Food Standards Agency in Northern Ireland

Sanitary Survey Review and Sampling Plan for Lough Foyle

(Revised)

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Glossary

ADCP	Acoustic Doppler Current Profiler
AFBI	Agri-Food and Biosciences Institute
AIS	Automatic Identification System
ASSI	Area of Special Scientific Interest
Bathymetry	The measurement of water depth at various places of a water body
Benthic	Of, pertaining to, or occurring at the bottom of a body of water
BMPA	Bivalve Mollusc Production Area
BOD	Biochemical Oxygen Demand
BTO	British Trust for Ornithology
CD	Chart Datum; the level of water that charted depths displayed on a nautical chart are measured from
CEFAS	Centre for Environmental, Fisheries & Aquaculture Science
CFU	Colony Forming Units
CRS	Coordinate Reference System
CSO	Combined Sewer Overflow
CSO	Central Statistics Office
Cultch	Material such as stones, shells, and other material which form the beds by which spat can attach forming the basis of the oyster bed.
DAERA	Department of Agriculture, Environment, and Rural Affairs
Depuration	The process of purification or removal of impurities

DSW	Designated Shellfish Waters
EC	European Communities
ED	Electoral Division
E. coli	*Escherichia coli*
EMS	Environmental Monitoring Stations
EU	European Union
FBO	Food Business Operators
Fetch	The distance a wave can travel towards land without being blocked
FSA	Food Standards Agency
Geometric Mean	The nth root of the product of n numbers (The average of the logarithmic values of a data set, converted back to a base 10 number).
GMS	Global System for Mobile Communication
GSNI	Geological Survey of Northern Ireland
GSI	Geological Survey of Ireland
GPS	Global Positioning System
Hydrodynamic	Forces in or motions of liquids
Hydrography	The description and analysis of the physical conditions, boundaries, flows, and related characteristics of water bodies
I-WeBS	Irish Wetland Bird Survey
Kn	Knots
LAT	Lowest Astronomical Tide

LBM	Live Bivalve Molluscs
LGD	Local Government District
LPHCs	London Port and Harbour Commissioners
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978. Marpol is short for Marine Pollution, 73 for 1973 and 78 for 1978.
MPN	Most Probable Number
MSD	Marine Sanitation Device
NBDC	National Biodiversity Data Centre
NBN	National Biodiversity Network
NIEA	Northern Ireland Environment Agency
NISRA	Northern Ireland Statistics and Research Agency
NI	Northern Ireland
NI Water	Northern Ireland Water
NRFA	National River Flow Archive
NTU	Nephelometric Turbidity Unit
OD	Ordnance Datum
p.e.	Population Equivalent
psu	Practical salinity unit
RAMSAR	A term adopted following an international conference, held in 1971 in Ramsar in Iran, to identify wetland sites of international importance, especially as waterfowl habitat.

RoI	Republic of Ireland
RMP	Representative Monitoring Point
SAC	Special Areas of Conservation
SFPA	Sea Fisheries Protection Authority
SPA	Special Protection Area
SPS	Sewage Pumping Station
UKHO	United Kingdom Hydrographic Office
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WwPS	Wastewater Pumping Station
WWTP	Wastewater Treatment Plant
WwTW	Wastewater Treatment Works

1. Executive Summary

Under Regulation (EU) 2017/625 and its subsequent Implementing Regulation (EU) 2019/627, there is a requirement for competent authorities intending to classify bivalve mollusc production and relaying areas to undertake a sanitary survey. The purpose of the sanitary survey is to determine the extent to which potential sources of pollution may impact a production area and ultimately inform the sampling plan for the Official Control Microbiological Monitoring Programme, the results of which determine the annual classification for bivalve mollusc production areas. In the context of this sanitary survey review, pollution encompassed *Escherichia coli* contamination only.

Lough Foyle spans the jurisdictions of both Northern Ireland and the Republic of Ireland. As such, shellfish classification and monitoring are carried out independently by two competent authorities: the Food Standards Agency Northern Ireland (FSA NI) and the Sea-Fisheries Protection Authority (SFPA). Each applies its own legal framework, sampling programme, and classification process. Results and classifications are not shared or mutually recognised across jurisdictions.

In accordance with the CEFAS Guide to Good Practice technical application on the microbiological monitoring of bivalve mollusc production areas and the Sea Fisheries Protection Authority's own Code of Practice for the Microbiological Monitoring of Bivalve Mollusc Production Areas, a re-evaluation of pollution sources and the sampling plan (primary sampling plan) should be undertaken if a time trigger (six years or more since the last survey) or a change in the environment has occurred. Unlicensed aquaculture occurs in Lough Foyle. Consequently, a sanitary survey review must be undertaken to determine the species-specific Representative Monitoring Points. This review identifies the sources and types of faecal (*i.e., E. coli*) contamination discharging into Lough Foyle and assesses whether changes in these sources are likely to affect the microbiological concentration in the production areas and the previously determined sampling plan.

Lough Foyle is located on the northern coast of Ireland and covers an area of approximately 186 km^2. Part of the North Western River Basin District and encompassing coastal areas of Northern Ireland and the Republic of Ireland, Lough Foyle has substantial mudflats and sandflats supporting a diverse range of marine and avian species. The lough has high ecological significance, forming part of a Ramsar site and two Special Protection

Areas. A survey by CEFAS in 2007 recorded the extent of live bivalve molluscs within the lough, however there were no recent data on the extent and distribution of these species at the time of writing this report. The previous sanitary survey and sanitary survey review were undertaken in 2010 and 2022, respectively.

Lough Foyle has semi-diurnal tides with a spring tidal range of 2.2 m. It is a relatively shallow basin with reported average depth of 5 m and reaching 20 m depth at the entrance to the lough. Stratification and a salt-water wedge in the mouth of the Foyle estuary have been recorded due to density differences between freshwater and seawater influencing sediment transport and resulting in estuarine circulation. Storm events may also alter flow patterns in the lough. Local wind-induced waves influence current patterns and may result in the resuspension of sediment over shallow regions of the lough. Significant freshwater discharges come from the Rivers Foyle, Roe, and Faughan and varying discharge levels interacting with the tides result in variable salinity. The south-eastern areas of the lough are more vulnerable to pollution due to shallow depths leading to increased suspended sediment concentrations and weak currents compared to the northwestern areas of the lough, which are characterised by deeper depths and stronger currents.

This report endeavours to document and quantify all known sources of pollution entering Lough Foyle. Data from 2021/22 revealed significant population growth in the Lough Foyle area, especially in areas such as Greysteel, Enagh, and Eglinton. Land use in the area has remained similar since the previous survey and agricultural activities are the dominant land use around the lough, particularly pasture land. The Rivers Foyle, Roe, and Faughan run over areas of agricultural land and may carry pollutants into Lough Foyle, especially after periods of high rainfall after the drier periods of spring and summer. There are 64 wastewater treatment works identified in the Lough Foyle area serving 187,782 people and some of these works are currently operating above-capacity. There has been an increase in the number of industrial consents since the previous review.

It has been concluded that the main sources of pollution entering Lough Foyle come from wastewater treatment plants into the Rivers Foyle, Roe and Faughan, and from non-point sources related to agricultural land-use in the lands surrounding Lough Foyle. Seasonal variation in pollution from animals, shipping, tourism, and hydrological features (rainfall, salinity, *etc.*) have also been recorded, with increases in tourism and population statistics

observed. Previously, Lough Foyle was divided into four production areas. The Sea Fisheries Protection Authority currently monitor and sample shellfish flesh in production areas 1 and 2, and the Foods Standards Agency NI currently monitor and sample shellfish flesh in production areas 3 and 4. Lough Foyle has maintained a B classification. In total there are seven representative monitoring points in Lough Foyle. The most recent shoreline survey and review of Lough Foyle did not find sufficient evidence of change within the lough to require alterations to the production area boundaries and the monitoring points.

2. Introduction

Consumption of raw or lightly cooked bivalve molluscs can result in illness due to the presence of microorganisms, many of which are derived from faecal contamination of the marine environment. Shellfish contaminated with pathogenic microorganisms may cause infectious disease in humans and such events are more likely to occur when production areas are impacted by sources of human and animal faecal contamination; referred to as pollution for the purposes of this report. The risk of contamination of bivalve molluscs with pathogenic microorganisms is assessed through national microbiological monitoring programmes. This assessment results in the classification of bivalve mollusc production areas (BMPAs), which in turn governs the level of treatment required for the shellfish before human consumption.

The Food Standards Agency (FSA) in Northern Ireland is responsible for carrying out sanitary surveys in classified production and relaying areas in accordance with Article 58 of Implementing Regulation European Union (EU) 2019/627. This requires the assessment of sources of pollution of human or animal origin and the hydrological characteristics of the associated contributing catchment area and coastal waters in conjunction with an examination of the quantities of organic pollutants released according to annual spatial and temporal variability. The scientific information gathered is then used to establish appropriate Representative Monitoring Points (RMPs) for the continued monitoring of classified production and relaying areas. The production and relaying areas shall be monitored periodically for microorganisms, the presence of toxin-producing plankton and marine biotoxins, chemical contaminants, and malpractices. Specifically, under Regulation (EU) 2017/625 and its subsequent Implementing Regulation (EU) 2019/627, there are requirements to carry out a sanitary survey before classifying any shellfish production or relaying area. The Sea Fisheries Protection Authority (SFPA) is responsible for the official sampling of shellfish in Lough Foyle. SFPA's Greencastle Port Office issue shellfish registration document books and regulate registered Food Business Operators (FBOs) and approved establishments that use shellfish from Lough Foyle, to ensure the products are safe for human consumption.

In shellfish production or relaying areas that have been classified previously, there are requirements to carry out a sanitary survey when the predesigned fixed review period has been reached. Article 56 of Implementing Regulation (EU) 2019/627 states:

1. Before classifying a production or relaying area, the competent authorities shall carry out a sanitary survey that includes:
    a) An inventory of the sources of pollution of human or animal origin likely to be a source of contamination for the production area.
    b) An examination of the quantities of organic pollutants released during the different periods of the year, according to the seasonal variations of human and animal populations in the catchment area, rainfall readings, wastewater treatment, *etc.*
    c) Determination of the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry, and the tidal cycle in the production area.
2. The competent authorities shall carry out a sanitary survey fulfilling the requirements set out in paragraph 1 in all classified production and relaying areas, unless carried out previously.
3. The competent authorities may be assisted by other official bodies or food business operators under conditions established by the competent authorities in relation to the performance of this survey.

In addition, Article 57 of Implementing Regulation (EU) 2019/627 requires competent authorities to establish a monitoring programme for live BMPAs that is based on an examination of the sanitary survey described above. It is the responsibility of the FSA to assess and classify production or relaying areas based on a sanitary survey in Northern Ireland. This report contains the documents relevant to the sanitary survey of the BMPA at Lough Foyle, located between Co. Donegal in the Republic of Ireland and Co. Derry/Londonderry in Northern Ireland.

3. Overview of the Fishery/Production Area

3.1 Description of Area

Lough Foyle is a relatively shallow, estuarine dominated sea lough located on the northern coast of Ireland. It lies between the rocky Inishowen Peninsula in Co. Donegal where quartzite is the predominant rock type, with small areas of schist and granite bedrock occurring, and the sedimentary rock dominated eastern shore of Co. Derry/Londonderry (see **Figure 3-1**). The lough is predominantly associated with agricultural, marine, and tourism-related sectors. It is approximately 30 km long and 13 km wide (at the widest point) and its topography is heavily influenced by numerous glaciations (Marine Institute, 2020).

Figure 3-1: Location of Lough Foyle.

The lough can be accessed through the North Channel between Inishowen Head and The Tuns, and the South Channel between the southern edge of The Tuns Bank and the eastern shore (**Figure 3-2**). The North Channel leads into a Maintained Commercial Channel along the northwest shore of the lough and provides access to the Foyle River

estuary and Foyle Port Marina. The South Channel passes Magilligan Point allowing access to the eastern shore. Modification of the shoreline has occurred mostly in the 19th century through reclamation work (Northern Ireland Environment Agency (NIEA), 1997).

At *circa* 186 km^2, Lough Foyle is part of the North Western River Basin District and forms one of the largest catchments of all Irish sea loughs (Marine Institute, 2020). There are small rivers along the western shore (see river waterbodies at EPA Maps; MacDonald *et al.*, 1951); however, on the southern and eastern shores lie the more significant rivers of the catchment, including the Foyle, Faughan, and Roe Rivers, which drain a large portion of the mountains of Donegal and the Sperrin Mountains (Marine Institute, 2020). These rivers, along with the estuaries and Lough Foyle, form part of a Ramsar site (Ulster Wildlife, 2019). The lough includes extensive intertidal and subtidal sand and mudflats, saltmarsh, and associated brackish ditches, however rocky substrate is limited (DAERA, 2017). The tidal flats can be broadly divided between sand flats north of the Roe River estuary and muddy sand flats to the south of this, both of which are *c.* four metres in depth (Hughes, 2021); the intertidal flats are most extensive along the eastern shore (NIEA, 1997).

