving water quality, restoring habitat (particularly riparian in upper reaches of rivers) and retaining sediment nutrients.

[5] https://www.gov.ie/en/consultation/2bda0-public-consultation-on-the-draft-river-basin-management-plan-for-ireland-2022-2027/

Further, the National Biodiversity Action Plan 2017 – 2021, and more particularly Objective 4 supports nature-based solutions in flood risk management as a biodiversity enhancement measure, with catchment-wide focus and non-structural measures preferred:

- *Objective 4: Conserve and restore biodiversity and ecosystem services in the wider countryside.*
    - *Target 4.3 – Optimised benefits for biodiversity in Flood Risk Management Planning and drainage schemes.*
        - *Ensure that Flood Risk Management (FRM) planning and associated SEA, EIA and AA, minimises loss of biodiversity and ecosystem services through policies to promote more catchment-wide and non-structural flood risk management measures.*
        - *All significant drainage (arterial drainage), including both initial drainage and maintenance drainage will be assessed for its implications for biodiversity, particularly for wetlands*

7.3.8 Protected/Notable Species

Several species of flora and fauna are afforded protection under national, European and international law. At a national level, species are protected under, inter alia, the Wildlife Acts. At a European level, species are protected under, inter alia, the Birds Directive (Council Directive 79/409/EEC) and Habitats Directive (Council Directive 92/43/EEC), which are transposed into national law by various measures including the European Communities (Natural Habitats) Regulations, 1997-2005, and the European Communities (Conservation of Wild Birds) Regulations, 1985. The badger is not considered endangered in Ireland; however, badgers are protected under the Wildlife Acts (Wildlife Act, 1976; Wildlife Amendment Act, 2000), and in Northern Ireland under the Wildlife (N.I.) Order of 1985.

In many cases a derogation licence will be required to remove or disturb these legally protected species or their habitats.

Protected/Notable species recorded in the study are include:

- Migratory and wetland birds
- Otter
- Red Squirrel
- Badgers
- Hedgehog
- Common Frog
- Smooth Newt
- Bats

- Various freshwater and saltwater fish, including Salmon
- Cretaceans

7.3.8.1 Birds

Over 90 bird species have been recorded from the study area including the following protected bird species: Barn Swallow (*Hirundo rustica*), Black Guillemot (*Cepphus grylle*), Black-headed Gull (*Larus ridibundus*), Brent Goose (*Branta bernicla*), Common Eider (*Somateria mollissima*), Common Grasshopper Warbler (*Locustella naevia*), Common Greenshank (*Tringa nebularia*), Common Guillemot (*Uria aalge*), Common Kestrel (*Falco tinnunculus*), Common Kingfisher (*Alcedo atthis*), Common Linnet (*Carduelis cannabina*), Common Pheasant (*Phasianus colchicus*), Common Redshank (*Tringa totanus*), Common Snipe (*Gallinago gallinago*), Common Starling (*Sturnus vulgaris*), Common Swift (*Apus apus*), Common Wood Pigeon (*Columba palumbus*), Eurasian Curlew (*Numenius arquata*), Eurasian Oystercatcher (*Haematopus ostralegus*), Eurasian Woodcock (*Scolopax rusticola*), Great Black-backed Gull (*Larus marinus*), Great Cormorant (*Phalacrocorax carbo*), Great Crested Grebe (*Podiceps cristatus*), Great Northern Diver (*Gavia immer*), Herring Gull (*Larus argentatus*), House Martin (*Delichon urbicum*), House Sparrow (*Passer domesticus*), Mallard (*Anas platyrhynchos*), Mew Gull (*Larus canus*), Northern Gannet (*Morus bassanus*), Peregrine Falcon (*Falco peregrinus*), Red Kite (*Milvus milvus*), Red-breasted Merganser (*Mergus serrator*), Ringed Plover (*Charadrius hiaticula*), Sand Martin (*Riparia riparia*), Sandwich Tern (*Sterna sandvicensis*), Sky Lark (*Alauda arvensis*), Spotted Flycatcher (*Muscicapa striata*), Twite (*Carduelis flavirostris*), and Yellowhammer (*Emberiza citrinella*).

7.3.8.2 Mammals (non volent)

The study site contains suitable foraging, commuting, breeding and resting habitats for common mammal species in general and similar habitats are also present at a larger scale in the wider landscape. Overall, the proposed site is considered of local importance for mammal (non-volant) species.

7.3.8.3 Otter

The ecological study area contains suitable commuting, foraging, breeding and resting habitats for otter, although it should be noted that no holts or field signs of otter were recorded during the ecological walkover survey. Desktop study indicates that otters have previously been reported as occurring in the vicinity of the scheme with spraints recorded at the Crana River and the Mill River.

Otter is listed as vulnerable in the Irish Red Data Book and is fully protected in the State by the Wildlife Act. It is also listed in both Annex II and IV of the EU Habitats Directive and in Appendix II of the Berne Convention.

7.3.8.4 Red Squirrel

Although red squirrels have been recorded in the study area, no dreys or field signs were recorded during the site visit. Construction work is very unlikely to threaten red squirrel as no drey sites were recorded within the proposed scheme area.

The red squirrel is protected under the Wildlife Act (1976) and Wildlife (Amendment) Acts (2000 and 2010) and the Bern Convention (Appendix III).

Ongoing/regular human disturbance may deter red squirrel from using the site on a regular basis.

7.3.8.5 Pine Marten

There are no existing NBDC records for Pine Marten within the study area. No evidence of pine marten activity was observed during the Habitat and Species Walkover Survey.

The pine marten is protected in Ireland by both national and international legislation. Under the Irish Wildlife Acts it is an offence, except under licence, to capture or kill a pine marten, or to destroy or disturb its resting places.

Ongoing/regular human disturbance may deter pine marten from using the site on a regular basis.

7.3.8.6 Badger

There are no existing NBDC records for badgers within the study area. No setts or field signs were recorded during the site visit. Construction work is very unlikely to threaten badger as no setts were recorded within the proposed scheme area. Ongoing/regular human disturbance may deter Badgers from using the site on a regular basis.

7.3.8.7 West European Hedgehog

Hedgehogs have been recorded within the study area. No field signs were recorded during the site visit.

7.3.8.8 Bats

Daubenton's Bat (*Myotis daubentonii*, Pipistrelle (*Pipistrellus pipistrellus* sensu *lato*) and Soprano Pipistrelle (*Pipistrellus pygmaeus*) have been recorded in the study area.

All bat species are listed in Annex IV(a) of the Habitats Directive and are strictly protected in Ireland. a person who deliberately captures, kills or disturbs a specimen in the wild..... or who damages or destroys a breeding site or resting place of such an animal, is guilty of an offence (Mullen, Marnell, & Nelson, 2021).

Habitat suitability index data compiled by the National Biodiversity Data Centre (NBDC, 2021) for the scheme area indicates that it is generally of low suitability for bat usage. The area is deemed most suitable for (notably) soprano pipistrelles, and less notably for brown long-eared bats, common pipistrelles, Leisler's and Daubenton's bats. The surrounding landscape is reasonably diverse, comprising a mixture of agricultural grassland, woodland and urban land-uses, which are punctuated by a network of criss-crossing treelines/hedgerows and a river system. The diverse landscape, as well as the presence of ecological corridors (in the form of hedgerows/treelines and rivers) are what increases the habitat suitability. Much of the 6km-square, on which the above data is based, is occupied by open water. This has likely influenced the suitability index for bats.

Bat habitat suitability within the study area is summarised in table 7-4 below.

Table 7-3 Bat habitat suitability index

Bat Species	Index (out of 100)
All Bats	18
Pipistrellus pygmaeus	55
Plecotus auritus	24
Pipistrellus pipistrellus	26
Rhinolophus hipposideros	0
Nyctalus leisleri	23
Myotis mystacinus	3
Myotis daubentonii	26
Pipistrellus nathusii	5
Myotis nattereri	0

7.3.8.9 Herpetofauna (reptiles and amphibians)

Records for Common Frog (*Rana temporaria*) and Smooth Newt (*Lissotriton vulgaris*) exist for the study area. No published records for Natterjack Toad (*Epidalea calamita*) are held by NBDC for the study area.

Common Frog is the only species of frog found in Ireland and is listed as an internationally important species. Frogs are protected under the European Union Habitats Directive and by the Irish Wildlife Act.

The smooth newt is Northern Ireland's only native newt. Smooth newts are protected in Ireland under Schedule 5 of the Wildlife Act, 1976 and Annex III of the Berne Convention.

7.3.8.10 Marine Mammals

NBCD hold records for the marine mammal species record in the vicinity of the scheme (Lough Swilly/Estuary) (shown in Table 7-4).

Table 7-4 Summary of protected marine mammal species records held by NBDC in the vicinity of the scheme

Species	Designation
Atlantic White-sided Dolphin (*Lagenorhynchus acutus*)	• Protected Species: EU Habitats Directive, Annex IV • Protected Species: Wildlife Acts
Bottle-nosed Dolphin (*Tursiops truncatus*)	• Protected Species: EU Habitats Directive, Annex II and Annex IV • Protected Species: Wildlife Acts
Common Dolphin (*Delphinus delphis*)	• Protected Species: EU Habitats Directive, Annex IV • Protected Species: Wildlife Acts
Common Porpoise (*Phocoena phocoena*)	• Protected Species: EU Habitats Directive, Annex II and Annex IV • Protected Species: Wildlife Acts • Threatened Species: OSPAR Convention

Species	Designation
Common Seal (*Phoca vitulina*)	• Protected Species: EU Habitats Directive, Annex II and Annex V • Protected Species: Wildlife Acts
Grey Seal (*Halichoerus grypus)*	• Protected Species: EU Habitats Directive, Annex II and Annex V • Protected Species: Wildlife Acts
Sperm Whale (*Physeter macrocephalus*)	• Protected Species: EU Habitats Directive, Annex IV • Protected Species: Wildlife Acts
Phocidae	N/A

7.3.8.11 Freshwater Fish

The primary fish species within the Crana River include Atlantic salmon (*Salmo salar*), Sea Trout (*Salmo trutta morpha trutta*) and Brown Trout (*Salmo trutta*). (Inland Fisheries Ireland, 2019).

Detections of the European eel were recorded on the lower area of the Mill River in Buncrana in May 2020 and April 2021 by voluntary river monitors within the locality. There are historical records of this species further upstream in the Mill River and from the River Crana (Inishowen Rivers Trust, 2021). Anthropogenic pressures and decreasing water quality in Irish rivers are recognised as drivers of declining numbers in European eels.

Further, barriers to migration are noted as being a considerable factor affecting riverine fish populations within Inishowen, whereby anthrophonic structures such as the Eddie Fullerton Dam on the upper area of the Crana River and the Swan's Mill Dam located at Gransha in the townland of Buncrana (Inishowen Rivers Trust, 2021). The barriers pose issues including restriction of river continuity delaying migration patterns and leading to possible mortalities, particularly in the European Eel stocks (Inishowen Rivers Trust, 2021). These barriers further represent a significant WFD pressure, particularly for the Mill River (EPA Catchments, 2021).

It is noted that there is an active National Salmon Monitoring Programme which is led by the Standing Scientific Committee on Salmon (SSCS) of Inland Fisheries Ireland. Conservation initiatives aim to recover stocks in rivers not meeting their conservation limits and to manage all rivers in compliance with the EU Habitats Directive (92/43/EEC).

Further surveys are required on site to establish the presence/absence / abundance of the fish species listed above. This will involve netting, electrofishing surveys and consultation with Inland Fisheries.

7.3.8.12 Marine Fish

NBCD records indicate that there were three sightings of the Basking Shark (*Cetorhinus maximus*) between approximately 1 km and 2 km off the coast at the North West Golf Club, Lisfannon, between 2012 and 2013.

7.3.8.13 Aquatic Invertebrates

NBCD hold historical records for the freshwater aquatic River limpet (*Ancylus fluviatilis*) from waterbodies in the scheme area. No records of crustaceans are available in the study area.

There are no waterbodies in the scheme area that are designated freshwater pearl mussel (*Margaritifera margaritifera*) sensitive areas. NPWS data indicates that there are no records of freshwater pearl mussel in the scheme area or within the wider subcatchment.

7.3.9 Aquatic and Terrestrial Site habitats

A habitats survey was completed in September 2021. Habitats (*sensu* Fossitt, 2000) present within the study area are listed in Table 7-5. Habitat maps are provided in Appendix C.

Table 7-5 Habitats types within and adjacent to the proposed scheme footprint.

Habitat Name	Habitat Code (as per Fossitt, 2000)
Eroding/Upland Rivers	FW1
Depositing/Lowland Rivers	FW2
Drainage Ditches	FW4
Improved Agricultural Grassland	GA1
Amenity Grassland	GA2
Dry Meadows and Grassy Verges	GS2
Wet Grassland	GS4
Mixed Broadleaved Woodland	WD1
Scrub	WS1
Hedgerows/Treelines	WL1/WL2
Spoil and Bare Ground	ED2
Recolonising Bare Ground	ED3
Buildings and Artificial Surfaces	BL3
Tidal Rivers	CW2
Fixed Dunes	CD3
Sea Walls, Piers and Jetties	CC1
Exposed Rocky Shores	LR1
Sand Shores	LS2
Mixed Sediment Shores	LS5
Open Marine Water	MW1
Annex I Habitats	**Code (as per EU Habitats Directive)**
Estuaries	1130
Mudflats and Sandflats not Covered by Seawater at Low Tide	1140

The two Annex 1 habitats (Code 1130 and 1140) encroach into the ecology study area, however do not overlap with the proposed works locations. These habitats are analogous to the boundary of the Lough Swilly SAC.

7.3.10 Invasive species

7.3.10.1 Invasive floral species

Currently, Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 make it an offence to: plant, disperse, allow dispersal or cause the spread of a number of non-native 'invasive species' including Japanese knotweed and Himalayan balsam.

NBDC record and Donegal County Council records indicate that Himalayan Balsam (*Impatiens glandulifera*) and Japanese Knotweed (*Fallopia japonica*) are recorded with the vicinity of the scheme. These terrestrial invasive flora species are non-native and subject to restrictions under Regulations 49 and 50 throughout the State (S.I. No. 477 of 2011, 3rd Schedule, Part 1).

Sycamores (*Acer pseudoplatanus*) are an invasive species widely present across the Island of Ireland that is not subject to legal restrictions.

A walkover survey to identify and record the occurrence of non-native invasive species was undertaken in September 2021. Japanese Knotweed, Giant Rhubarb and Himalayan balsam have been identified as present within the potential locations of scheme defences, as shown in Figure 7-4.

An invasive species treatment and management plan will be implemented for the scheme during 2022 and on a continuous basis leading to construction and operation of the Scheme.

7.3.10.2 Invasive faunal species

Desktop study indicates that the non-native New Zealand Flatworm (*Arthurdendyus triangulatus*) recorded in the study area in the 1992 (NBDC 2021).

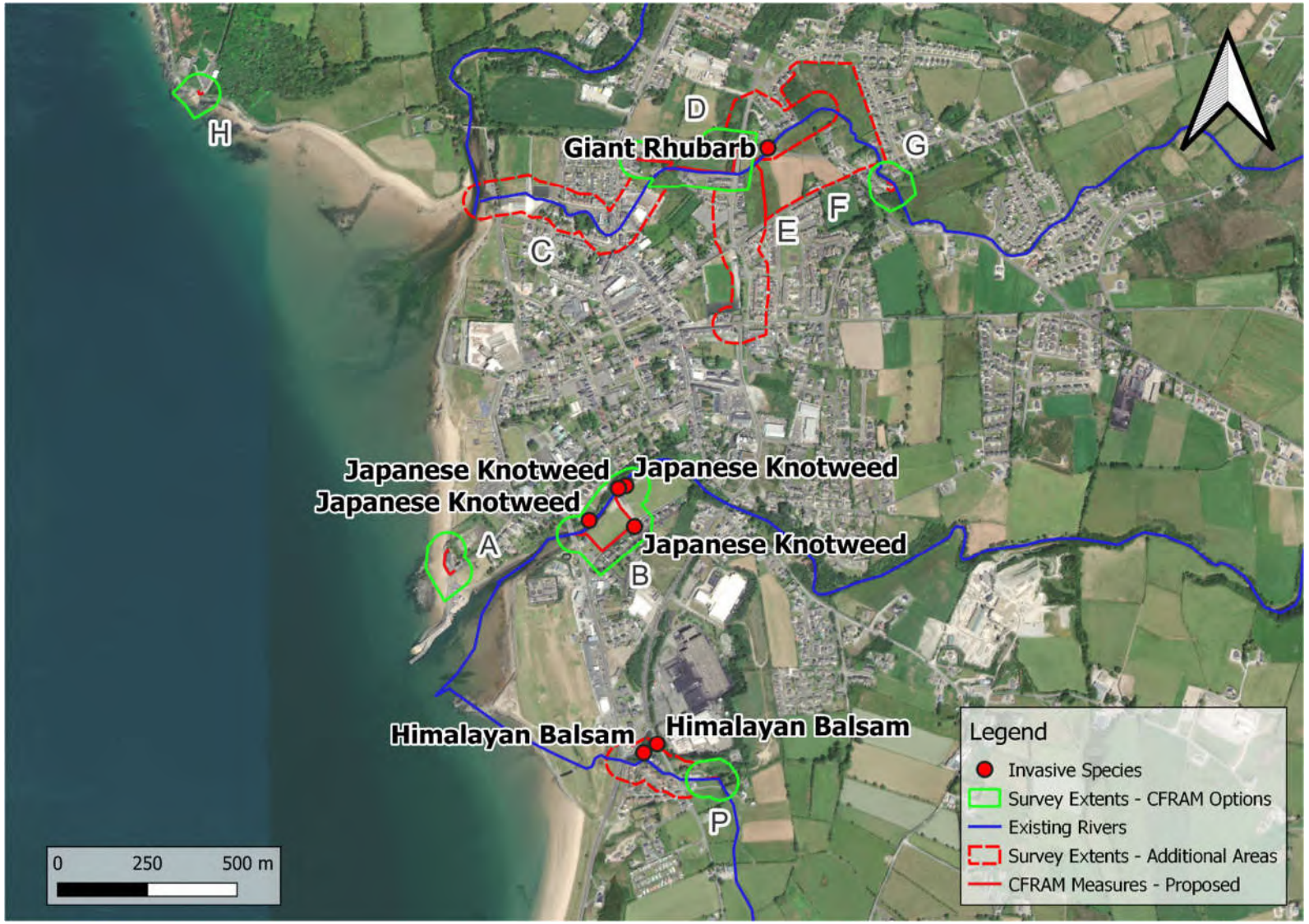

Figure 7.4. Invasive Floral Species in the scheme area (1/2)

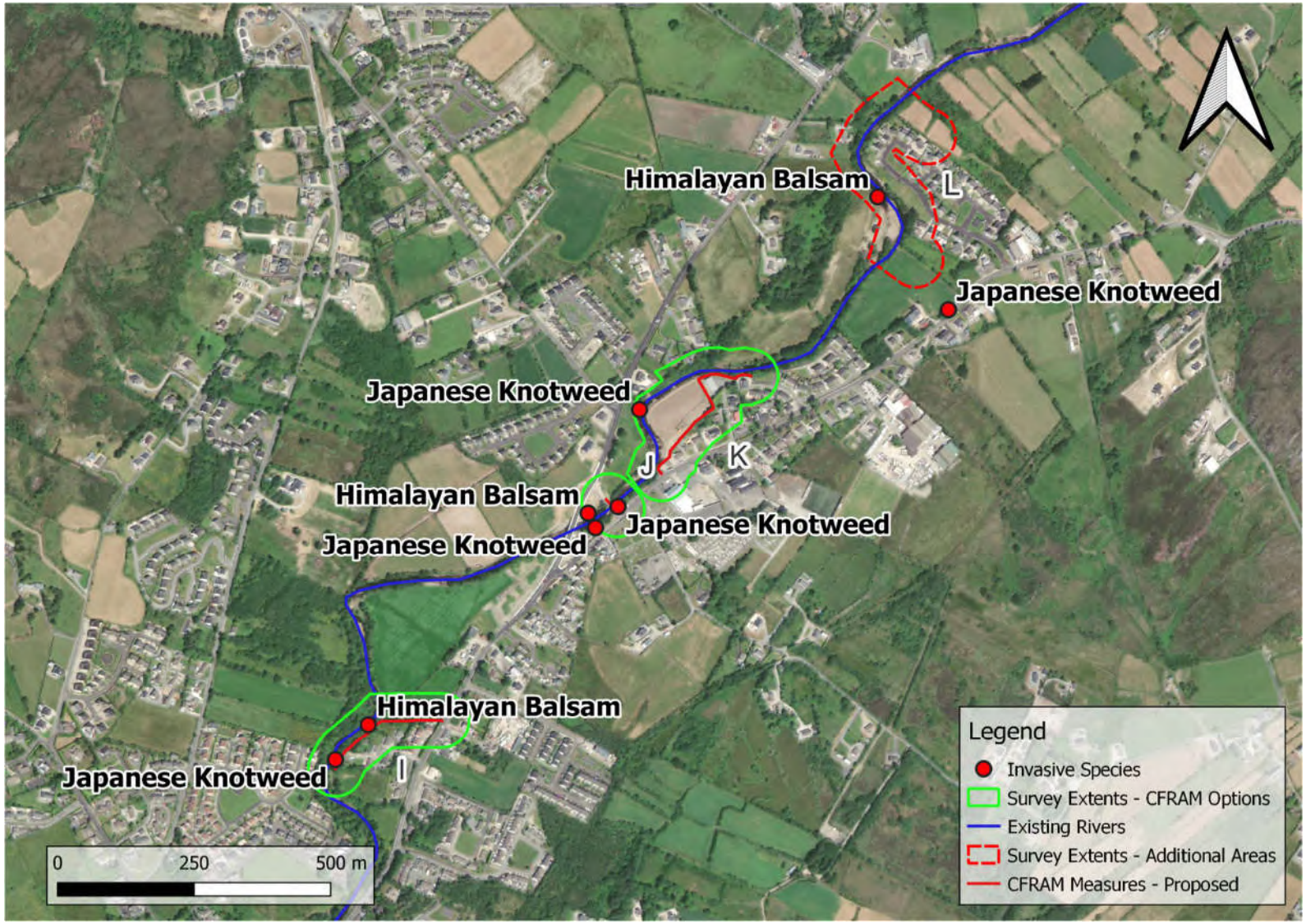

Figure 7.5. Invasive Floral Species in the scheme area (2/2)