The mudflats, covering approximately 20% of the lough, support a variety of organisms including eelgrass and mussels (Agri-Food and Biosciences Institution [AFBI]), 2015). Lough Foyle hosts two species of eelgrass (*Zostera* spp.), which form some of the largest colonies in Northern Ireland. These include narrow-leaved eelgrass (*Zostera angustifolia*) and dwarf eelgrass (*Zostera noltii*). Extensive mussel beds on the mudflats offer a hard substrate for epifaunal organisms, including acorn barnacles (*Semibalanus balanoides*) and periwinkles (*Littorina littorea*). The predatory green leaf polychaete worm (*Eulalia viridis*) is also commonly associated with these habitats (DAERA, 2017). The intertidal mussel beds in Lough Foyle may reach densities of 25 kg/m^2 (Loughs Agency, 2018). The boundaries of the mussel beds have experienced varying levels of change in recent years however, this is considered to be due to natural environmental factors and not human influence (Loughs Agency, 2018). The soft sandy and muddy shores of Lough Foyle host a range of species commonly associated with these substrates including the polychaete worm *Hediste diversicolor*, indicative of reduced salinity conditions (DAERA, 2017). The highest diversity of sediment and ecological communities occurs at Balls Point (**Figure 3-2**) which has also been found to hold large populations of bivalve sand gaper (*Mya arenaria*) and peppery furrow shell (*Scrobicularia plana*) (DAERA, 2017).

A transitional sequence of community type is evident in the saltmarsh vegetation on the foreshore. The lower colonising saltmarsh consists of the common saltmarsh grass (*Puccinellia maritima*). The middle marsh is characterised by red fescue (*Festuca rubra*) and mud rush (*Juncus gerardii*), with localised stands of sea club-rush (*Bolboschoenus maritimus*) and common reed (*Phragmites australis*) (DAERA, 2017). The upper marsh community is dominated by common couch (*Elymus repens*). Large intertidal mudflats form part of a larger creek network west of Ballykelly Bank and the lower saltmarsh communities are replaced by common cordgrass (*Spartina anglica*). Behind the shore, brackish dykes are present, which support a range of marine, aquatic, and swamp vegetations (DAERA, 2017). The western coastline of Lough Foyle is characterised by agricultural lands surrounded by trees and hedgerows. According to CORINE land cover, pastures remain the dominant land cover in the region, followed by peat bogs, moors, and heathland.

Lough Foyle spans two Special Protection Areas (SPAs): Lough Foyle SPA (004087) in the Republic of Ireland and Lough Foyle SPA (UK9020031) in Northern Ireland. It supports more than 20,000 nationally and internationally important wintering waterbirds (NPWS Lough Foyle SPA, DAERA Lough Foyle SPA). These SPAs are designated under Annex I of the Birds Directive 2009/147/EC (as amended) for the presence of several significant bird species. Lough Foyle is of high ornithological importance, featuring both a Ramsar site and an Area of Special Scientific Interest (ASSI), which overlap with Lough Foyle SPA (UK9020031). While the Magilligan Special Area of Conservation (SAC) (UK0016613) also overlaps part of Lough Foyle SPA (UK9020031), it is not designated for marine mammals.

By 2018, unlicensed oyster farming in Lough Foyle had increased to over 60,000 trestles (Hughes, 2021), and in 2021, the lough was classified as having a Class B production area for oysters. A significant number of invasive species were recorded in the most recent pre-fishery stock assessment for the native oyster fishery in Lough Foyle (Loughs Agency, 2022). Slipper limpets (*Crepidula fornicata*) were first noted in Lough Foyle during the 2018 autumn stock assessment on native oyster beds. While not fully established, their abundance has increased since 2018 (Lough Agency, 2020), posing a serious threat to the oyster industry due to their potential to smother other organisms. Numerous other species occur in Lough Foyle that pose a threat to successful shellfish fisheries and mussel farming there. The Chinese mitten crab (*Eriocheir sinensis*), though present is not established, while the carpet sea squirt (*Didemnum vexillum*) is established and threatens mussel farming

activities. Japanese kelp (*Undaria pinnatifida*) is established and may have implications on shellfish fisheries and biological parameters through hydrodynamic alterations, reducing light levels, and fouling shellfish beds. Japanese wireweed (*Sargassum muticum*) is also established and may cause hydrodynamic alteration and increase sediment deposition. Smooth cordgrass (*Spartina alterniflora*) is established, with its impacts primarily observed in the intertidal zone.

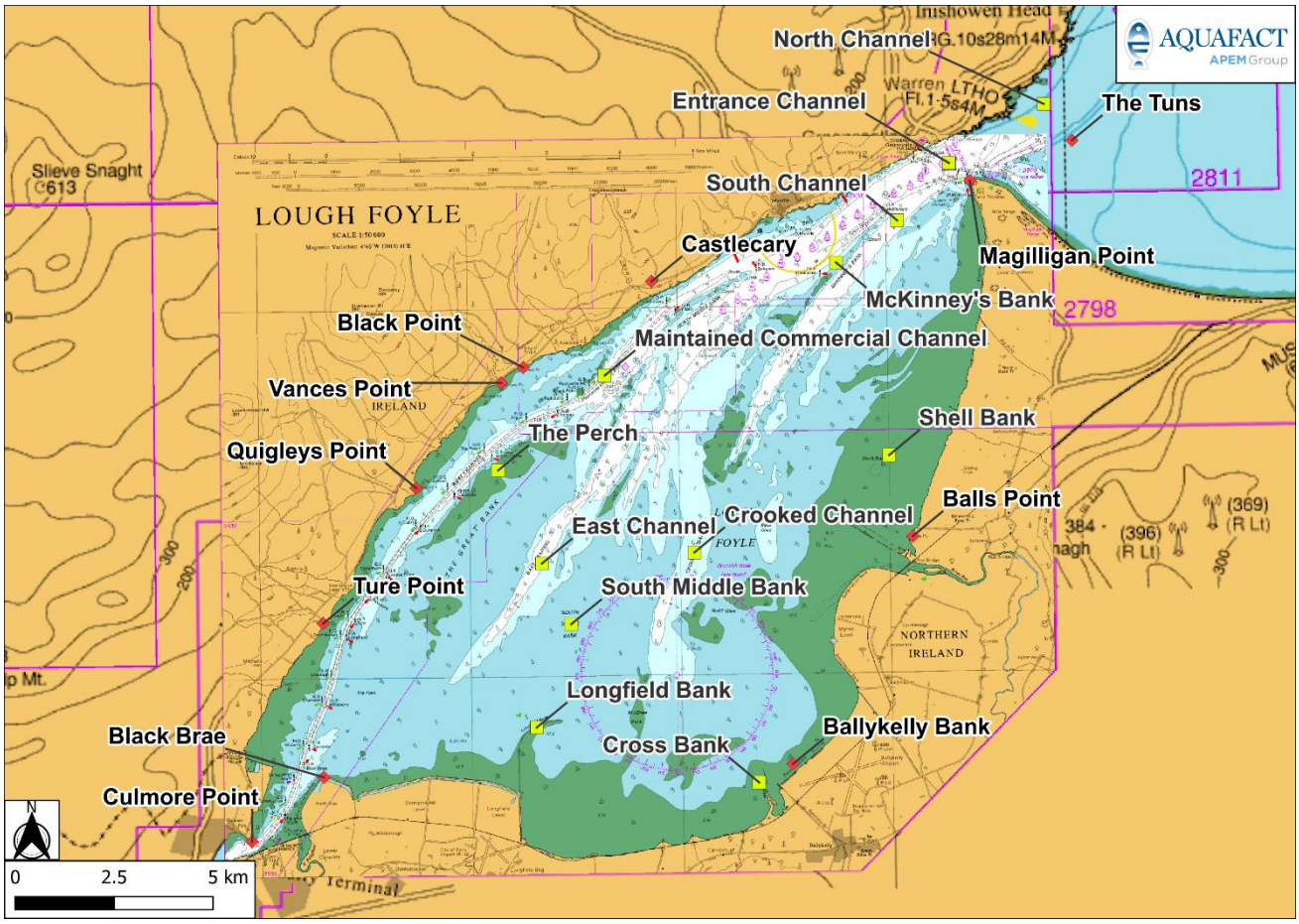

Figure 3-2: Lough Foyle navigation and bathymetry.

3.2 Location/Extent of Growing/Harvesting Area

3.2.1 Blue Mussel

CEFAS (2007) undertook an extensive baseline survey, funded by the Loughs Agency, to identify oyster and mussel habitat usage, extent, production, biomass, stock status, and areas of the lough that were historically or currently suitable for these species that are not presently fished. The survey also identified other fisheries in the lough and the potential for new fisheries. **Figure 3-3** shows the locations of blue mussel (*Mytilus edulis*) grounds within Lough Foyle in 2007 (CEFAS, 2007). Both wild and farmed mussels are present in Lough Foyle. In 2007, wild mussels were left to spawn and repopulate their native beds, while farmed mussels were grown from spat placed in designated areas. The CEFAS (2007) survey could not distinguish between wild and re-laid mussels and so guidance was sought from an experienced skipper to determine the likely locations for each. Mussel grounds that could not be classified were labelled 'undifferentiated mussel'. Using these survey data (CEFAS, 2007), QGIS 3.34.7 was employed to calculate the area of the shellfish grounds. In 2007, there were *c.* 23.34 km^2 of re-laid mussel grounds, *c.* 4.11 km^2 of wild mussel grounds, *c.* 7.62 km^2 of undifferentiated mussel grounds, and *c.* 2 km^2 of intertidal mussel grounds. The intertidal mussel beds were located at Vances Point (western shoreline), at Longfield Bank moving east to Cross Bank (southern shoreline), at Shell Bank, and approximately one km west of Balls Point (eastern shoreline) (see **Figure 3-2** for locations).

In 2007, a small number of fishermen fished for wild mussels throughout the year on Lough Foyle, using box dredges and mussel dredges ranging in size from 1 to 2.5 metres in diameter (CEFAS, 2007). Aquaculture operations in Lough Foyle began in 1997 and have grown significantly since, with mussel cultivation primarily conducted via bottom culture. This extensive bottom culture is based on dredging mussel spat or seed from areas where abundant settlement has occurred and relaying the seed at lower densities (CEFAS, 2007). The seed is relayed to prepared plots for improved stabilisation which allows for enhanced growth and meat content. Re-seeding of the lough occurs between July and November (CEFAS, 2007).

In 2007, large areas of the lough were used for mussel relaying and considerable stocks of rough mussels existed either naturally or as remnants of past relaying exercises (CEFAS, 2007). Some residual stock south of Magilligan Point was heavily fowled in 2007 and then

acted as a parent stock for spat fall outside the entrance to the lough (CEFAS, 2007). At the time of writing, no recent data on mussel densities in Lough Foyle were available.

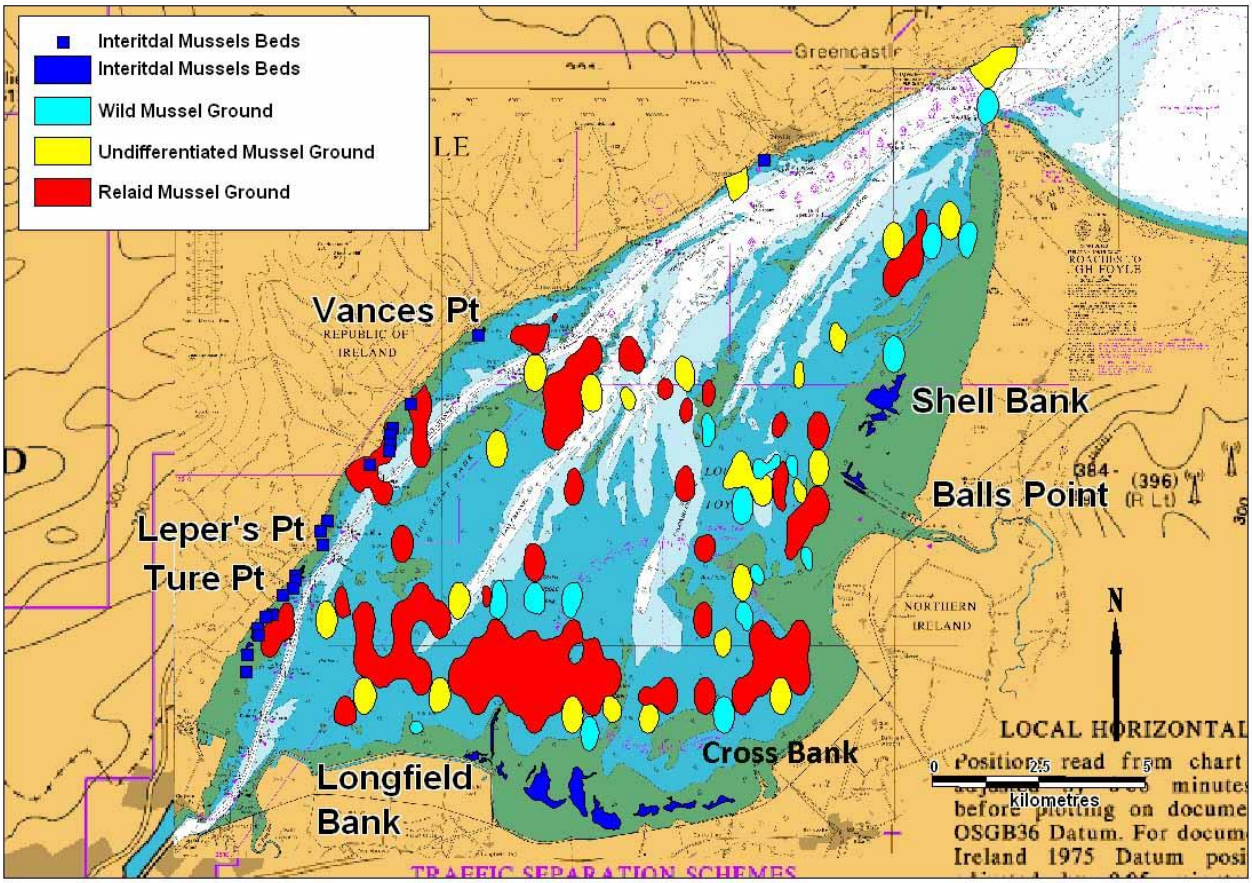

Figure 3-3: Mussel ground types located within Lough Foyle (source: CEFAS, 2007).