7.4 Key Constraints

7.4.1 Nature Based Flood Solutions and Biodiversity Enhancement

As mentioned in Section 7.3.7, the IRT, in partnership with Trinity College, are currently reviewing possibilities of nature-based flood solutions in Donegal through implementation of Natural Flood Management (NFM) and Natural Water Retention (NWR) to improve water quality, restore riparian habitats, retain sediment nutrients and build community capacity (Inishowenriverstrust.com).

These solutions are sponsored and supported by the OPW, LAWPRO and DCC and, as such, the Scheme should be aware of these intentions and implement NFM and NWR where possible.

Further, the National Biodiversity Action Plan 2017 – 2021, and more particularly Objective 4 supports nature-based solutions in flood risk management as a biodiversity enhancement measure, with catchment-wide focus and non-structural measures preferred. The scheme should investigate options for the implementation of such solutions.

7.4.2 Water Framework Directive

Surface water bodies in the study area are classed under the Water Framework Directive as 'At risk' of not meeting the WFD objectives of 'good' Ecological Status.

Under WFD requirements, the development of the scheme should incorporate measures to ensure that the hydromorphological and ecological conditions of the water body is consistent with the achievement of the required ecological status.Potential impacts on the hydrology, morphology and ecological status of the study area watercourses during construction, maintenance and operations should be considered and all possible risks of point source pollution or runoff during construction and operation should be assessed and prevented. Works during the construction of the scheme could pose a threat to the water quality of water bodies within and downstream of the study area though various mechanism, chiefly:

(1) Increasing suspended solids in the water bodies through release or run-off of significant amounts of suspended solids during enabling works and construction; and

(2) Unplanned events such as leaks/spills/runoff/accidental release or escape of fuels, oils and lubricants, bulk liquid cement, contaminated leachate, etc.

A hydromorphology survey will be completed using the River Hydromorphology Assessment Technique (RHAT).

7.4.3 Protected Sites

The most significant ecological constraint in Buncrana is Lough Swilly, given its status as an SAC and SPA, in addition to shellfish protected water status within the wider environs of Lough Swilly. For this reason, any works that are to be carried out adjacent to the lough, or on the banks of waterbodies that feed into the lough, to reduce flooding must take this sensitivity into account.

Where at all possible, any in-river and coastal/marine works should be avoided and every effort must be made to minimise, if not avoid, any run off to it. Options to include the setting back of hard defences from the watercourses/waterbodies will continue to be considered as the design options progress in order to minimise potential impacts on the protected sites.

All work that is to be carried out adjacent to waterbodies must be carried out in such a way as to minimise the potential for events such as diesel or concrete spillages, run off of water with suspended sediment loadings or any accidental spillages. If it considered necessary to re-build of build in river structures (e.g. culverts, weirs), the same sort of construction approach should be designed in to minimise resuspension and loss of concrete to the river.

Appropriate Assessment under Articles 6(3) and 6(4) of the EU Habitats Directive (Directive 92/43/EEC) will be required for the proposed scheme. The Habitats Directive was initially transposed into Irish law in 1997 by the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997)6, with later amendment regulations (S.I. No. 233 of 1998; S.I. No. 378 of 2005).

7.4.4 Protected/notable Species

In ecological terms, the river corridor (including the river itself), the coast (including coastal mudflats) and transitional estuarine waters support a number of protected species. Any in-river and bankside works, and costal and estuarine works have to be designed to minimise potential impacts on these (and all other) species.

All works should be planned wherever possible to be carried out at times of the year that are ecologically least sensitive e.g. outside bird nesting (March – September) and fish migration periods (Spring/Summer, depending on species).

7.4.5 Otter

As a European protected species, the otter is fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Any scheme option that may have the potential to disturb otters must be assessed.

A full otter survey should be completed once the scheme extents are known. If otters are found to be present and disturbance is likely then DCC must apply for a licence to allow proposed development works that might affect otters to proceed legally. The potential impacts on otter will be assessed and reported in the EIA.

Otter mitigation works can potentially be conducted at any time of year but must avoid the breeding season (usually Spring but can be any time of year) if holts are present on site.

7.4.6 Badgers

Pre-construction update surveys would be carried out to maintain the validity of species data. Should a badger sett be recorded within the scheme extents prior to construction works then appropriate mitigation and a licence for works will be required. Construction of new setts must be

completed in Spring/Summer with blocking and destruction of existing setts completed in Autumn/early winter.

7.4.7 Bat

The scattered mature trees, bridges, architecture (churches, masonry) and areas of low water flow provide good foraging, roosting and commuting routes for bat species in the area. Options that require the removal of mature trees or works to bridges or other riverine structures with the potential to support roosting bats shall be assessed for bat potential. Bat surveys shall be conducted on any features with medium or high potential for roosting bats.

Once more detail becomes available pertaining to the proposed structural alterations to the site (including the proposed methods of construction), the site should be re-visited for the purpose of:

- Surveying key locations (e.g. where it is known that potential roosting habitat will be removed or disturbed); and
- Obtaining more detailed information about any potential bat roosts (i.e. whether it is a maternity roost, hibernaculum, etc.)

This information will inform any considerations of mitigation measures that may need to be implemented. The optimal time to conduct map surveys are May and August when bats are most active. If bats are found, they should not be disturbed during hibernation period (October to March) or maternity period (June to August). If a bat roost requires removal, then a licence would be required. Removal of roosts should be carried out during the summer months for hibernation roosts and during the winter months for maternity roosts.

As all Irish bats and their roosts are protected under national and EU legislation it is an offence to disturb or interfere with them without a licence. Such a derogation (which must be given by the Minister for the Environment, Heritage and Local Government) can only be sanctioned where there is no satisfactory alternative and where it will not be detrimental to the favourable conservation status of the species concerned. Therefore, any felling of trees or work on bridges which provide suitable roost habitat for bats should be sought in advance of any development that may interfere with such roost sites.

7.4.8 Freshwater Fish

A fish survey of suitable waterbodies in the study area should be competed on site to establish the presence/absence/abundance of fish species. This will involve netting and electrofishing surveys, where required (i.e. where instream works will cause disturbance to the river bed via structure or excavation) and where technically feasible.

In terms of the construction programme, it should be noted that in salmonid catchments, in-stream works are not permitted between the months of January to April (migration) and October to December (spawning). This corresponds with guidance from Inland Fisheries Ireland (Murphy, 2016).

Lamprey (both species) spawning takes place in the spring and early summer period in often the same habitats where salmon and trout spawn (O'Connor, 2017). The spawning season for brown and sea trout is November to February. If spawning grounds are found to be present in the construction zone for the scheme, then this period should be avoided.

A full impact assessment and management plan for these fish species will be produced as part of the EIA report once full scheme details (including construction methods) are known.

7.4.9 Invasive Species

Japanese Knotweed, Himalayan Balsam and Giant Rhubarb have been identified as present within the study area. An Invasive Species Management Plan has been prepared separately (Report Ref (ByrneLooby, 2021 Ref: W3639-BLP-R-ENV-011)).

An invasive species treatment and management plan will be implemented for the scheme during 2022 and on a continuous basis leading to construction and operation of the Scheme.

8 Cultural Heritage and Archaeology

8.1 Introduction

This section assesses and evaluates the potential cultural heritage and archaeology (consisting archaeological and build heritage) constraints of the study area.

For the purposes of this report, the constraints study area is defined as the area outlined in Figure 1-1. All the cultural heritage constraints within the scheme area are considered. Further focus was given to the designated heritage assets which are present within 100m of reaches of waterbodies where CFRAM measure are proposed or areas for further investigation have been identified, as this area is most likely to be potentially physically affected by the proposed works.

8.2 Methodology

Constraints were determined through a desk study. The assessment involved the compilation and mapping of available cultural heritage data sets. This forms a permanent renewable database that can be utilised by multiple specialist users to provide information for the project design and EIA process.

A review of the following information took place in order to inform the cultural heritage report:

- Guidelines for the Archaeological Assessment of Flood Relief Schemes (Department of Housing, Local Government and Heritage, 2021).
- Framework and Principles for the Protection of the Archaeological Heritage – Published by Dúchas (Department of Arts, Heritage, Gaeltacht and the Islands, 1999).
- UNESCO World Heritage Sites (WHS) and Tentative World Heritage Sites and those monuments on the tentative list.
- National Monuments in State care, as listed by the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage (DHLGH).
- National Monuments Sites with Preservation Orders Sites.
- Sites listed in the Register of Historic Monuments.
- Record of Monuments and Places (RMP) and the Sites and Monuments Record (SMR) from the Archaeological Survey of Ireland.
- National Inventory of Architectural Heritage (NIAH) Building Survey (NIAH ratings are international, national, regional, local and record, and those of regional and above are recommended for inclusion in the RPS).
- Cartographical Sources, OSi Historic Mapping Archive, including early editions of the Ordnance Survey including historical mapping (OSi, 2021).

- Topographical files of the National Museum of Ireland as provided through Heritagemaps.ie (The Heritage Council, 2021).
- Place names; Townland names and toponomy (Gaois, Fiontar & Scoil na Gaeilge and The Placenames Branch Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media, 2021).
- The Dúchas Project National Folklore Collection (UCD, 2021).
- A review and interpretation of aerial imagery (Google earth 2001–2021 used in combination with historic mapping to identify potential cultural heritage assets.
- Settlement Character Assessment in Landscape Character Assessment of County Donegal (Donegal County Council, 2021).
- National Inventory of Architectural Heritage, Survey of the Architectural Heritage of County Donegal (NIAH) (National Inventory of Architectural Heritage, 2021).
- The Irish archaeological excavations catalogue i.e. Excavations bulletin and Excavations Database (Department of Housing Local Government and Heritage, 2021).
- Draft County Donegal Heritage Plan 2014-2019 (County Donegal Heritage Forum, 2015).
- Wreck Inventory of Ireland Database (WIID) (National Monuments Service, 2021).
- Record of Protected Structures 2020 as set out in the Draft County Donegal Development Plan 2018–2024 (Donegal County Council, 2020)

The 'Archaeological Survey of County Donegal' 1983 is currently being reprinted as part of the implementation of the Draft County Donegal Heritage Plan.

8.3 Baseline / Receiving Environment

Buncrana has a long history of settlement however neither Buncrana nor Luddan are not considered ‘Heritage Towns’ by Donegal County Council nor ‘Historic Towns’ by the Heritage Council.

Objectives for the protection of the Archaeological and Built Heritage in the county are set out in the County Donegal Development Plan 2018 – 2024:

‘AH-O-1: To conserve and protect the County’s archaeological heritage for present and future generations.’

‘BH-O-1: To preserve, protect, enhance and record the archaeological heritage of the County.’

8.3.1 Previous excavations

There have been 13 archaeological excavations within the core of Buncrana. The excavations and investigations within the study area are summarised as follows (Department of Housing Local Government and Heritage, 2021):

- Tullydush Lower (code: 2013:520): Site type of no archaeological significance.
- Gransha (code: 2007:360). Site type of Early Bronze Age cremation burial.
- Ballymacarry Lower (code 2008:299). Site type of two linear features of archaeological significance.
- Ballymacarry (code 2011:138). Site type of two features of potential archaeological significance.
- Buncrana (code 2002:0411). Site type of no archaeological significance.
- Lough Swilly Hotel, Swilly Road (code 2009:203). Site type of no archaeological significance.
- Ardaravan (code 1977-79:0025). Site type of unaccompanied cremation.
- Buncrana (code 2002:0410). Site type of disused railway line but with nothing of archaeological interest surviving.
- Magherainture (code 2002:0427). Site type of no archaeological significance.
- Inishowen Co-op, Ballymacarry (code 2010:177). Site type of no archaeological significance.
- Ballymacarry (code 2007:343). Site type of no archaeological significance.
- Cockhill (code 2006:446). Site type of no archaeological significance.
- Tullyarvan (code 2008:314). Site type of no archaeological significance.

8.3.2 Designated Heritage Constraints

8.3.2.1 Underwater archaeology

In response to initial consultation, Development Applications Unit have advised in a pers comm dated 5th November 2021 that 'the Wreck Inventory of Ireland Database lists a large number of longboat discoveries from the Rivers Finn and Foyle, near Ballybofey, and wrecks are recorded from Lough Swilly near Buncrana and Ramelton'. However, such records are not readily identifiable in the publicly available online datasets hosted by Department of Housing, Local Government, and Heritage or the National Monuments Service: Wreck Viewer and archive records will be consulted during the specialist surveys to be completed in 2022.

8.3.2.2 World Heritage Site

There are no World Heritage Sites in the study area nor are there any sites contained in the tentative list of candidate Sites.

8.3.2.3 Record of Monuments and Places and Sites and Monuments Record Sites (RMP / SMR sites) and Zone of Archaeological Potential (ZAP)

The Record of Monuments and Places (RMP) of the DHLGH records known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites identified as cropmarks on vertical aerial photographs. Archaeological sites identified since 1994 have been added to the non-statutory SMR database of the

Archaeological Survey of Ireland (National Monuments Service, DHLGH), which is available online at www.archaeology.ie and includes both RMP and SMR sites. Those sites designated as SMR sites have not yet been added to the statutory record but are scheduled for inclusion in the next revision of the RMP. RMP sites located within the proposed study area are detailed in Table 8-1 and illustrated in Figure 8.2 below.

Table 8-1: RMP sites within the proposed scheme area

Map Label	RMP No.	Type	Townland	ITM Coordinates	
				Easting	Northing
1	DG00848	Ringfort - rath	Ballymagan and Clonblosk	636014	934371
2	DG00849	Souterrain	Ballymagan and Clonblosk	636240	934319
3	DG00856	Bullaun stone	Tullyarvan	634834	934111
4	DG00857	Ringfort - cashel	Tullyarvan	635168	934130
5	DG00858	Souterrain	Tullyarvan	635168	934130
6	DG00859	Rock art	Tullyarvan	635168	934130
7	DG00860	Enclosure	Ballymagan and Clonblosk	636278	933721
8	DG00863	Ritual site - holy well	Ballynarry	633407	933253
9	DG00865	Castle - tower house	Tullyarvan	634253	932627
10	DG00866	House - 18th/19th century	Tullyarvan	634168	932608
11	DG00867	Ringfort - cashel	Ballymacarry	635380	932910
12	DG00868	Ringfort - cashel	Ballymacarry	635358	932785
13	DG00869	Ringfort - cashel	Ardaravan	635325	932548
14	DG00876	Cist	Ardaravan	635061	931662
15	DG00877	Standing stone	Ardaravan	635434	931834
16	DG00878	Enclosure	Aghilly and Lenynarnan	636076	931614
17	DG00879	Ringfort - unclassified	Aghilly and Lenynarnan	636735	931557
18	DG00885	Standing stone	Gransha	635521	931003
19	DG00886	Standing stone	Gransha	635521	931003
20	DG00887	Standing stone	Gransha	635518	930945
21	DG00888	Standing stone	Gransha	635516	930937
22	DG00891	Burial ground	Luddan	635235	930418
23	DG00893	Midden	Luddan	634197	929835
24	DG02987	Bullaun stone	Luddan	635235	930418
25	DG03347	Bawn	Tullyarvan	634253	932627
26	DG03640	Cremated remains	Gransha	635410	931063

8.3.2.4 Architectural Conservation Area (ACA)

An ACA refers to a place, area, group of structures or townscape that is of special architectural, archaeological, historical, social, cultural, or scientific interest, or that contributes to the appreciation of a Protected Structure. There is no designated ACA present within the study area.

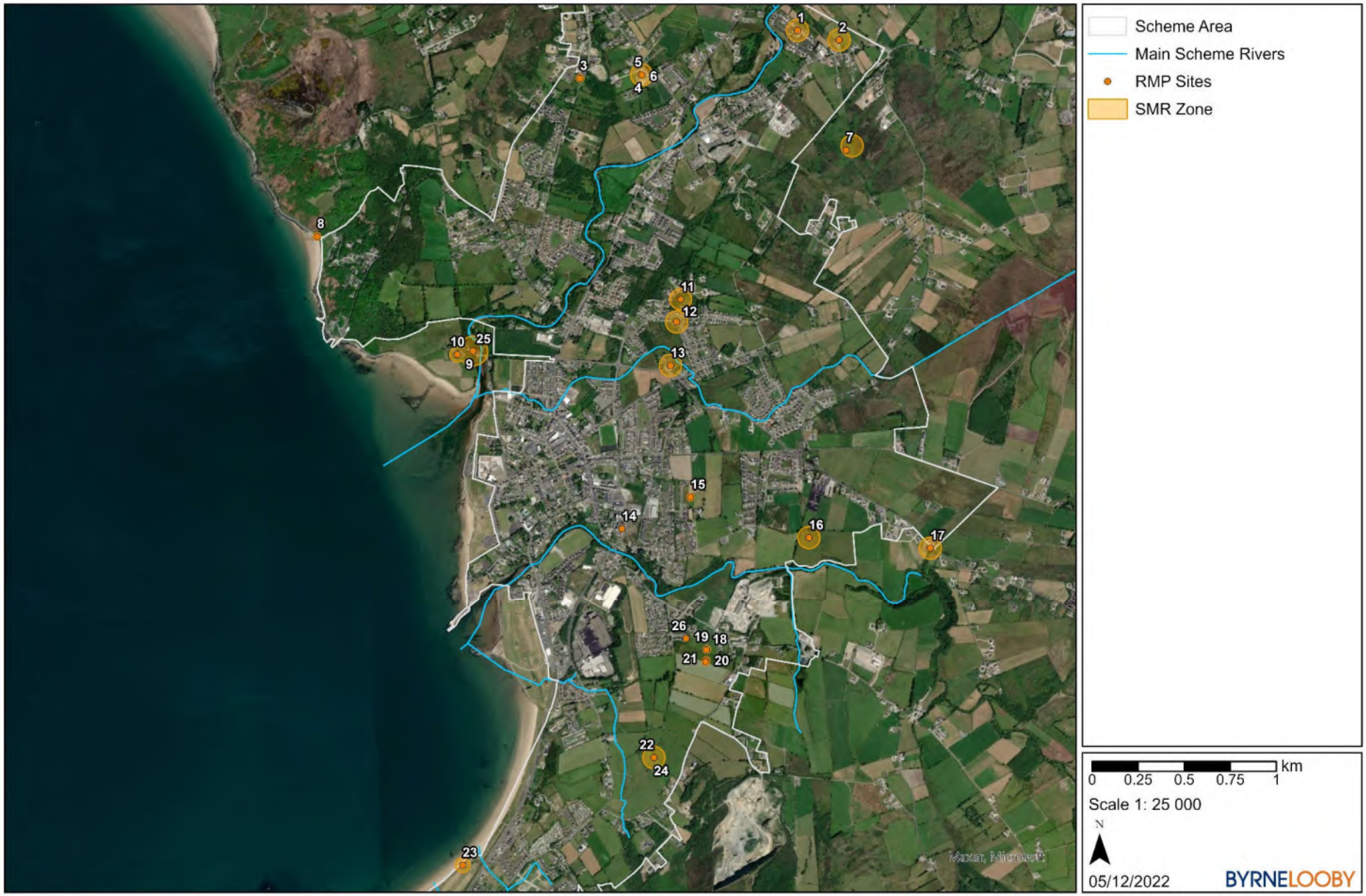

Figure 8.1 RMP / SMR sites within the constraints study area

8.3.2.5 National Inventory of Architectural Heritage (NIAH)

The National Inventory of Architectural Heritage (NIAH) building surveys provide the basis for the recommendations of the Minister for Culture, Heritage and the Gaeltacht to the planning authorities for the inclusion of particular structures in their Record of Protected Structures. The published surveys are a source of information on the selected structures for relevant planning authorities. It is worthwhile noting that the NIAH survey is not considered to be a complete record of the architectural heritage of an area.

The properties recorded in the study area by the NIAH are considered as being buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest and are recorded by this survey as having a 'Regional' rating. Structures that are considered of regional significance are recommended by the Minister to the relevant planning authority for inclusion in their Record of Protected Structures (RPS) and the planning authorities can add to the record at any time should the choose to adopt them.