3.2.2 Native Oyster

Figure 3-4 illustrates the native oyster (*Ostrea edulis*) grounds within Lough Foyle in 2007 (CEFAS, 2007). These grounds were characterised by the presence of oysters and by the presence of suitable shell cultch, indicating past and potential future habitat suitability despite containing very few, if any, oysters (CEFAS, 2007). The cultch was primarily comprised of oyster shell, though clam, cockle, and mussel shell often comprised significant proportions of the cultch (CEFAS, 2007). Using QGIS 3.34.7, it was calculated that there were approximately 63.83 km^2 of potential native oyster grounds using 2007 data (**Figure 3-4**).

Oyster density classes are monitored and recorded in the lough. They are classified into High (> 0.5 oysters/m^2), Medium (0.1 – 0.5 oysters/m^2), and Low (<0.1 oysters/m^2). In

spring of 2010 (see **Figure 3-5**), High class oysters were located at The Perch, between Quigleys Point and Vances Point, between Ture Point and Quigleys Point, and in the Crooked Channel (see **Figure 3-2** for locations) (Loughs Agency, 2010). The majority of Medium class oysters in spring 2010 were located between Ture Point and Castlecary, in East Channel, South Middle Bank, and in the north and south of Crooked Channel (**Figure 3-2**) (Loughs Agency, 2010). The remaining areas of Lough Foyle were Low class oysters (Loughs Agency, 2010).

The Loughs Agency monitors fisheries and oyster density annually to biannually in Lough Foyle. Oyster density data from autumn 2022 was compared against that in the 2010 report using the same density classifications (Loughs Agency 2010). In 2022, High density oysters were sparsely located around Ture Point, Quigley's Point, and Vances Point, with the most significant densities in South Middle Bank (**Figure 3-6**). Medium density areas of oysters were concentrated in the southern regions of the lough and areas of Low density oysters were found in the northern regions of the lough, particularly dominant in the channel adjacent to McKinney's Bank (see **Figure 3-2** for location of features; see **Figure 3-6** for oyster size classes in 2022) (Loughs Agency, 2022).

In 2022, mean oyster bed density was 0.104 oysters/m^2, a substantial increase from the 2017-2019 surveys, attributed to successful recruitment (Loughs Agency, 2022). Native oyster densities were also compared from 2008 to 2020 (**Figure 3-7**), showing an overall increase since 2008, though there is significant variability in adult densities from year to year.

Bonamia ostrea is a microscopic single-celled parasite that causes mortality and reduced health in native oysters. It was first detected in Lough Foyle in 2005 when 13 out of 30 oysters sampled by the Marine Institute were identified as positive for the parasite (CEFAS, 2007; Marine Institute – *Bonamia ostrea*). While *B. ostrea* has been attributed to elevated mortality in the lough, levels of infection remain low (Lough Agency, 2010; Flannery *et al.*, 2016).

Historically, the wild oyster fishery operated in October, November, and September every Tuesday and Wednesday. More recently it has been active in January, February, and March on the same days, although the opening of the fishery is dependent on the Loughs Agency approval (SFPA Senior Port Officer, *per comm.*).

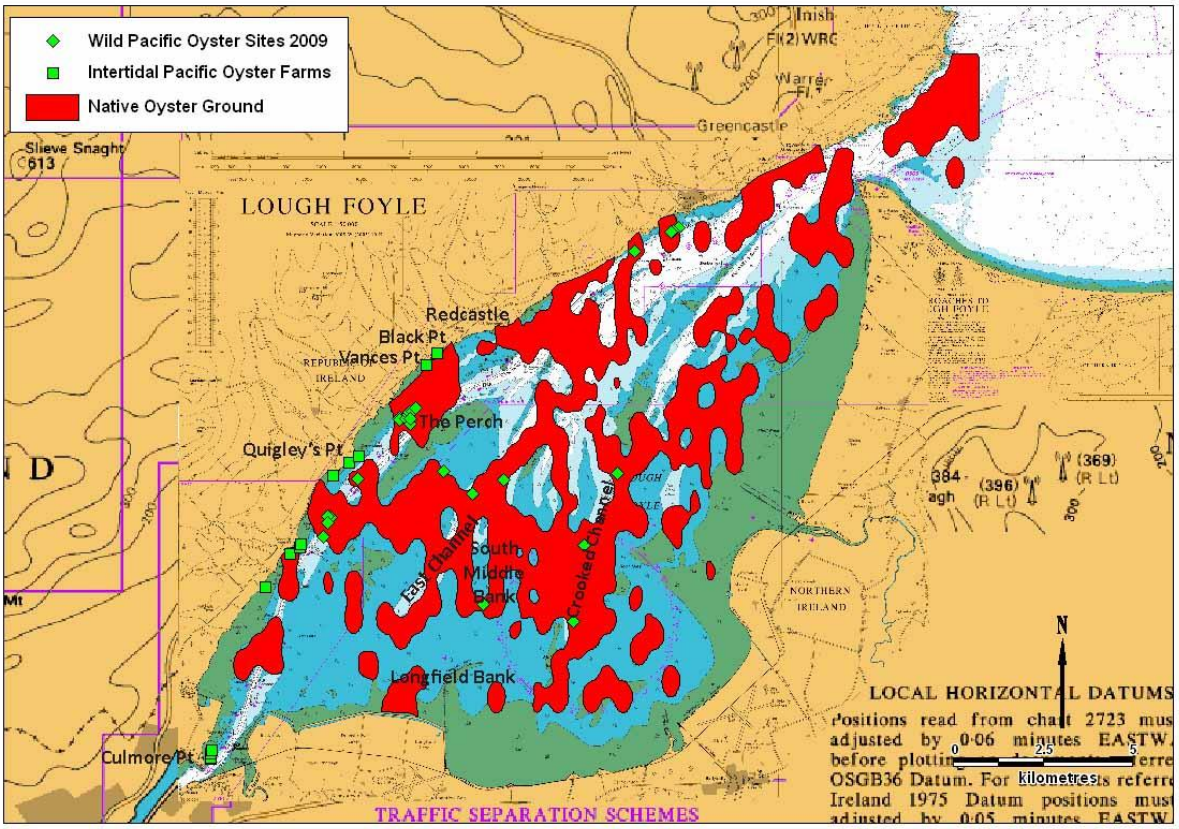

Figure 3-4: Native and Pacific oyster grounds located within Lough Foyle (source: CEFAS, 2007).

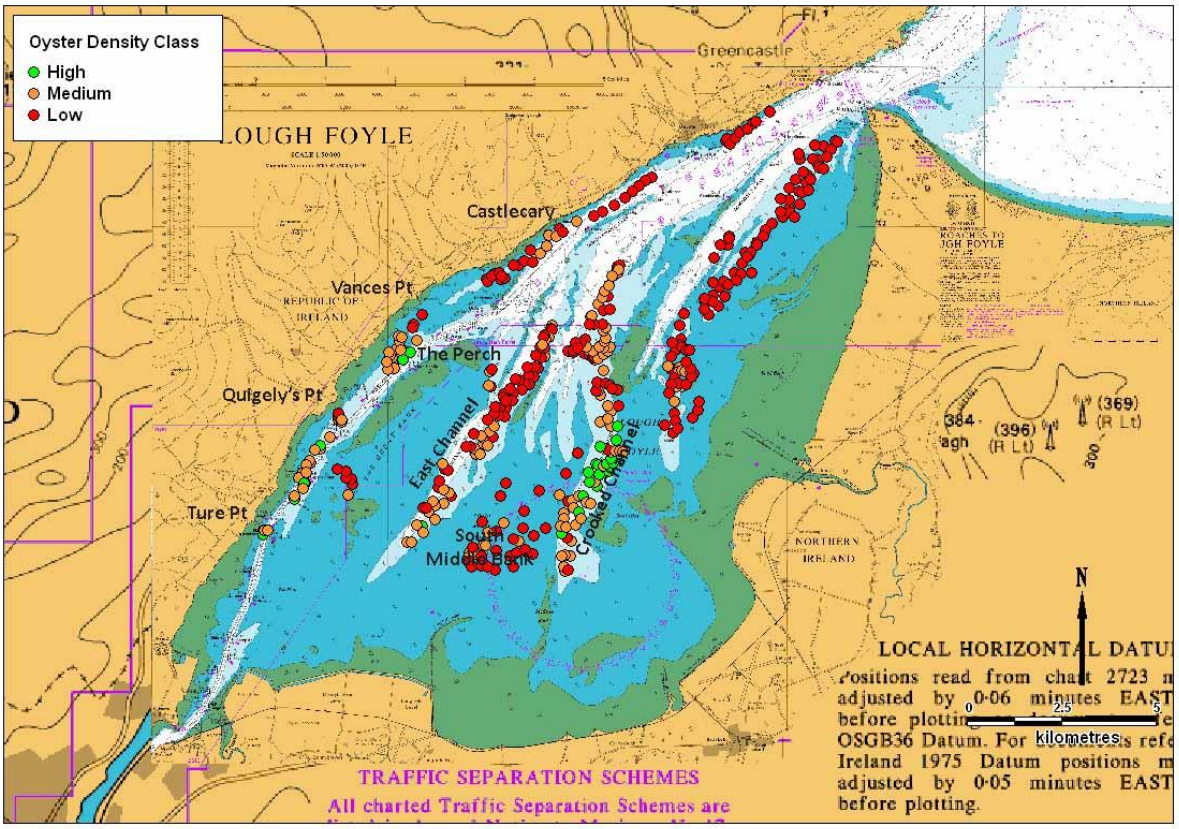

Figure 3-5: Oyster density class (High, Medium, Low) in Lough Foyle (source: Loughs Agency, 2010).

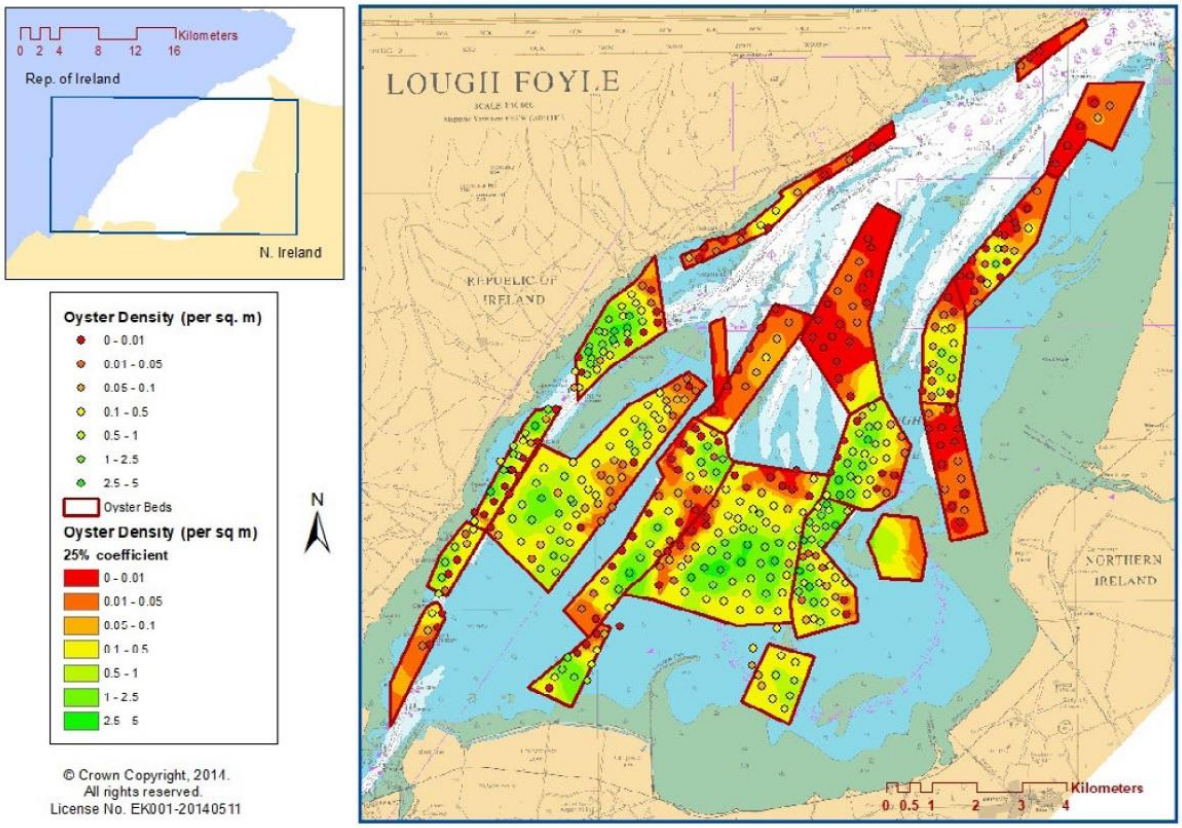

Figure 3-6: Native oyster (*Ostrea edulis*) abundance per m^2 in Lough Foyle in 2020 (source: Loughs Agency, 2020).