The NIAH sites within the study area are indicated in Figure 8.2 and details provided in Table 8-2. There are 78 NIAH sites in the study area, of which 27 have been added to the RPS.

Table 8-2: NIAH Sites within the study area

Map #	NIAH Reg#	Name	Date	Townland	RPS	Originality*	In-Use Type
1	40815001	Buncrana Castle	1715 - 1720	Tullyarvan	Y	country house	house
2	40815002	Buncrana Castle	1710 - 1840	Tullyarvan	Y	outbuilding (3)	outbuilding BCA_Cath
3	40815003	Castle Bridge	1710 - 1730	Ballymacarry, Tullyarvan	Y	bridge	bridge
4	40815004	Buncrana Castle	1720 - 1840	Ballymacarry	Y	gates/ railings/ walls	gates/ railings/ walls
5	40815005	Buncrana Castle	1720 - 1840	Ballymacarry	Y	gates/ railings/ walls	-
6	40815006	-	1830 - 1870	Ardaravan, Ballymacarry	Y	quay/ wharf; bridge	-
7	40815007	Buncrana Castle	1710 - 1730	Tullyarvan	Y	garden; walled garden	-
8	40815008	-	1865 - 1875	Ardaravan	Y	coastguard station	house
9	40815009	Ardeelan	1900 - 1930	Ardaravan	N	house (2)	house
10	40815012	-	1870 - 1890	Ardaravan	N	house (2)	house
11	40815013	-	1900 - 1920	Ardaravan	N	house (2)	house
12	40815014	Cloneen	1900 - 1920	Ardaravan	N	house (2)	house
13	40815015	Drift Inn	1860 - 1870	Ballymacarry Lower	Y	railway station	public house
14	40815016	Drift Inn	1860 - 1870	Ballymacarry Lower	Y	building misc.; water tower	-
15	40815017	-	1880 - 1900	Ardaravan	N	house	house
16	40815018	-	1880 - 1900	Ardaravan	N	house (2)	house
17	40815019	-	1880 - 1900	Ardaravan	N	house (2)	house
18	40815020	-	1880 - 1900	Ardaravan	N	house	house

Map #	NIAH Reg#	Name	Date	Townland	RPS	Originality*	In-Use Type
19	40815021	-	1880 - 1900	Ardaravan	N	house (2)	house
20	40815022	-	1930 - 1940	Ardaravan	N	house (2)	house
21	40815023	-	1880 - 1900	Ardaravan	N	house (3)	house
22	40815025	Macetown Villa	1860 - 1890	Ardaravan	N	house (2)	house
23	40815026	Buncrana Town Council Civic Offices	1850 - 1890	Ardaravan	N	house (2)	office
24	40815030	-	1880 - 1900	Ardaravan	N	house	house
25	40815031	Mill River Railway Bridge	1895 - 1905	Ardaravan, Ballymacarry Lower	Y	bridge	-
26	40815032	Swan Mills	1860 - 1900	Ardaravan	Y	mill (water)	-
27	40815033	Mill River Bridge	1700 - 1760	Ardaravan, Ballymacarry Lower	Y	bridge	bridge
28	40815034	Millfield House	1800 - 1870	Ardaravan	Y	house	house
29	40815035	-	1860 - 1900	Ardaravan	N	house	house
30	40815037	-	1920 - 1950	Ardaravan	N	post box	post box
31	40815039	Buncrana Courthouse	1840 - 1850	Ardaravan	Y	courthouse (2)	courthouse
32	40815040	Bank of Ireland	1930 - 1935	Ardaravan	N	bank/ financial institution	bank/ financial institution
33	40815041	Allied Irish Bank	1880 - 1910	Ardaravan	N	bank/ financial institution	bank/ financial institution
34	40815042	Christ Church Church of Ireland Church	1800 - 1810	Ardaravan	Y	church/ chapel (3)	church/ chapel
35	40815043	Buncrana Church of Ireland Parish School	1870 - 1880	Ardaravan	Y	school (2)	building misc.; hall
36	40815045	Atlantic Bar	1790 - 1880	Ardaravan	N	hotel	public house
37	40815046	-	1930 - 1940	Ardaravan	N	shop/ retail outlet	
38	40815047	John Barr	1840 - 1880	Ardaravan	Y	house	shop/ retail outlet
39	40815048	The Plaza	1840 - 1880	Ardaravan	N	house	community centre
40	40815050	-	1890 - 1930	Ardaravan	N	water pump	
41	40815052	-	1885 - 1900	Ardaravan	N	house	house
42	40815053	-	1885 - 1900	Ardaravan	N	house	house
43	40815055	-	1922 - 1950	Ardaravan	N	post box	post box
44	40815056	Ard Caein	1875 - 1895	Ardaravan	N	house (2)	house
45	40815057	The Cinema Buncrana	1900 - 1905	Ardaravan	Y	church hall/ parish hall	community centre
46	40815058	Buncrana Library	1860 - 1865	Ardaravan	Y	church/ chapel	library/ archive
47	40815059	St. Columb's	1900 - 1915	Ardaravan	N	house (4)	house
48	40815060	-	1890 - 1910	Ardaravan	N	house	house

Map #	NIAH Reg#	Name	Date	Townland	RPS	Originality*	In-Use Type
49	40815061	St. Mary's Catholic Oratory	1925 - 1930	Ardaravan	Y	church/ chapel (2)	church/ chapel
50	40815062	Ardaraven	1880 - 1900	Ardaravan	N	house (2)	house
51	40815064	Osborne House	1900 - 1910	Ardaravan	N	house (2)	house
52	40815065	-	1900 - 1910	Ardaravan	N	house (2)	house
53	40815068	Schooners View	1870 - 1900	Ardaravan	N	house (2)	house
54	40815069	-	1870 - 1900	Ardaravan	N	house (2)	house
55	40815070	-	1870 - 1900	Ardaravan	N	house (2)	house
56	40815071	Bayview	1870 - 1900	Ardaravan	N	house (2)	house
57	40815072	Youthreach	1900 - 1940	Ardaravan	N	clubhouse; gentlemen's club (2)	building misc.
58	40815073	Buncrana Lighthouse	1870 - 1920	Ardaravan	N	lighthouse	-
59	40815074	Buncrana Castle	1800 - 1860	Tullyarvan	Y	well	well
60	40815076	Buncrana Castle	1900 - 1940	Tullyarvan	Y	handball alley	-
61	40815083	-	1900 - 1920	Ardaravan	N	house (2)	house
62	40815084	Inishfree	1900 - 1910	Ardaravan	N	house	house
63	40815085	-	1900 - 1910	Ardaravan	N	house	house
64	40815086	-	1900 - 1910	Ardaravan	N	house	house
65	40815087	-	1890 - 1910	Ardaravan	N	house	house
66	40815088	-	1890 - 1905	Ardaravan	N	house	house
67	40815089	Scoil Íosagáin	1920 - 1940	Ardaravan	N	school	school
68	40902922	Ned's Point Fort	1810 - 1910	Tullyarvan	Y	battery	
69	40902923	Tullyarvan Mill	1910 - 1930	Tullyarvan	Y	mill (water)	hostel
70	40902924	St. Mary's Catholic Church	1845 - 1850	Ballymacarry	N	church/ chapel	church/ chapel
71	40902925	Cockhill Bridge	1780 - 1820	Ballymacarry, Tullyarvan	Y	bridge	bridge
72	40902928	Wilson's Bridge	1800 - 1810	Ballymacarry, Tullyarvan	Y	bridge	bridge
73	40902929	-	1800 - 1840	Luddan	N	house	house
74	40902930	-	1800 - 1840	Ballymacarry Lower	N	farmhouse; house	house
75	40902931	-	1860 - 1900	Ballymacarry Lower	N	milestone/ milepost	milestone/ milepost
76	40902935	The Cottage	1850 - 1900	Tullyarvan	N	gates/ railings/ walls	gates/ railings/ walls
77	40902945	Westbrook House	1800 - 1850	Tullyarvan	N	house	house
78	40902946	-	1690 - 1750	Tullyarvan	N	mass rock	-

** The number in brackets represents the number of structures where multiple structures are registered under the same NIAH registration number*