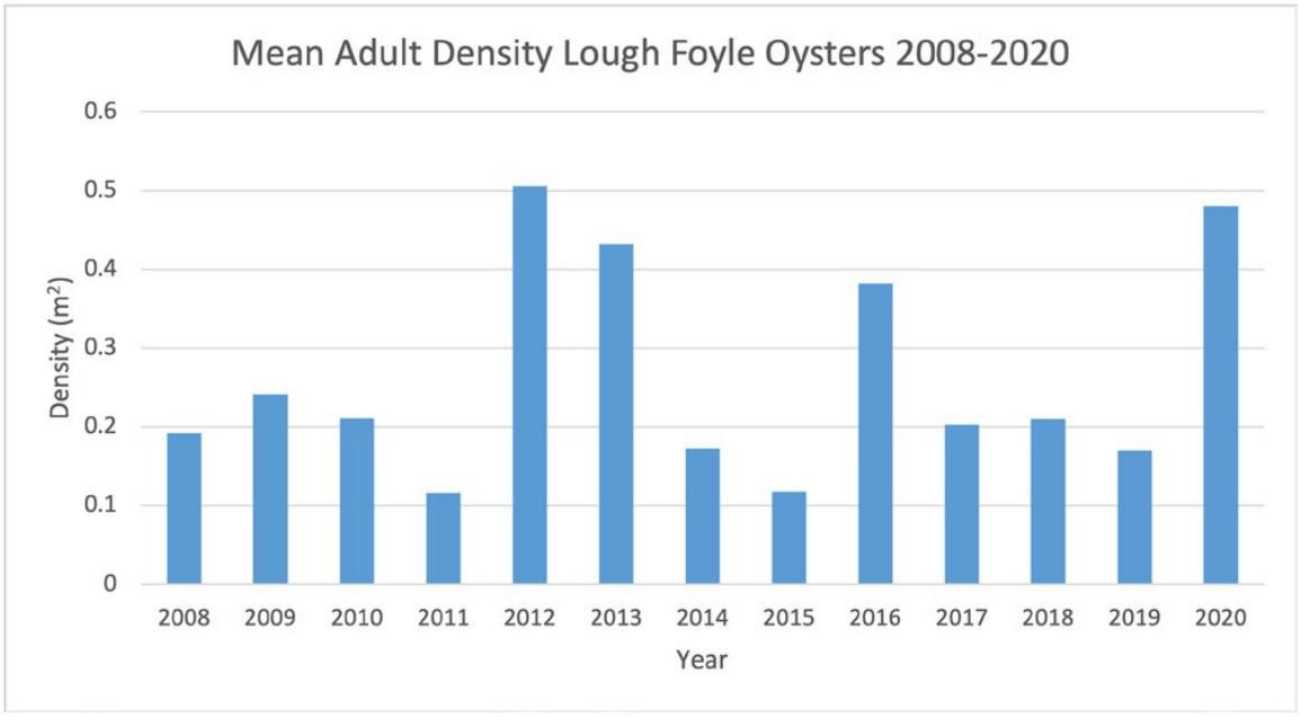

Figure 3-7: Mature native oyster (*Ostrea edulis*) density m^2 in Lough Foyle between 2008-2020 (source: Loughs Agency).

3.2.3 Pacific Oyster

In 2007, there was one significant Pacific oyster farm operating in Lough Foyle, culturing triploid oysters which were either on-grown or supplied directly to a small number of farms within the lough (CEFAS, 2007). In 2007, surveys of native oyster beds found Pacific oysters of unknown origin and of a similar size class throughout the lough (CEFAS, 2007). At that time there were 0.02 km^2 of intertidal Pacific oyster grounds farmed within the lough (CEFAS, 2007). In 2009, monitoring was conducted to assess the location of subtidal and intertidal Pacific oysters (**Figure 3-4**) (Loughs Agency, 2009). Wild Pacific oyster populations were observed at 25 different locations around the lough (Loughs Agency, 2009). Intertidal oyster grounds extend approximately 13 km from Culmore Point northeast to Black Point along the western shoreline (see **Figure 3-2** for locations). Unlicensed Pacific oyster production extends approximately from the border of Co. Derry/Londonderry to Greencastle (SFPA Senior Port Officer. *per comms*). In 2010, fishermen were encouraged to remove Pacific oysters from native oyster beds (Loughs Agency, 2010). In the Loughs Agency (2022) survey, wild Pacific oysters were recorded on one native oyster bed during the survey and densities have reduced since 2012.

4. Hydrography/Hydrodynamics

Given the large expanse of Lough Foyle, the surrounding land type, and numerous influencing rivers, a 20 km buffer distance was used to establish the contributing catchment for this sanitary survey review; 10 km and 5 km buffer zones were included to provide further illustrative reference (**Figure 5-1**). The area within the 20 km boundary line will be hereafter referred to as Lough Foyle contributing catchment/the contributing catchment.

4.1 Tides and Currents

The island of Ireland experiences semi-diurnal tides. In Lough Foyle, this results in tidal motion that moves from east to west with daily inequalities (Charlesworth, 1999). Lough Foyle experiences a small tidal range compared to other sea loughs in Northern Ireland, with a mean spring tidal range of 2.2 m and a mean neap tidal range of one m (Deltares, 2009). Based on the spring tidal range the lough is classified as meso-tidal.

The Londonderry Port and Harbour Commissioners (LPHCs) operate a tidal gauge near Lisahally in the southwest corner of Lough Foyle. A time series of water levels was recorded

from 01-03-2006 to the 30-11-2008 and can be seen in **Figure 4-1** (Deltares, 2009). From the Deltares (2009) Delft3D-FLOW model, validated by data from EGS International Ltd., the tidal surge is amplified as it travels up the lough. There is an increase in the mean tidal range of a few decimetres from the entrance channel (within the North/South Channel) to the southwestern corner of the lough, near Culmore, a distance of 25 km (Deltares, 2009). A phase difference of approximately one hour accompanies the tidal amplification between the north and south corners of the lough (Deltares, 2009). Tidal forcing is the dominant influence on water level variations within the lough, followed by variations in air pressure and wind set-up, and both of which can generate water level variations in the order of a few decimetres.

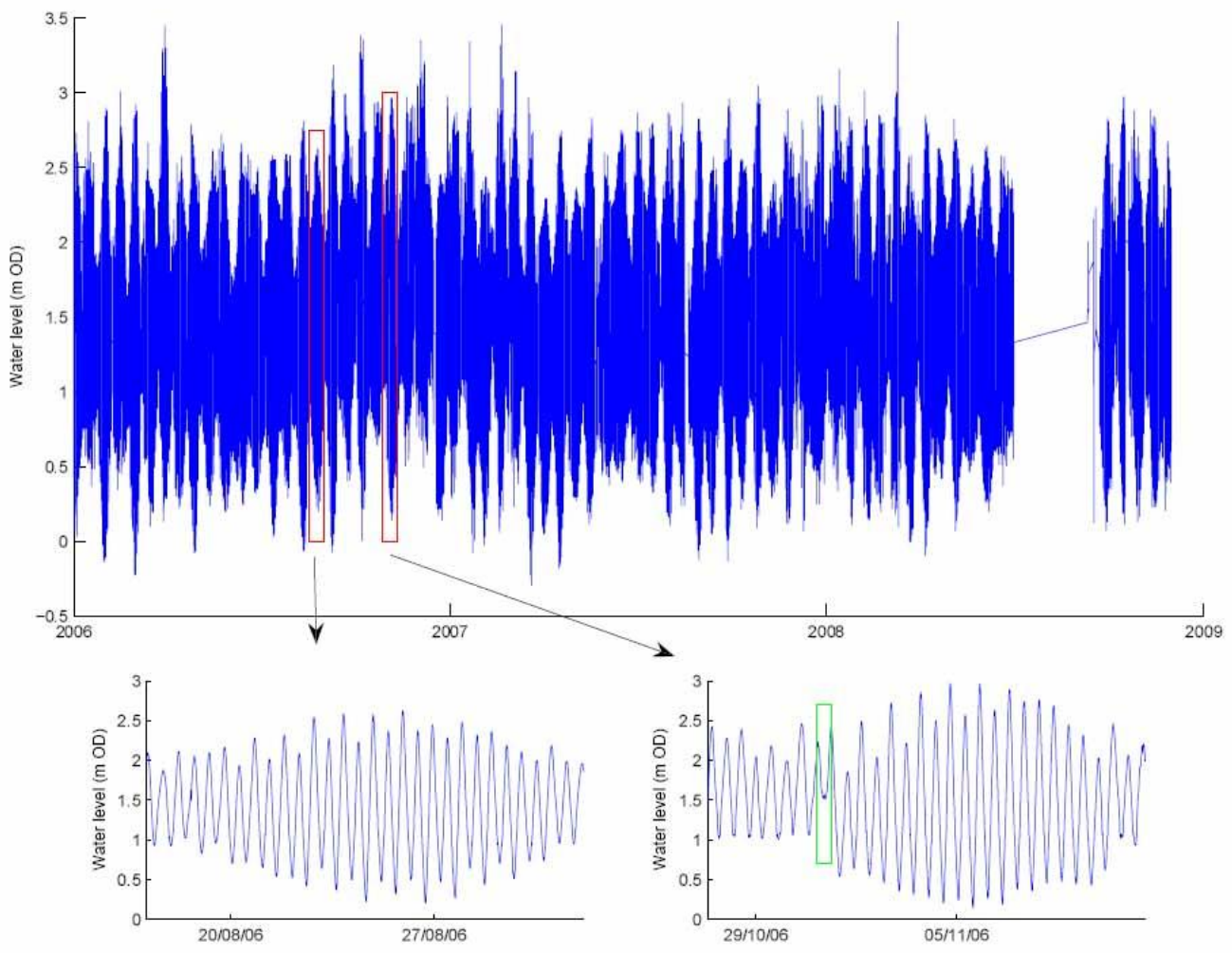

Figure 4-1: Water levels (metres Ordnance datum (OD)) in Lough Foyle from 2006-2008 (source: Deltares, 2009).

The characteristic tidal levels of the Foyle River at Lisahally are detailed in **Table 4-1**. These are sourced from the Admiralty Tide Tables (UKHO, 2006 used in Deltares, 2009) and from tidal analyses carried out by Deltares (2009). Levels are presented in metres above chart datum, which corresponds approximately to the Lowest Astronomical Tide (LAT).

Table 4-1: Foyle River (at Lisahally) tidal characteristics (source: UKHO, 2006 and tidal analyses carried out by Deltares, 2009).

Tidal Level	Admiralty Chart Levels (m Chart Datum)	Derived levels (m Chart Datum)
Highest Astronomical Tide	3.1	2.96
Mean High Water Spring	2.6	2.52
Mean High Water Neap	1.9	1.78
Mean Sea Level	1.4	1.36
Mean Low Water Neap	0.9	0.97
Mean Low Water Spring	0.4	0.23
Lowest Astronomical Tide	0	-0.04
Ordnance Datum Belfast	1.37	-

The current flow in the lough is primarily driven by tidal and riverine influences. Stratified conditions and three-dimensional flow patterns are present due to density differences between the fresh water flowing from rivers and the saline water from the ocean (Deltares, 2009). These factors create complex hydrodynamic patterns leading to considerable spatial variation in current flow occurring throughout the lough (Deltares, 2009).

A 1990 survey conducted by Atkins revealed a complex flow regime with significant spatial variation near the Maintained Commercial Channel (Atkins, 1990). Fragmented current speed data were reported in Atkins (1990) for various survey sites across the lough. Maximum current velocities up to 1.2 m/s were recorded in the East Channel (**Figure 3-2**), with flow reversal observed around slack tides (Atkins, 1990). However, this is contradicted by the Deltares (2009) study, which found the highest velocities in the entrance channel (within North/South Channel).

In addition, EGS International Ltd. collected Acoustic Doppler Current Profiler (ADCP) measurements from Lough Foyle to validate the Delft3D-FLOW model (Deltares, 2009). The outputs from this model show the current speeds and directions during a spring and neap tide (see **Figure 4-2** to **Figure 4-9**).

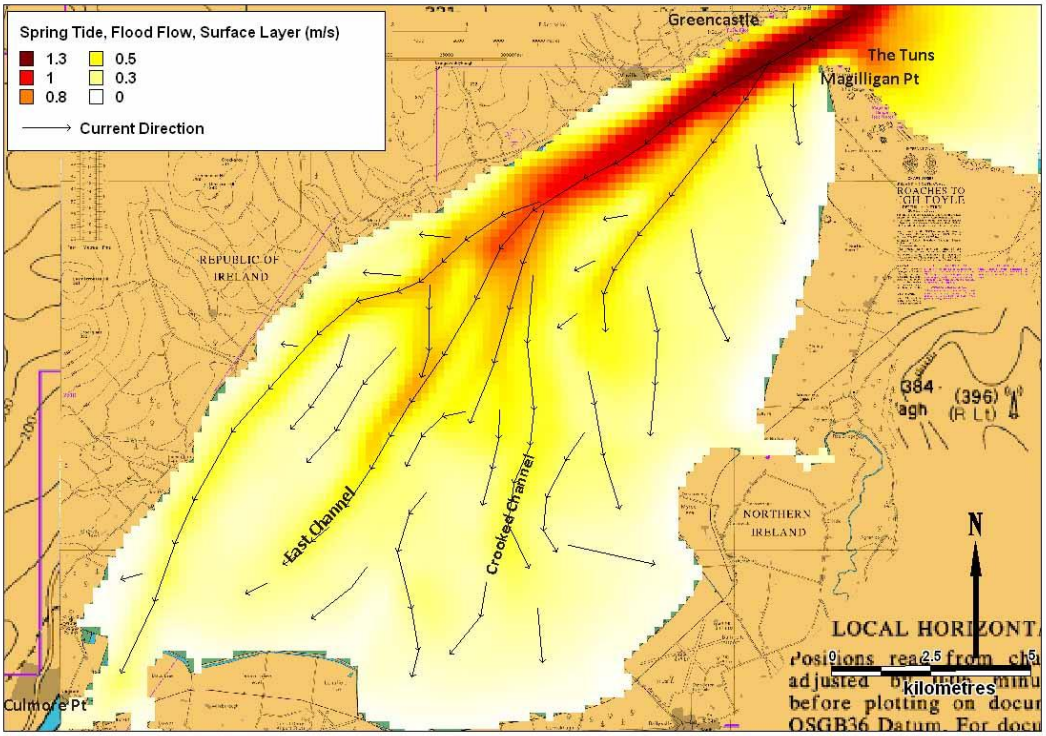

Figure 4-2: Surface layer current velocities (m/s) and direction during a spring tide, flood flow at 16:30:00 November 13th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