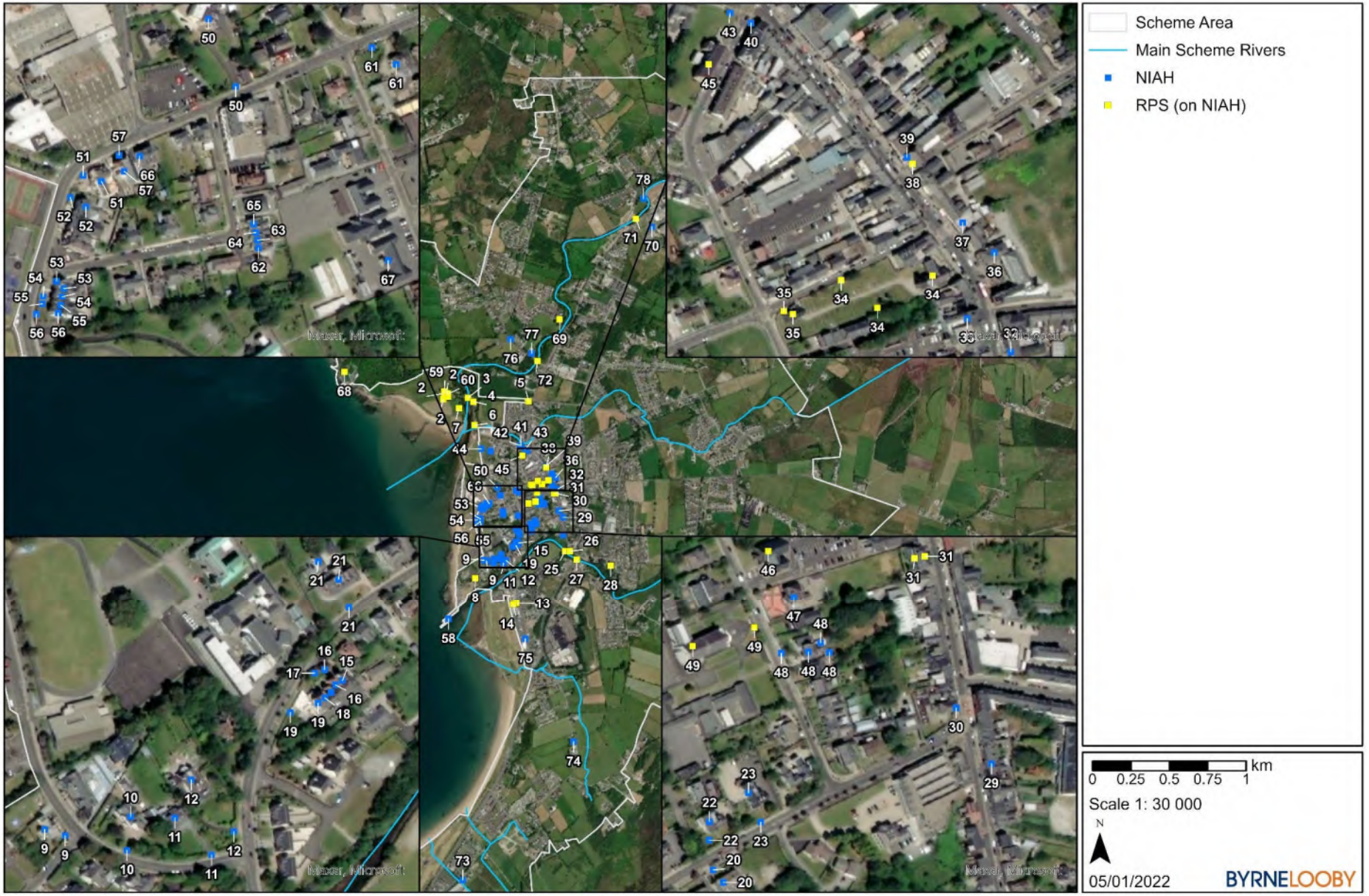

Figure 8.2 NIAH sites and NIAH sites on the RPS in the study area

8.4 Key Constraints

All archaeological and historic sites/features and properties with statutory designation in the study area are the key considerations in the constraints study in relation to cultural heritage, these sites have been identified and mapped for the constraints study. In summary the following constraints have been identified.

Arranging Archaeological Licenses when working in the vicinity of monuments or possible areas of interest is a constraint to the Project and can be a time-consuming exercise.

8.4.1 Archaeological Heritage

The scheme area may contain known and previously unknown underwater archaeological heritage that should be considered in any study to inform planning design and any potential EIARs. Such sites can include a range of underwater cultural heritage such as fortifications with associated slipways, quays, etc., harbours with associated infrastructure, shipwrecks, weirs, fishtraps, lakeside dwellings, causeways, logboats, sites such as rock cut platforms and steps, and artefactual material associated with sites or as individual depositions in underwater environments. Riverine post-medieval built heritage, such as quaysides, slips and flood-defence parapet walls may also be included, as can structures and features relating to the former use of the rivers for the milling and brewing industries. Archaeological materials relating to earlier quaysides, industrial structures and the reclamation of these areas may also be present beneath present ground level (DAU pers. comm. 05/11/2021; reference: G Pre00255/2021).

As advised by DAU National Monuments Service (NMS), the methodologies and processes outlined in the 'Framework and Principles for the Protection of the Archaeological Heritage and the 'Guidelines for the Archaeological Assessment of Flood Relief Schemes' (DHLGH 2021) should be consulted and adhered to in undertaking the archaeological assessments for these projects (DAU pers. comm. 05/11/2021; reference: G Pre00255/2021).

There is a general riverine/coastal archaeological potential in Buncrana and Lough Swilly. All wrecks over 100-years old are protected under the 1987 and 1994 (Amendment) Acts of the National Monuments Acts.

There are 27 RPS sites within the constraints study area. These structures/features should be considered as cultural heritage constraints during the design of the proposed flood relief scheme and avoided where possible.

There are 51 NIAH sites in the study area that have not been added to the RPS, however there is a potential that they may be added in the future.

Every care should be taken in these locations to avoid direct impacts on protected structures or by means of careful design or by the application of appropriate mitigation measures. This includes development that might adversely affect the setting of the protected structure. Any design proposals in the vicinity of protected structures vicinity should be carried out in a way that will not materially affect the character, integrity, amenity and setting of these sites. As advised by DAU (DAU

pers. comm. 05/11/2021; reference: G Pre00255/2021), it is suggested that OPW appoint a dedicated Project Archaeologist to support in this process.

There may be opportunities under Objective 4 of the County Donegal Heritage Plan Actions set out in the Heritage Council Strategy (2018-2022) to 'promote heritage education, training, tourism and outreach activities'.

8.4.2 Historic Character and Setting

O'Doherty's Keep, mill buildings, mill race, bridges, and weirs provide cultural, historical industrial and social amenity to Buncrana. Every effort should be made to retain or enhance this amenity.

While change within the setting of an historic site or landscape may be acceptable, in certain instances development will be considered intrusive and inappropriate (such as large embankments, walls or similar permanent infrastructure). This effect on the setting of archaeological and architectural heritage sites requires an assessment to be made on a case-by-case basis according to the type of development, its location and landscape setting by means of objective analysis based on a set of predefined criteria and professional judgement, supported by appropriate descriptive material.

Specific mitigation requirements can only be identified as issues for development once the design options are defined. Further assessments such as archaeological testing, underwater archaeological assessments, structural architectural heritage appraisals or structural surveys, etc. may be required in the next phases of the assessment or as mitigation measures for the scheme.

It should be noted, however, if flood relief measures impact any areas in proximity to an RMP, the judicious use of archaeological assessment techniques may be required in these areas in order to understand the implications for the proposed scheme.

In accordance with the Architectural Heritage Guidelines any work to or in the vicinity of a Protected Structure, NIAH sites require a conservation heritage impact assessment by a conservation architect.

All recommendations made in this report are subject to approval of the relevant Local Authorities and the National Monuments Service, Department of Housing, Local Government and Heritage.

9 Landscape and Visual

9.1 Introduction

This section of the report provides a review of the landscape and visual constraints that have been identified within the study area.

For the purposes of this report, the study is defined as the area outlined in Figure 1.1.

9.2 Methodology

The procedure used for the landscape and visual constraints study entailed a desktop study of the scheme area in relation to its overall context both locally and regionally and including a review of the relevant planning polices and publications, including the following:

- County Donegal Development Plan 2018-2024, including interactive mapping for scenic amenity (Donegal County Council, 2018).
- Landscape Character Assessment of County Donegal (Donegal County Council, 2016) comprising:
    - Landscape Character Assessment of County Donegal (including 'Buncrana Coast LCA 8')
    - Settlement Character Assessment
    - Digital Interactive Mapping.
- National Parks & Wildlife Service – location of SPAs, SACs and NHAs.
- Guidelines for Landscape and Visual Impact Assessment (Landscape Institute & I.E.M.A., UK 2013).
- National Landscape Strategy for Ireland 2015-2025 (Department of Housing, Local Government and Heritage, 2020).
- Historic Gardens and Designed Landscape sites in County Donegal - National Inventory of Architectural Heritage (National Inventory of Architectural Heritage, 2020).

9.3 Baseline / Receiving Environment

9.3.1 Landscape Character

Buncrana and Luddan are located on the west of the Inishowen Peninsula. Both areas are located in a fertile agricultural landscape along a stretch of sandy coastline on Lough Swilly and largely bordered by mountains.

9.3.1.1 Landscape Character Assessment (LCA)

Landform and land cover in the vicinity of the scheme is characterised by the undulating, fertile agricultural landscape with underlying schist geology, bordered by uplands to the north, east and south and Lough Swilly to the west. Between Dunree and Buncrana the land undulates lands towards the shore and consists of broadly medium to large agricultural fields largely bound by native hedgerow interspersed with clumps of trees and isolated deciduous trees (Donegal County Council, 2016).

The southern section of the LCA contains large working quarry and is bounded by the schist mountains of Luddan Hill and Mouldy Hill which have forestry plantations on their lower northern and eastern slopes (Donegal County Council, 2016).

The coastline has a low rocky edge along the northern section of the LCA with a softer sandy shoreline towards the south from Lady's Bay along Buncrana Beach towards the beach at Lisfannon (Donegal County Council, 2016).

Landscape character assessment is a process which describes, maps and classifies landscapes objectively. Defining landscape character enables an understanding to be formed of the inherent value and importance of individual landscape elements and the processes that may alter landscape character in the future. In relation to landscape character, the County Donegal Development Plan 2018-2024 contains a range of objectives applicable to protected areas, ecology, built structures, culture, tourism, and industry are key objects (reproduced in Appendix E).

All new developments within County Donegal must have regard to the specific landscape classifications as provided in the Landscape Character Assessment of County Donegal (2016), in terms of integration and assimilation of development into the receiving landscape, particularly in accordance with Policy NH-P-13 (see Appendix E). The study area contains Areas of Especially High Scenic Amenity (EHSA) broadly located parallel to the coast with inland areas classed as Areas of High Scenic Amenity (HSA) and Areas of Moderate Scenic Amenity (MSA), shown in Figure 9.1 in Section 9.3.6.

9.3.2 Seascape features

Lough Swilly (Seascape Unit 6) overlaps with the area for the Donegal County Council Landscape Character Assessment for Buncrana (Donegal County Council, 2016).

Lough Swilly is a large inland glacial tidal fjord that separates the Inishowen and Fanad peninsulas and the seascape has a high degree of uninterrupted visibility of the lough from many points along the shore and coast. The seascape topography is characterised by with high elevated bog and low-lying fertile fields and a range of uses including agriculture, tourism, forestry, and multiple sea uses including fishing, aquaculture, sailing, swimming, water sports and diving. The coastal edge is predominantly low-lying with silty edges and areas of salt marsh and salt meadows (Donegal County Council, 2016)

Special features of Seascape Unit 6 comprise: significant buildings, landmarks, biodiversity and cultural features. This includes the beaches of Lisfannon and Lady's Bay, the defensive forts at Dunree head and Ned's Point, and other protected structures and structures identified on the

National Inventory of Architectural Heritage as well as a rich archaeological heritage and old demesne landscape (Donegal County Council, 2016).

9.3.3 Historic Landscape Characterisation (HLC)

No historic landscape characterisation has been undertaken for the vicinity of the scheme boundary at the time of writing.

This is a historic landscape intrinsically associated with Lough Swilly as evident from the plethora of recorded monuments and protected structures in the landscape including enclosures, middens, cairns, promontory forts, Napoleonic forts, a castle and seaside Victorian architecture (Donegal County Council, 2016). There are numerous archaeological structures and sites throughout the area, including a number of Recorded Monuments and imposed built heritage including five RPS structures and 137 on the NIAH (details of those in structures in the study area are provided in Section 8.3).

The area has a significant maritime and defensive history due to its strategic location alongside Lough Swilly, and surviving structures include:

- Lighthouse at Dunree Head
- Dunree Military Fort
- Porthaw Fort
- Buncrana castle
- Lighthouse along Buncrana Shore

Buncrana contains examples of architecture and urban planning throughout the town. Buncrana originally developed as an Irish linear settlement and the town was modified during the 'Plantation' to create a planned main street and market square (Donegal County Council, 2016).

The area was, historically, the home of the O'Doherty clan and O'Doherty's Keep. The remains of the 14th Century Castle is located in Swan Park at the mouth of the Crana River. Later, the development of the Buncrana as a seaside resort was aided by increased accessibility to the town by rail. Buncrana Railway Station operated from 1864-1953 connecting Buncrana to Derry and the south-east, and north towards Clonmany.

More recently, Buncrana had a major textiles industry and the Swan Mill and Tullyarvan Mills, and associated structures inform the character of areas of Buncrana today. In the modern day, Buncrana continues to be a key service centre for Inishowen and the wider Donegal County (Donegal County Council, 2016).

9.3.4 Existing Trees and Hedgerows

The County Donegal Development Plan 2018-2024 states that Traditional field boundaries such as stone walls, hedgerows, tree lines, banks and ditches contribute to the regional character of rural

landscapes in County Donegal and reflect historical landownership and farming practises that reinforce our sense of place.

There are areas of mature woodland, tree planting and hedgerows within and around the study area. While there are no Tree Preservation Orders or Heritage Trees within the study area, the woodland, tree planting and hedgerows may provide visual and residential amenity and biodiversity benefits within this area and the surrounding environment.

Trees and hedgerows marking boundaries and along the river corridors create important biodiversity corridors and linkages.

9.3.5 Land Use Zoning

Details on land use zoning are provided in Section 3.3.8.

Appendix D contains Land Use Zoning Maps for Buncrana reproduced from the County Donegal Development Plan 2018-2024 (Donegal County Council, 2021).

9.3.6 Regeneration Strategy

Details of the regeneration plans for Buncrana are provided in Section 4.3.4.

9.3.7 Protected Views, Corridors and Prospects

There are no protected views within or into the study area at the time of writing (County Donegal Development Plan 2018 – 2024). Protected views across Lough Swilly in the vicinity of the scheme area are as follows and do not look towards, or are located within, Buncrana or Luddan:

- Broadly north west from Lisfannan and Fahan from the shoreline,
- South, south west, and west from Old Mountain, near Glebe, and
- North east from Drumhallagh, on the opposite shore of Lough Swilly to Buncrana (Donegal County Council, 2021).

The length of the Crana River, Mill River and Buncrana River within the scheme area is a green corridor with riparian habitat, and discontinuous tree cover and agricultural lands on banks within the study area. Urban development is located close to the banks on both sites of the river within the town.

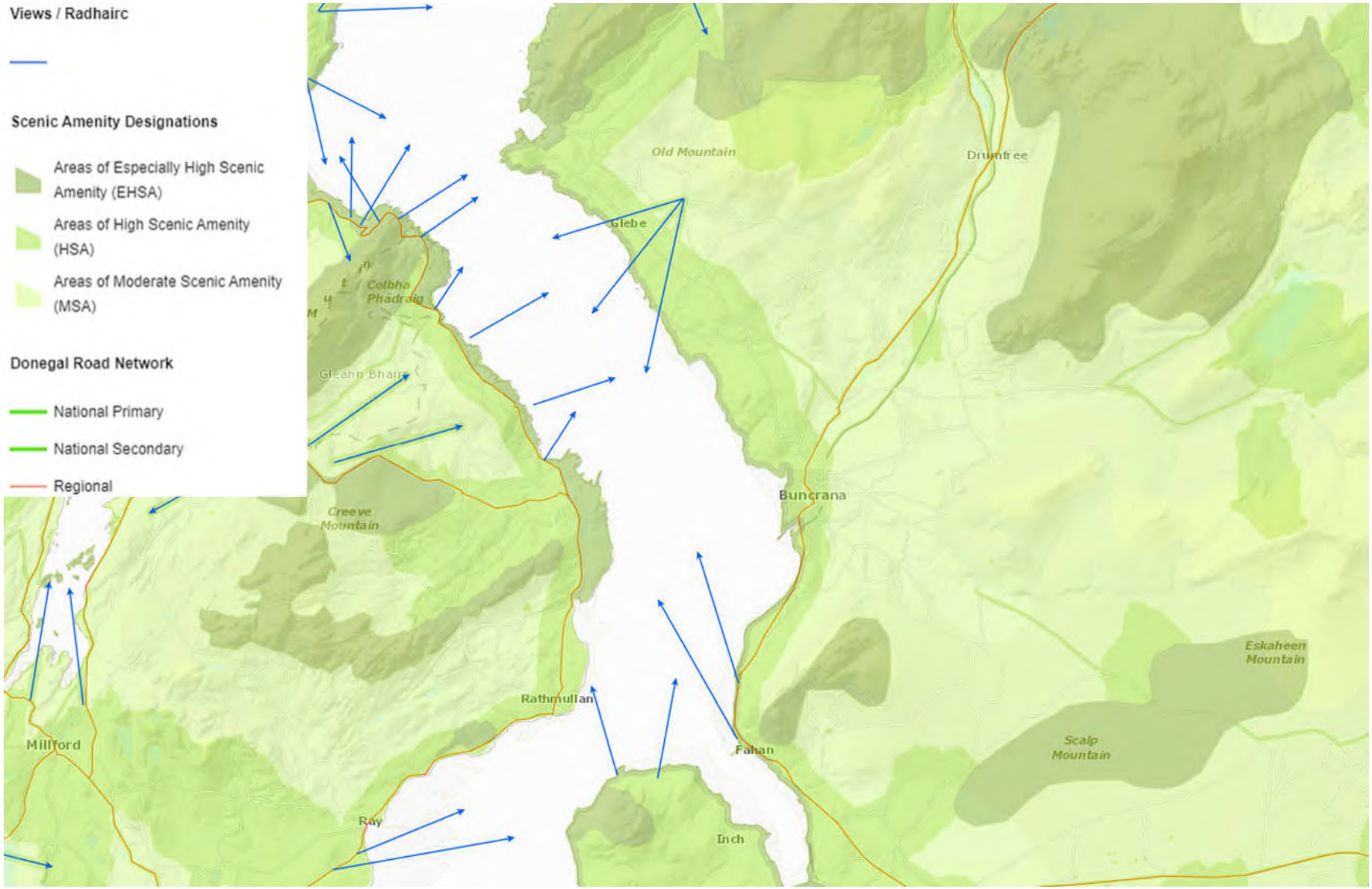

Figure 9.1 Scenic Amenity Designations and views
Source: (Scenic Amenity Designations, 2021)

9.4 Key Constraints

The existing trees and planting within the study area provides both visual and recreational amenity for the residential and amenity areas within the study area and the wider districts. Additionally, the 'green' and coastal character of the landscape is considered to be a key component of local tourism development for the towns and the wider area. Such areas also provide a network of habitats, ecological 'corridors' and 'stepping stones' essential for wildlife. Accordingly, such feature should be retained where possible.

The proposed development of the subject site will result in a change to the landscape character which will be most noticeable locally, such as from the adjacent residential and tourist areas (including along the river banks and bridges). The potential magnitude of this change will be assessed when the details, scale and extent of the proposed interventions have been finalised.

Historical landscape character and cultural heritage: Within the study area there are several designations and structures of national interest that need to be considered such as Protected Structures and Recorded Monuments, a Conservation Area, and Sites of Archaeological Interest

Protecting the key landscape resource which underpins the Wild Atlantic Way and the Donegal Tourism brand generally from inappropriate development is recognised as a key planning challenge in Donegal

There are recreational amenities within the study area that need to be considered in relation to possible impacts on their accessibility, recreational and visual values:

- Walk/Cycle Pathways along the coast and banks of the rivers.
- Land use zoning objectives in county development plans – areas zoned as for Amenity.

Key viewpoints will be selected when the details, scale and extent of the proposed interventions have been defined.

There is a need to protect:

- Views towards the rivers, estuary and lough from business serving the tourism and recreational sector (e.g. cafes, etc).
- Recreational views – towards to and from the river, estuary and lough (e.g. public pathways).
- Public, recreational and residential views to and from the coast, rivers and bridges, with emphasis on area that may be visually impacted by the suggested hard defence proposals in CFRAM:
    - Towards and from Lough Swill SAC and SPA
    - Towards and from Recorded Monuments and Protected Structures
    - Public pathways and amenity areas which pass through the study area

  - Other tourist amenities e.g. guesthouses, cafes, restaurants, seating areas

- During the construction phase, the following elements of the proposed development have the potential to cause visual impacts, they will however be short to medium term in duration:
  - Temporary site works – hoarding, lighting, cranes, car parking, storage areas
  - Construction traffic – dust and emissions
  - Tree and vegetation clearance
  - Groundworks – cut and fill excavations
  - Laying of foundations

The principal elements which are likely to give rise to landscape and visual impact visual impact in the long term/operational phase are:

- Removal of some existing trees
- Height of proposed structures/ interventions
- New structures/ interventions
- Change of character – dependent on proposed interventions type and scale
- Proposed tree and shrub planting

Appropriate design, siting and mitigation measures are required to integrate the proposed scheme within the landscape.

As advised by the Minister of transport (Minister of Transport pers. comm. 20/10/2021), given that all of the hard measures identified and assessed in 2018 scored quite high with regards to negative environmental consequences, designers are advised to weigh nature-based criteria compared to hard defences when designing these flood relief schemes.

Further, visual impact from existing national roads should be considered as part of the EIAR.

10 Air Quality

10.1 Introduction

This section describes the existing air quality environment in the scheme study area and identifies possible issues which have the potential to constrain the flood relief scheme design.

For the purposes of this report, the study area is defined as the Scheme Area which includes Buncrana-Luddon and some of the surrounding rural area (up to an outer extent of 500m).

10.2 Methodology

The procedure used for the landscape and visual constraints study entailed a desktop study of the scheme area in relation to its overall context both locally and regionally and including a review of the relevant planning polices and publications, including the following:

- Air Quality Index for Health (EPA, 2021),
- Most recent data for from the Letterkenny Station 64 (EPA, 2021),
- Donegal County Council Website, Air pollution (Donegal County Council , 2021),
- EPA air quality data (EPA, 2021).

10.3 Baseline / Receiving Environment

The scheme study area is comprised Buncrana and Luddan and surrounding rural areas, small villages and settlements, farmland, open spaces The closest national air quality monitoring station is Station 64 at Letterkenny, c. 26 km from the study area.

Item 'WES-0-6' in the County Donegal Development Plan (2018-2024) states the following air quality objective:

'It is the policy of the Council to provide for environmental protection, through: the protection of surface water and ground water from pollution in accordance with the River Basin Management Plan, Groundwater Protection Scheme and Source Protection Plans for public water supplies, the protection against soil contamination; minimising air and noise pollution; supporting remediation of all existing pollution; ensuring full compliance with relevant National and European Regulations, Statutes and Directives through monitoring and control of relevant activities.' (Donegal County Council, 2018).