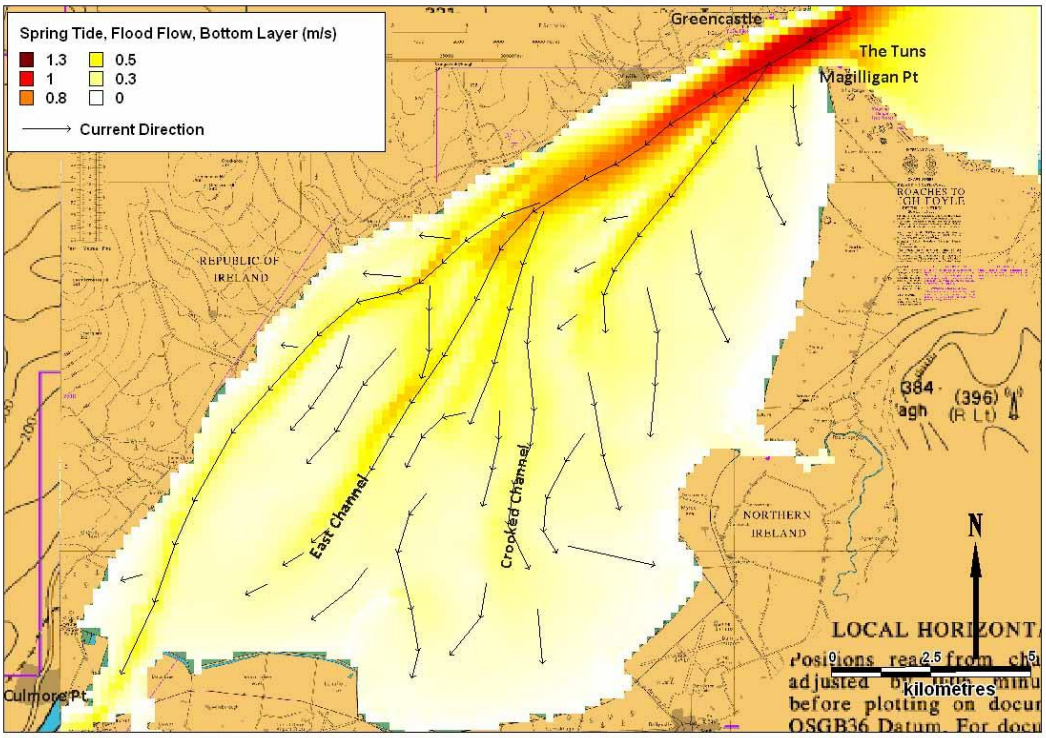

Figure 4-3: Bottom layer current velocities (m/s) and direction during a spring tide, flood flow at 16:30:00 November 13th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

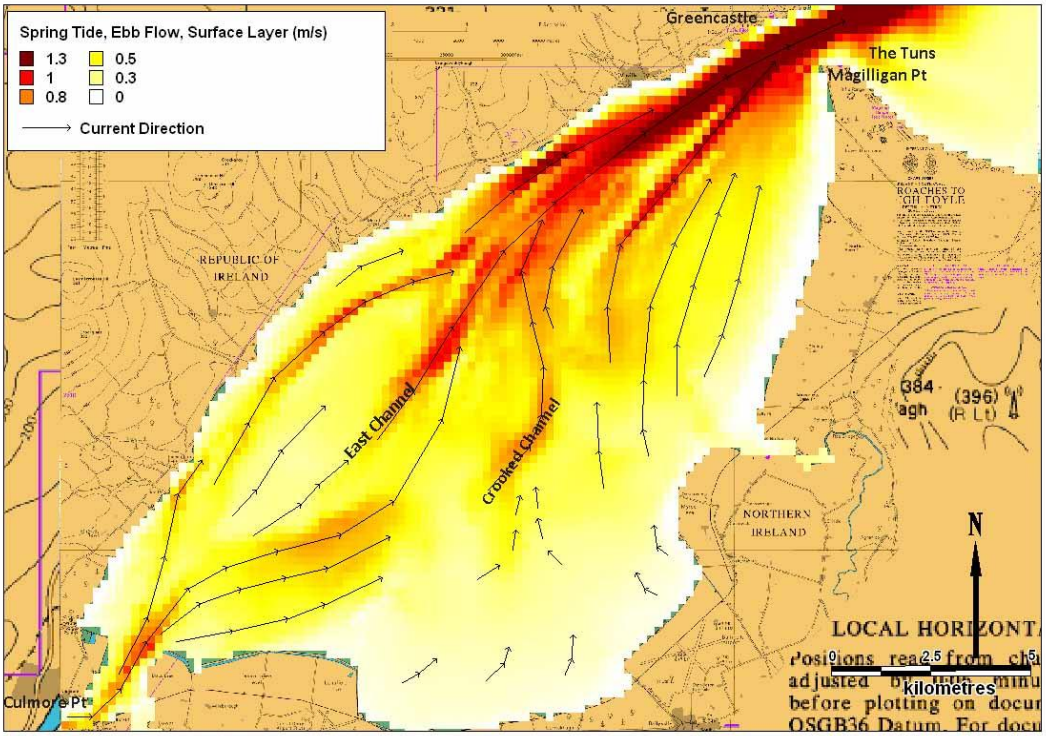

Figure 4-4: Surface layer current velocities (m/s) and direction during a spring tide, ebb flow at 21:30:00 November 13th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

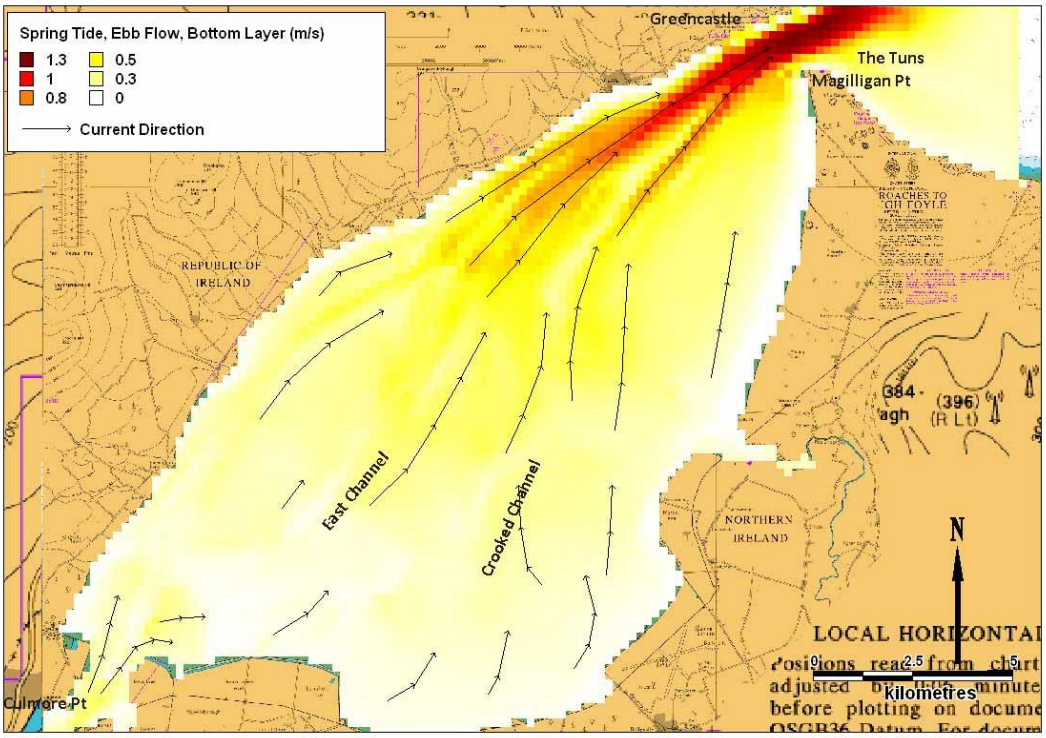

Figure 4-5: Bottom layer current velocities (m/s) and direction during a spring tide, ebb flow at 21:30:00 November 13th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

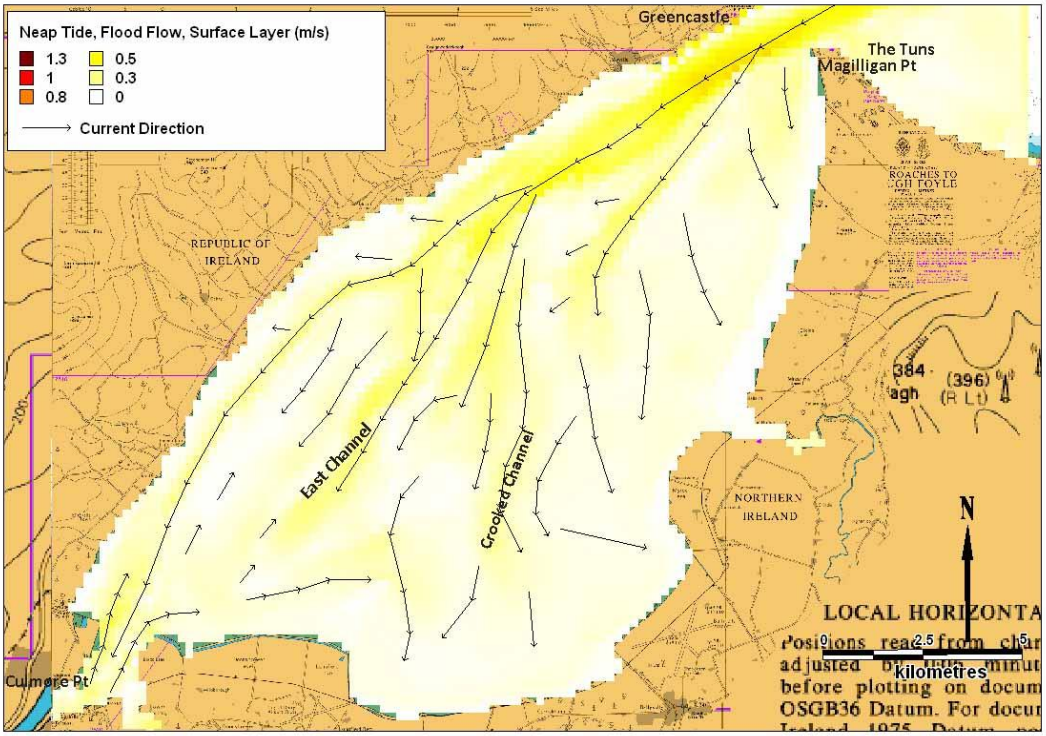

Figure 4-6: Surface layer current velocities (m/s) and direction during a neap tide, flood flow at 10:30:00 November 5th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

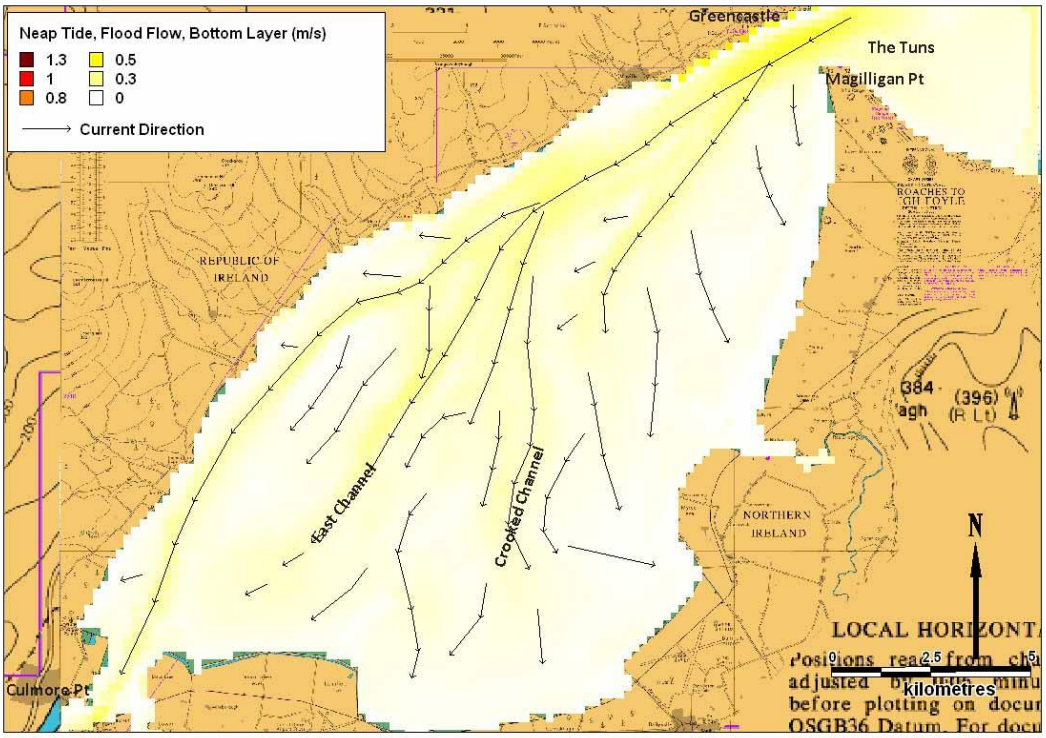

Figure 4-7: Bottom layer current velocities (m/s) and direction during a neap tide, flood flow at 10:30:00 November 5th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

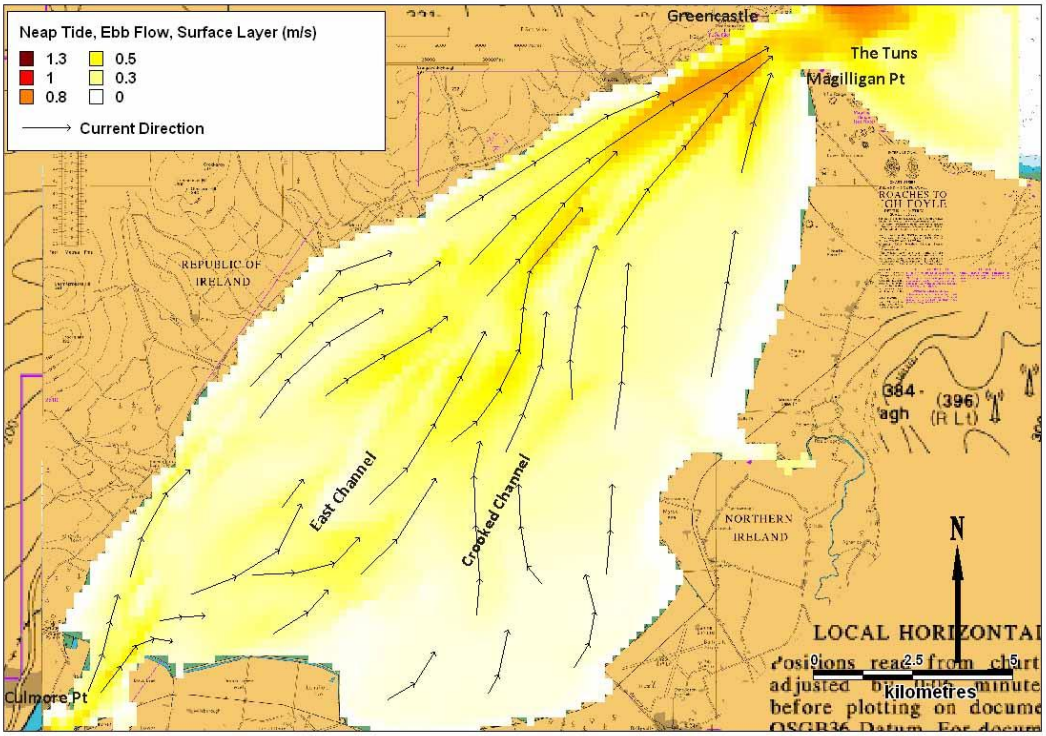

Figure 4-8: Surface layer current velocities (m/s) and direction during a neap tide, ebb flow at 15:30:00 November 5th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

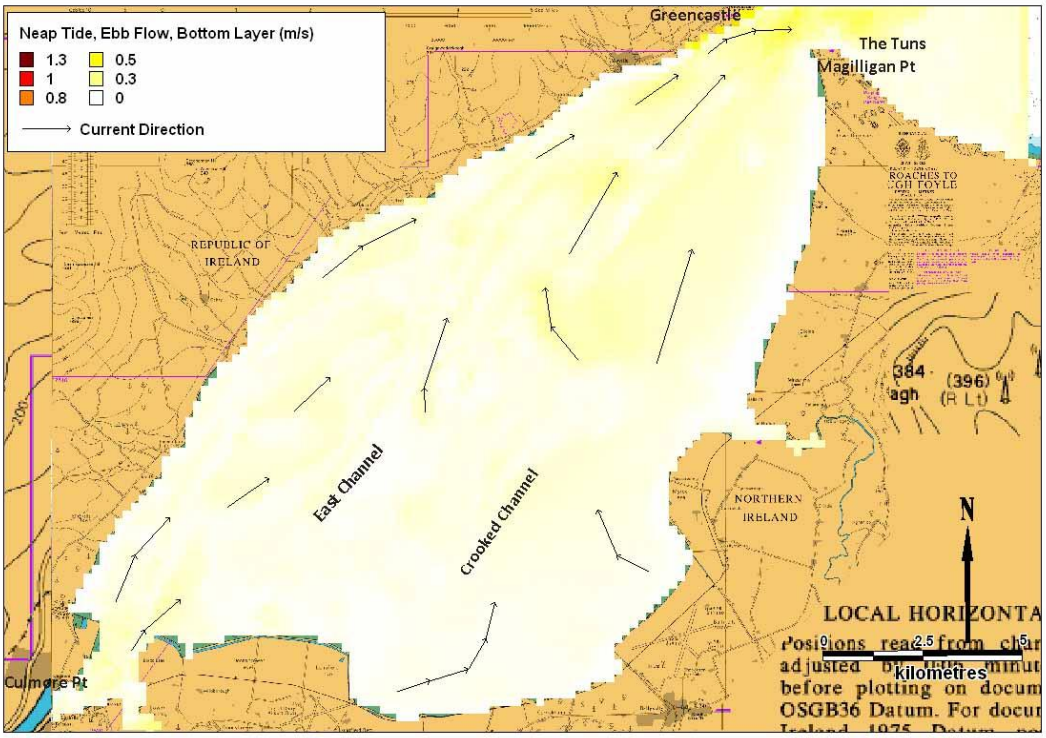

Figure 4-9: Bottom layer current velocities (m/s) and direction during a neap tide, ebb flow at 15:30:00 November 5th, 2008 (source: Deltares Delft3D-FLOW model, 2009).

Tidal currents begin to fill the lough from the southern side of the entrance channel (within the North/South Channel) from low water. During spring tides, the flow is amplified, passing over The Tuns first, a shallow offshore area east of the entrance to Lough Foyle (**Figure 3-2**) (Deltares, 2009). The flow then arrives from the North Channel (**Figure 3-2**) filling the deeper channels before spreading into shallower areas. Maximum flood velocities are recorded between Magilligan Point and Greencastle, particularly in the narrowest and deepest regions of the entrance channel (within North/South Channel) (Deltares, 2009). In contrast velocities over the shallow areas are low in comparison to the deeper tidal channels (Deltares, 2009).

During the tidal flood, water enters the entrance channel (within the North/South Channel) and primarily moves through the tidal channels, particularly the East Channel (**Figure 3-2**), before flooding over the shallower tidal flats in the south and into the Maintained Commercial Channel (Deltares, 2009). Under spring tidal conditions, the river flow is pushed back by the incoming tidal flow, resulting in upstream directed currents in the mouth of the Foyle River (Deltares, 2009). Under neap tidal conditions, the tidal flow is less dominant compared to the river flow. Seaward directed river runoff is evident in the surface layer at the mouth of the Foyle River, however inward directed currents are present in the bottom layer of the water body (Deltares, 2009) (see **Figure 4-6** and **Figure 4-7**).

The ebbing tide is accompanied by the generation of strong currents in the surface layer of the mouth of the Foyle River. Bottom layer velocities are relatively low compared to surface velocities in the river mouth region. This is due to magnification in the return flow of the less dense river discharge in the surface layer which impacts the vertical velocity profile of the water column (Deltares, 2009). On the ebbing tide, the river discharge and tidal emptying of the southwestern regions of the lough occurs predominantly through the East and Crooked Channels (**Figure 3-2**), and generally takes the shortest route to the entrance channel (within North/South Channel) contrary to the flooding tide (Deltares, 2009). Strongest ebb currents are recorded in the entrance channel.

The water current velocity distribution over Lough Foyle shows a clear spring-neap variation and, excluding the river mouth, experiences a reduction in magnitude moving further into the lough (Deltares, 2009). The largest velocities of *c.* 1.9 m/s were recorded in the

entrance channel (within North/South Channel) during spring tides on an ebb flow and maximums were slightly decreased on the flood flow (Deltares, 2009).

Density differences between the large volumes of river runoff and the seawater affect current patterns in the river mouth, with strong ebb flow peaks in the surface layer and strong flood flow peaks in the bottom layer, indicating stratified conditions and the influence of a salt-water wedge (Deltares, 2009). River discharges create differences between the bottom and surface velocities in the Maintained Commercial Channel during ebb flow which are of a greater magnitude compared to flood flow and influenced by depth (Deltares, 2009).

The opposing river flow causes a reduction in velocity in the surface layer during the flooding tide which is reinforced during the ebbing tide resulting in the increased velocities observed (Deltares, 2009). Bottom velocities decrease during ebb flow due to the penetrating salt wedge which results in estuarine circulation (due to net inward residual currents). This is more pronounced during the neap tidal cycle (Deltares, 2009).

The estuarine circulation also affects the residual current pattern in Lough Foyle and in turn influences transport and sedimentation patterns. This circulation leads to long term bed load transport, while suspended sediment transport is shaped by inward directed bottom flow and outward directed surface flow (Deltares, 2009).

4.2 Rainfall Data

4.2.1 Rainfall Volume and Time of Year

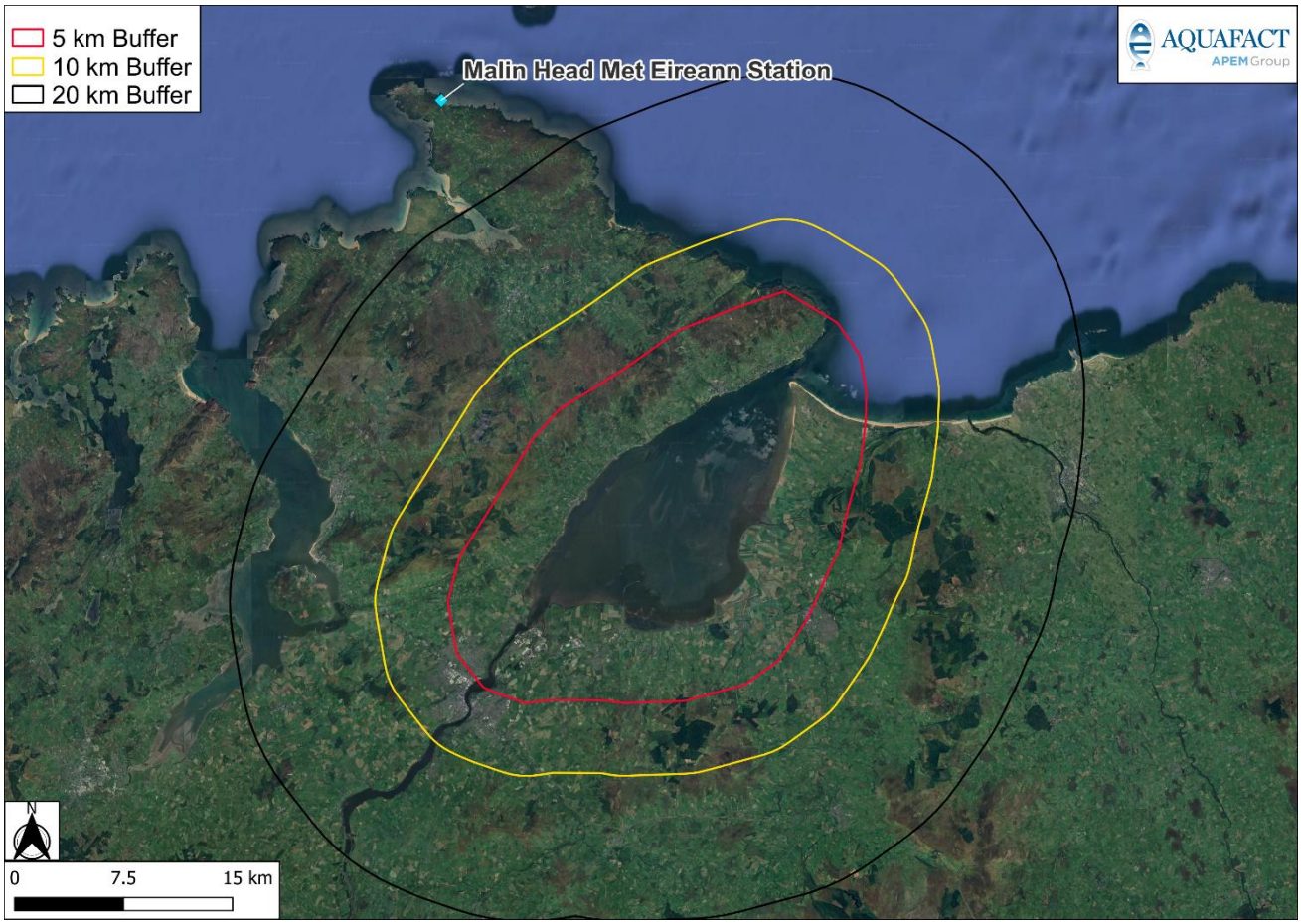

Figure 4-10: Location of Malin Head Met Éireann station in relation to Lough Foyle contributing catchment.

Data from the Malin Head Met Éireann station was used to investigate precipitation over a 30-year period (**Figure 4-10**). For the period 1981 to 2010, average rainfall at the station (**Table 4-2**) ranged from 9.9 mm (February) to 250.4 mm (October). The lowest median value was 52.9 mm in May and the highest median value was 113 mm in January. During the period 1993 to 2023 (**Table 4-4**), the average rainfall at Malin Head Met Éireann station ranged from 13.3 mm (August) to 272.9 mm (December). The lowest median value was 61.6 mm in April and the highest median value was 121.1 mm in December.

Table 4-3 shows the mean seasonal rainfall for 1981-2010. Over this 30-year period, spring had the lowest rainfall (212.6 mm), and autumn had the highest (326.2 mm). **Table 4-5** shows the total seasonal rainfall values over the period 1993 to 2023. Seasonally over the

30-year period, spring was the driest season (213.7 mm), and winter was the wettest (361.3 mm).