Under the Clean Air for Europe Directive, EU member states must designate "Zones" for the purpose of managing air quality. For Ireland, four zones were defined in the Air Quality Standards Regulations (2011). The zones were amended on 1 January 2013 to take account of population counts from the 2011 CSO Census and to align with the coal restricted areas in the 2012 Regulations (S.I. No. 326 of 2012).

Ireland is divided into zones (Zones A, B C and D) for the assessment and management of air quality, in compliance with EU legislation. The scheme study area is located in Zone D: Rural Ireland ('Rural West'). According to the EPA Air quality index for health (AQIH) the air quality of the zone in which Buncrana and Luddan are located was reported as '3 - Good' (data correct as of 25th May 2021) (EPA, 2021).

Sensitive receptors within the scheme study area with respect to air quality and climate are predominantly people. This includes homes, schools, medical centres, businesses, sports facilities, and places of worship. Flora and fauna can also be sensitive to air quality and climate. Biodiversity is dealt with in Section 7.

During the construction phase, sensitive receptors may be impacted due to construction activities and construction traffic.

The operational phase will not result in any impacts in relation to air and will have will be beneficial to the surrounding property owners in alleviating flooding which may increase in frequency due to climate change.

10.4 Key Constraints

The key constraints in relation to air quality are any sensitive receptors in proximity to the location of construction works. The scheme design should take into consideration any air sensitive receptors such as residences, schools, businesses, and medical facilities located in proximity to works associated with the flood relief scheme.

11 Climate Change

11.1 Introduction

This section describes the baseline conditions, the regulatory framework (with regard to the consideration of climate change for flood relief schemes in Ireland) and identifies any implications, considerations, constraints and/or opportunities with regards to the proposed scheme.

For the purposes of this report, the study is defined as the island of Ireland.

11.2 Methodology

The procedure used to identify potential climate change constraints entailed a review of relevant legislation, policy and guidance, a desktop study of climate data available for Ireland and an identification of key constraints for the proposed scheme.

This Chapter has been prepared with review of the following documents:

- Climate Change Sectoral Adaptation Plan for Flood Risk Management (2019 - 2024) (Office of Public Works, 2019)
- Climate Change and Low Carbon Development Act (2015) (amended 2021)
- The National Adaptation Framework (2018) (Department of Communications, Climate Action & Environment, 2018)
- Donegal County Council's Climate Adaptation Strategy 2019-2024. (Donegal County Council , 2019).

11.3 Baseline / Receiving Environment

11.3.1 Flood Risk and Climate Change

It is acknowledged nationally that climate change is likely to have a significant effect upon flood risk in Ireland due to rising sea levels and more intense rainfall events and storms (Office of Public Works, 2019) however there remains uncertainty in relation to the rate and scale of this change.

Met Éireann has predicted that in Ireland the autumns and winters may see a rise in rainfall events of approximately 20%, and that the summer period may become drier. However, the change in precipitation patterns in Ireland, particularly at a local level and for shorter (sub-seasonal) durations, remains uncertain and is the subject of ongoing research (Office of Public Works, 2019). The Climate Change Sectoral Adaptation Plan for Flood Risk Management (2019 – 2024) reports that since the early 1990s, a rise in mean sea level of approximately 3.5 cm per decade has been observed and various studies have shown that during the 20th century, sea level rise has been accelerating.

To add to this, an increase in storm events over the North Atlantic Region are predicted to have a direct impact upon storm surges on the coast of Ireland (Office of Public Works, 2019).

Rising sea levels and increased rainfall predictions place parts of Ireland and, more specifically, County Donegal at greater risk of flooding from coastal, groundwater pluvial and fluvial flooding. Currently, flooding has already been identified as a key concern for County Donegal and current levels of adaptation are projected to be insufficient to avoid flooding for current global warming predictions (Donegal County Council , 2019). This calls for a greater need for planning and development in vulnerable areas.

Climate change allowance for the hydrological analysis will be calculated for two possible future scenarios, namely the Mid-range Future Scenario (MRFS) and the High-End Future Scenario (HEFS). Table 11-1 summaries the climate change allowances to be applied, in line with national guidance (Office of Public Works, 2019).

Table 11-1: Climate Change Allowances

Parameter	MRFS	HEFS
Extreme Rainfall Depth	+20%	+30%
Extreme Flows	+20%	+30%
Sea Level Rise	+500mm	+1000mm
Urbanisation	*No general allowance – review on a case-by-case basis*	
Forestation	-1/6 Tp[1]	-1/3 Tp[1] +10% SPR[2]
Note 1: Reduce the time to peak (Tp) by a third: This allows for potential accelerated runoff that may arise as a result of drainage of afforested land. Note 2: Add 10% to the Standard Percentage Runoff (SPR) rate: This allows for increased runoff rates that may arise following felling of forestry.		

11.3.2 Carbon and Climate Change

The Climate Action and Low Carbon Development Act provides for the approval of plans by the Government in relation to climate change for the purpose of pursuing the transition to a low carbon, climate resilient and environmentally sustainable economy; to establish a body to be known as the National Expert Advisory Council on Climate Change; and to provide for matters connected therewith. The Act is Ireland's first framework piece of climate change legislation and lays the ground for transition towards a low carbon economy, to be achieved through a combination of the following:

- a national greenhouse gas mitigation plan;
- a national adaptation framework; and
- specific sectoral adaptation plans. (Grantham Research Institute on Climate Change and the Environment, 2022)

Carbon impacts in relation to flooding consist of a) the potential impacts associated with flood damages and b) potential impacts associate with the construction and operation of the flood defences themselves.

Through installing flood relief measures, the potential impacts associated with flood damages can be largely mitigated, however carbon impacts from construction and operation (the 'carbon cost' will be calculated as the scheme progresses.

As part of the Project, the foreseen 'Carbon Cost' of the tonnes of Carbon Dioxide (CO_2) the proposed scheme options will generate, and the financial implications of this CO_2 quantity will be undertaken, taking into account relevant guidelines from the EU. The calculation of the Carbon Cost shall include:

- The quantities of different types of materials to be used for the option or Scheme.
- The quantity of CO_2 embodied in each type of material through sourcing, production, etc.
- The quantity of CO_2 that would be generated through the construction process.
- The quantity of CO_2 that would be generated per year in operation and maintenance of the option or scheme, such as through the operation of pumps, maintenance operations, etc.

11.4 Key Constraints

For the purposes of this report, potential climate change impacts have been classified as potential flood risk impacts and potential carbon impacts.

The Climate Change Sectoral Adaptation Plan for Flood Risk Management (2019 - 2024) considers Flood Relief Schemes to be a key prevention strategy for effects of climate change, and as such, this Project is integral to the overall climate adaptation strategy.

However, climate change is considered as a constraint on the design of the scheme, as higher rainfall and extreme weather events attributing to climate changes may lead to higher water levels, which would influence the design of the scheme.

The design should be mindful of the Donegal County Council Climate Adaptation Strategy which sets out strategic priorities, measures and responses for adaptation in the County over the next five years, as required by the Climate Action and Low Carbon Development Act 2015 (Donegal County Council, 2019). The risk of flooding and provision of sustainable protection infrastructure is noted as a key item in the Strategy.

The WFD has also called for a shift in flood management approach away from site specific hard engineering solutions, towards an integrated assessment of water resources and flood management at the catchment scale. The assessment and design should be mindful of this and reference key climate change legislation, as outlined in Section 11.2 above.

Carbon impacts in relation to flooding consist of a) the potential impacts associated with flood damages and b) potential impacts associated with the construction and operation of the flood defences themselves.

Through installing flood relief measures, the potential impacts associated with flood damages can be largely mitigated, however carbon impacts from construction and operation (the 'carbon cost' will be calculated as the scheme progresses.

As part of the Project, the foreseen 'Carbon Cost' of the tonnes of Carbon Dioxide (CO_2) the proposed scheme options will generate, and the financial implications of this CO_2 quantity will be undertaken, taking into account relevant guidelines from the EU.

12 Noise and Vibration

12.1 Introduction

This section describes the existing noise environment in the scheme study area and identifies possible issues which have the potential to constrain the flood relief scheme design.

For the purposes of this report, the study is defined as the Scheme Area which includes Buncrana-Luddon and some of the surrounding rural area (up to an outer extent of 500m).

12.2 Methodology

The procedure used for the noise and vibration constraints study entailed a desktop study of the scheme area in relation to its overall context both locally and regionally and including a review of the relevant planning polices and publications, including the following:

- Available aerial & street photography available by Google (2021) and OSi (2021).

12.3 Baseline / Receiving Environment

Sensitive Receivers to noise and vibration within the study area are predominately people and animals. Sensitive Receivers to vibration may include built structures and potentially vulnerable structures could include bridges, buildings, walls, property, and protected structures.

Most of the noise and/or vibration-sensitive receptors in the study areas are within the urban areas of Buncrana. Sensitive receptors are also present in Luddan and rural areas where built structures (including residential) or livestock may be present in proximity to construction works.

Noise during the construction phase of the project may have a temporary or short-term adverse impact on the local environment. It is not envisaged that the development of the flood relief scheme will lead to noise and vibration impacts that have a long-term or detrimental effect to sensitive receptors within the study area.

12.4 Key Constraints

During the Options assessment is recommended that the short-listed flood alleviation measures be assessed in relation to the impact of noise and vibration during the construction phase of the project.

Noise and vibration effects are expected to occur during the construction phase only and would be expected to include:

- Construction traffic,

- Earthmoving plant and equipment,
- Sheet piling,
- Power tools and generators.

Construction noise is temporary in nature, and therefore the normal way of minimising the impact is to limit the working hours. The Local Authority may place noise limits on the construction works.

The project CEMP will include measures to avoid or minimise the potential impacts of noise on sensitive receptors during construction. The following noise control measures may be employed to limit noise impacts from the scheme:

- Install site hoarding 2.4 m high around site boundaries,
- Install local noise barriers with absorptive linings near to specific sources, during construction works,
- Provide enclosures around generators,
- Provide local screening,
- Implement appropriate noise management measures.

Ground-borne vibration attenuates rapidly with distance. People are very sensitive to vibration and can feel vibration long before it becomes an issue in terms of cosmetic damage or structural damage to buildings. Assessment of potential for damage due to vibration should be carried out where vulnerable structures are located in close proximity to works such as sheet piling.

The scheme design and methods for works during construction should consider potential impacts to potential vulnerable structures and consider if there is a requirement for ongoing noise and vibration monitoring during construction.

Traffic along national route roads within the town is congested and traffic noise, particularly at peak times, and construction traffic should be managed to ensure cumulative or in-combination impacts from noise and/or vibration are avoided, where possible, or minimised.

13 References

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