Figure 4-11 illustrates average annual rainfall data for Northern Ireland and the UK (Met Office) over the 30-year period 1991 to 2020. High levels of precipitation are evident over the 30-year periods.

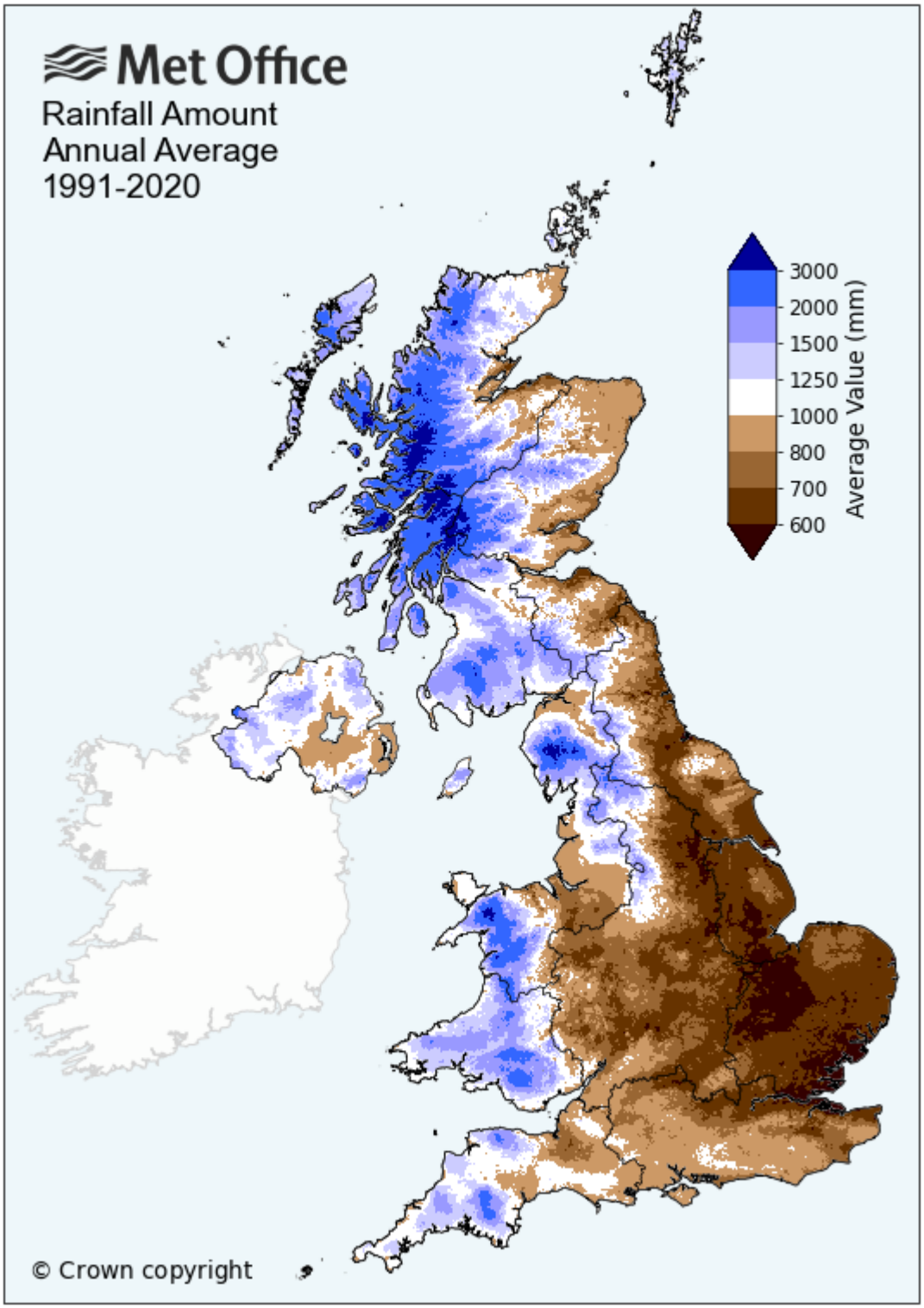

Figure 4-11: Average annual rainfall (mm) from 1991 to 2020 for Northern Ireland and the UK (source: Met Office, 2024).

Table 4-2: Monthly rainfall range (mm) and median monthly rainfall (mm) data from Malin Head Met Éireann station from 1981 to 2010 (source: Met Éireann, 2024).

Month	Range (mm)	Median (mm)
January	22.2 - 188.8	113
February	9.9 - 200.2	80.85
March	18.9 - 151.3	84.6
April	22.9 - 124.5	69
May	15.1 - 115.5	52.9
June	24.7 - 115.8	66.3
July	16.5 - 152.3	75.65
August	13.3 - 180.8	83
September	29.3 - 218.9	87
October	30.4 - 250.4	111
November	28.1 - 227.6	103.35
December	46.1 - 245	111.4

Table 4-3: Mean seasonal rainfall values (mm) from Malin Head Met Éireann station based on daily precipitation over the 30-year period from 1981 to 2010 (source: Met Éireann, 2024).

Season	Rainfall (mm)
Autumn	326.2
Spring	212.6
Summer	245.9
Winter	323.8

Table 4-4: Monthly rainfall (mm) range and median monthly rainfall (mm) data from Malin Head Met Éireann station from 1993 to 2023 (source: Met Éireann, 2024).

Month	Range (mm)	Median (mm)
January	22.2 - 203.7	112.5
February	33.5 - 210.4	86.5
March	18.9 - 151.3	72.7
April	20.1 - 124.5	61.6
May	15.1 - 137	72.6
June	24.7 - 141.1	69.3
July	24.3 - 192.6	76.2
August	13.3 - 117.4	89.9
September	23 - 176	93.2
October	37.6 - 190.9	110
November	91.6 - 227.6	110.6
December	46.1 - 272.9	121.1

Table 4-5: Mean seasonal rainfall values (mm) from Malin Head Met Éireann station based on daily precipitation over the 30-year period from 1993 to 2023 (source: Met Éireann, 2024).

Season	Rainfall (mm)
Winter	361.3
Spring	213.7
Summer	263.1
Autumn	337.7

Precipitation was assessed for five-year periods at Malin Head Met Éireann station. **Table 4-6** shows these average monthly rainfall (mm) data at Malin Head Met Éireann station from 2014 to 2018, and **Table 4-8** shows the total seasonal rainfall (mm) over the same time period. Malin Head Met Éireann station is located approximately 30 km northwest of Lough Foyle. Total monthly precipitation ranged from 23 mm in September 2014 to 272.1 mm in December 2015. The following seasonal fluctuations were observed from 2014 to 2018: in 2014, 2016, and 2018 spring was the driest season and winter was the wettest; in 2015,

summer was the driest season and winter was the wettest; in 2017, spring was the driest season and summer was the wettest. Over the five years, spring was the driest and winter was the wettest. **Table 4-7** shows the average monthly rainfall (mm) data at Malin Head Met Éireann station from 2019 to 2023, and **Table 4-9** shows the total seasonal rainfall (mm) over the same time period. Monthly precipitation ranged from 20.1 mm in April 2020 to 214.2 mm in December 2023. The following seasonal fluctuations were observed from 2019 to 2023: in 2019, winter was the driest season and summer was the wettest; in 2020 and 2023, spring was the driest season and winter was the wettest; in 2021 and 2022, summer was the driest season and winter was the wettest. Over the five-year period (2019 to 2023), spring was the driest season and winter was the wettest. There was a high volume of precipitation in 2019, with August having the highest monthly rainfall that annum (162.9 mm).

Table 4-6: Average monthly rainfall (mm) and total annual rainfall (mm) data at Malin Head Met Éireann station, Co. Donegal from 2014 to 2018 (source: Met Éireann, 2024).

Month/Year	2014 (mm)	2015 (mm)	2016 (mm)	2017 (mm)	2018 (mm)	Monthly Total (mm)	Monthly Average (mm)
January	159.9	176.0	167.1	56.7	205.0	**764.7**	**152.9**
February	191.6	85.6	127.7	85.0	74.2	**564.1**	**112.8**
March	71.9	123.3	75.7	97.0	67.2	**435.1**	**87.0**
April	33.5	64.7	52.5	41.1	63.4	**255.2**	**51.0**
May	87.0	137.0	66.0	50.9	41.5	**382.4**	**76.5**
June	48.6	56.1	72.1	77.7	51.1	**305.6**	**61.1**
July	86.0	132.7	110.2	114.6	60.3	**503.8**	**100.8**
August	95.5	111.0	89.9	172.5	125.8	**594.7**	**118.9**
September	23.0	29.7	94.7	88.2	108.5	**344.1**	**68.8**
October	131.4	71.8	37.6	109.9	106.0	**456.7**	**91.3**
November	134.4	222.9	113.9	137.5	100.8	**709.5**	**141.9**
December	150.5	272.1	76.0	115.7	97.7	**712.0**	**142.4**
Annual Total (mm)	**1213.3**	**1482.9**	**1083.4**	**1146.8**	**1101.5**		
Annual Average (mm)	**101.1**	**123.6**	**90.3**	**95.6**	**91.8**		

Table 4-7: Average monthly rainfall (mm) and total annual rainfall (mm) data at Malin Head Met Éireann station, Co. Donegal from 2019 to 2023 (source: Met Éireann, 2024).

Month/Year	2019 (mm)	2020 (mm)	2021 (mm)	2022 (mm)	2023 (mm)	Monthly Total (mm)	Monthly Average (mm)
January	81.5	79.3	126.9	93.1	109.2	**490**	**98**
February	59.7	210.4	96.1	177.3	55.6	**599.1**	**119.82**
March	138.8	79.4	90.7	23.3	99.1	**431.3**	**86.26**
April	49.9	20.1	31.6	84.2	68	**253.8**	**50.76**
May	79.9	37.3	99.3	74.8	48.2	**339.5**	**67.9**
June	67.3	106.3	49	66.4	66.8	**355.8**	**71.16**
July	85.9	133.8	52	66.3	192.6	**530.6**	**106.12**
August	162.9	123.1	69.1	44.1	117.4	**516.6**	**103.32**
September	124.5	115.7	68.3	98.2	103.3	**510**	**102**
October	82.6	148.4	156.2	162.1	114.6	**663.9**	**132.78**
November	91.7	130	95.4	110.6	129.2	**556.9**	**111.38**
December	124.2	144.3	115.2	109.1	214.2	**707**	**141.4**
Annual Total (mm)	**1148.9**	**1328.1**	**1049.8**	**1109.5**	**1318.2**		
Annual Average (mm)	**95.74**	**110.68**	**87.48**	**92.46**	**109.85**		

Table 4-8: Total seasonal rainfall (mm) at Malin Head Met Éireann station, Co. Donegal from 2014 to 2018 (source: Met Éireann, 2024).

Season/Year	2014 (mm)	2015 (mm)	2016 (mm)	2017 (mm)	2018 (mm)
Autumn	288.8	324.4	246.2	335.6	315.3
Spring	192.4	325	194.2	189	172.1
Summer	230.1	299.8	272.2	364.8	237.2
Winter	502	533.7	370.8	257.4	376.9

Table 4-9: Total seasonal rainfall (mm) at Malin Head Met Éireann station, Co. Donegal from 2019 to 2023 (source: Met Éireann, 2024).

Season/Year	2019 (mm)	2020 (mm)	2021 (mm)	2022 (mm)	2023 (mm)
Autumn	298.8	394.1	319.9	370.9	347.1
Spring	268.6	136.8	221.6	182.3	215.3
Summer	316.1	363.2	170.1	176.8	376.8
Winter	265.4	434	338.2	379.5	379

4.2.2 Frequency of Significant Rainfalls

Met Éireann has developed a depth-duration frequency model to estimate point rainfall frequencies (Fitzgerald, 2007; Mateus & Coonan, 2023). For a one in 100-year return period, 31.6 mm of rain would be expected over a one-hour period and 83.5 mm over a 24-hour period (based on Irish National Grid coordinates 250750 E 432976 W). While these would be extremely uncommon events, the model predicts that once a year, 10.4 mm of rain would fall in one hour and 35.2 mm over a 24-hour period. Data from the Malin Head Met Éireann station shows that over the 30-year period from 1993 to 2023, there have been nine 24-hour periods within which more than 35.2 mm of rain fell. For this same period, December had the highest daily rainfall with 80.6 mm. Over the five-year period 2019-2023, data from Malin Head Met Éireann station show there has been one 24-hour period in which more than 35.2 mm of rain fell. For this same period, August had the greatest daily rainfall (37 mm).

Increased faecal contamination in coastal waters is typically associated with high rainfall and storm events through surface water run-off from livestock or other animals present, and through sewer and wastewater treatment plant overflows (Mallin *et al.*, 2001; Lee & Morgan, 2003). It is therefore expected that run-off due to rainfall will be higher during the October to January period. However, as can be seen from these rainfall data in **Table 4-10**, heavy rainfall events leading to episodes of increased run-off can occur in most months of the year and, therefore, it is not just the winter months that are at risk of increased faecal contamination. When these out of season heavy rainfall events occur during generally drier periods in spring and summer months, they are likely to carry higher loadings of faecal material which has accumulated on pastures where greater numbers of livestock are present.

Table 4-10: Rainfall events greater than 35.2 mm within a 24-hour period over 30 years, recorded at the Malin Head Met Éireann station (source: Met Éireann, 2024).

Date	Rainfall (mm)
24-Oct-95	47.5
05-Aug-96	37.5
16-Nov-09	38.1
30-Mar-10	35.7
06-Sep-10	37.3
22-Jun-12	50.9
05-Dec-15	80.6
22-Aug-17	77.2
04-Aug-20	37.0

4.3 Wind and Waves

Wind data for Malin Head Met Éireann station (**Figure 4-10**) from 2005 to 2009 are displayed in **Table 4-11** and wind roses for each five-year period can be seen in **Figure 4-12**. In 2005, 25% of the wind came from the south-southwest, while 16.7% came from the north, east-southeast, and the south. Wind speed is measured in knots (kn) and strongest winds came from the south-southwest (16-21 kn). In 2006, 25% of the wind came from the south while 16.7% each came from the north, west, west-southwest, and south-southwest. The strongest winds in 2006 came from the south, north and west (16-21 kn). In 2007, 25% of the wind came from the south while 16.7% each came from the north-northwest and southwest. The strongest winds in 2007 were from the southwest (>21 kn). In 2008, 25% of the winds came from both the north and west-southwest. The strongest winds in 2008 came from the north, northwest and west-southwest (16-21 kn). In 2009, 20% of the wind came from each of the following directions: east-northeast, southwest, and west-southwest. The strongest winds in 2009 came from the southeast.

Table 4-13 shows the seasonal averages from 2005 to 2009. Seasonal averages over the past five years indicate that winds are typically stronger in the winter months, decreasing by approximately two kn in the spring and by a further 3.5 kn in the summer, and then increasing by approximately 3 kn in autumn.

Wind data for Malin Head Met Éireann station from 2016 to 2020 is displayed in **Table 4-12** below and wind roses for each year can be seen in **Figure 4-12**. In 2016, 25% of the wind came from the south; while 25% came from the south-southeast, 16.67% came from the southwest and 33% came from the south-southwest. The strongest winds came from the south-southwest (18.3 kn). In 2017, 33% of the wind came from the south-southwest, 35% came from the south-southeast, 25% came from the southwest, and 8% came from both the west and west-southwest. The strongest winds in 2017 came from the south-southeast (17.6 kn). In 2018, 33% of the wind came from the southwest, 16.67% came from both the south-southeast and southeast, and 8% came from both the south and west-southwest. The strongest winds in 2018 were from the southwest (18.4 kn). In 2019, 33.3% of the winds came from the southwest, 25% from the south, 16.67% from south-southwest, 16.67% from the southeast and 8% from the east. The strongest winds in 2019 came from the south-southwest (18.42 kn). In 2020 41.6% of the wind came from the southwest, 16.67% came from the south-southwest, 25% came from the south-southeast, 8% from the south and southwest, respectively. The strongest winds in 2020 came from the southwest (22.3 kn).

Table 4-14 shows the seasonal wind strength (kn) averages from 2016 to 2020. Seasonal averages over this five-year period indicate that winds are typically stronger in the winter months, decreasing by approximately 2 kn in the spring, further decreasing by approximately 3 kn in the summer, and increasing by approximately 5 kn in autumn. This data does not differ much from 2005-2009 data with similar seasonal averages reported for both sets of data.

Table 4-11: Wind speed (kn) and direction (°) for Malin Head Met Éireann station from 2005-2009 (source: Met Éireann, 2024).

	2005		2006		2007		2008		2009	
Month	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**
January	20.7	200	15.7	200	21.5	230	18.4	250	16.5	140
February	15.8	340	16.6	360	15.8	190	18.7	350	14.4	60
March	14.1	360	16.1	170	17.9	350	20.4	320	16	360
April	14.4	210	14.9	10	11.4	310	17.3	10	12.1	70
May	11	110	16.3	190	13.8	220	13.1	130	14.8	230
June	8.5	230	11.6	250	11.8	90	14.5	240	10.7	250
July	8.6	210	10.5	210	10.2	180	14.2	170	10.8	100
August	9.9	170	13.3	300	12.7	340	12.8	110	12.3	230
September	13	190	13	180	13.5	340	12.3	50	12.8	170
October	13.2	110	15.2	250	13	180	19.2	10	12.1	250
November	15.8	350	19.3	260	17.2	50	17.4	330	n/a	n/a
December	13.7	150	17.5	280	16.5	150	15.6	250	n/a	n/a

Table 4-12: Wind speed (kn) and direction (°) data for Malin Head Met Éireann station from 2016 to 2020 (source: Met Éireann, 2024).

	2016		2017		2018		2019		2020	
Month	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**	**Mean Speed (kn)**	**Max 10-min Mean Dir (°)**
January	18.3	194.51	16.5	201.93	18.4	210.32	15.3	220.645	19.1	225.48
February	17.8	217.24	17.6	174.64	17.2	210	15.9	175.35	22.3	230.68
March	13.1	214.19	14	176.77	17.8	149.03	18.4	224.83	16.5	193.87
April	15.2	156	14.4	229.66	14.3	140.66	15.6	125.33	12.4	157.66
May	12.1	159.67	11.3	164.51	11.7	185.48	10.9	183.22	13.2	153.22
June	9.9	176	14.5	204.13	9.2	168.33	12.3	139.33	12.1	206.33
July	12.4	213.54	13	201.93	9.9	218.70	11.4	203.548	13.4	233.22
August	13.3	186.12	13.1	226	13.3	209.35	13.6	215.62	11.5	164.83
September	14.6	185	15	216	16.3	246.33	13.8	215.66	14.2	189
October	13.7	149.66	18	225.16	16.7	227.41	16.3	172.90	17.2	225.80
November	14.9	197.33	16.9	267	17.5	152.66	14.9	98.33	15.6	220
December	16.8	192.90	16.9	252.58	15.8	201.61	17.3	223.87	17.9	208.06

Table 4-13: Seasonal wind speed averages (kn) for Malin Head Met Éireann station wind data from 2005 to 2009 (source: Met Éireann, 2024).

Season	2005 (kn)	2006 (kn)	2007 (kn)	2008 (kn)	2009 (kn)	5-year average (kn)
Winter	16.7	16.6	17.9	17.6	15.5	16.9
Spring	13.2	15.8	14.4	16.9	14.3	14.9
Summer	9	11.8	11.6	13.8	11.3	11.5
Autumn	14	15.8	14.6	16.3	12.5	14.6

Table 4-14: Seasonal wind speed averages (kn) for Malin Head Met Éireann station wind data from 2016 to 2020 (source: Met Éireann, 2024).

Season	2016 (kn)	2017 (kn)	2018 (kn)	2019 (kn)	2020 (kn)	5-year average (kn)
Winter	17.63	17	17.13	16.16	19.76	17.54
Spring	13.46	13.23	14.6	14.96	14.03	14.06
Summer	11.86	13.53	10.8	12.43	12.33	12.19
Autumn	14.4	16.63	16.83	15	15.66	15.7

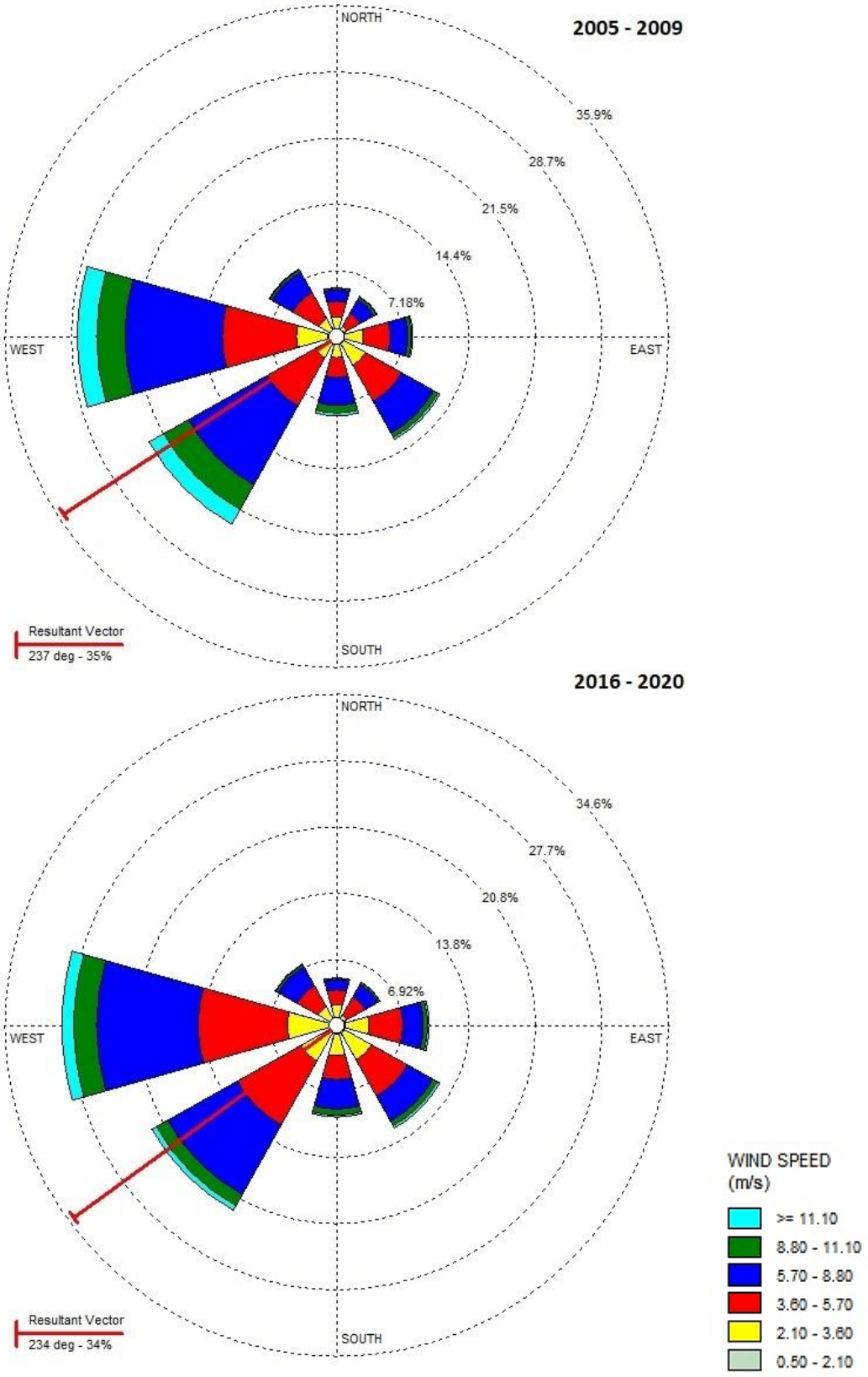

Figure 4-12: Wind roses for Malin Head Met Éireann station from 2005 to 2009 and 2016 to 2020 (source: Met Éireann, 2024).

In shallow environments, wind speed and direction plays a key role in sediment resuspension and transport through the generation of currents and waves, which ultimately affect hydrodynamic conditions in coastal environments (Jalil *et al*., 2019). In Lough Foyle, wind-induced waves are important in sediment resuspension, and this is heightened over the vast shallow areas of the lough. The impact of wind-induced bottom friction may lead to sediment resuspension and entrainment within the water column (Deltares, 2009). There is a critical threshold after which erosion and resuspension processes occur, and even small wind-induced waves (< 30 cm) may exceed this threshold and result in the resuspension of fine material in shallow regions resulting from shear stress on the bottom (Atkins, 1992).

In addition to the wind data from Met Éireann, wind data recorded at the port of Lisahally between January 2006 and November 2008 was also used to analyse local wind conditions, however, there were data missing from December 2006, August to September 2008, and December 2008 which may skew interpretation (Deltares, 2009). Monthly median wind speeds varied between six and eight m/s with a mean monthly average of seven m/s. Low wind speeds in summer months experienced a minor increase in winter and indicated a minute seasonal effect; this effect was not reflected in the mean wind direction (Deltares, 2009). Mean monthly wind direction corresponds to the approximate orientation of Lough Foyle at 240ºN west-southwest, however a strong divergence from this value occurred in May (150º N south-southeast) (Deltares, 2009). Wind direction was found to be more variable in spring and summer compared to winter and autumn (Deltares, 2009). The presence of hills along the coast of the lough results in a tunnelling effect leading to uniformity in wind direction over the water that may cause wind-induced advection of potentially contaminated surface waters from the southwestern corner of the lough to the entrance channel (within North/South Channel) (Deltares, 2009).

Deltares (2009), through consultation with the relevant port authorities, found no significant offshore wave penetration into Lough Foyle beyond Greencastle. Offshore wave energy is predicted to dissipate on a shallow area east of the entrance of Lough Foyle known as “The Tuns”. This is a shallow bank which disrupts waves before they reach the narrow entrance channel (within North/South Channel) (Deltares, 2009). As such, local wind-induced waves are the strongest force determining wave climate conditions in the lough (Deltares, 2009).

Figure 4-13 shows wave heights (m), peak period, and near-bed orbital velocity at mean sea level. This was produced by Deltares using the wave model SWAN (Booij *et al*., 1999). The longest fetch length and highest waves occur on the northeastern shore of the lough as a result of the prevailing wind direction corresponding to the orientation of the lough (*i.e.*, parallel to the dominant axis). At the downwind shore, maximum computed wave height was *c.* 0.3 m and maximum wave period was two seconds. Wave heights are influenced by depth and shallow areas result in reduced wave heights with deeper channels characteristic of the highest and longest waves (Deltares, 2009). Despite greater wave heights in deeper regions of the lough, the largest near-bed velocities and subsequent bed shear stresses occurred in shallow regions (see panel **c** in **Figure 4-13**) indicating that increased sediment resuspension as a function of wave action occurs predominantly in shallow areas (Deltares, 2009).

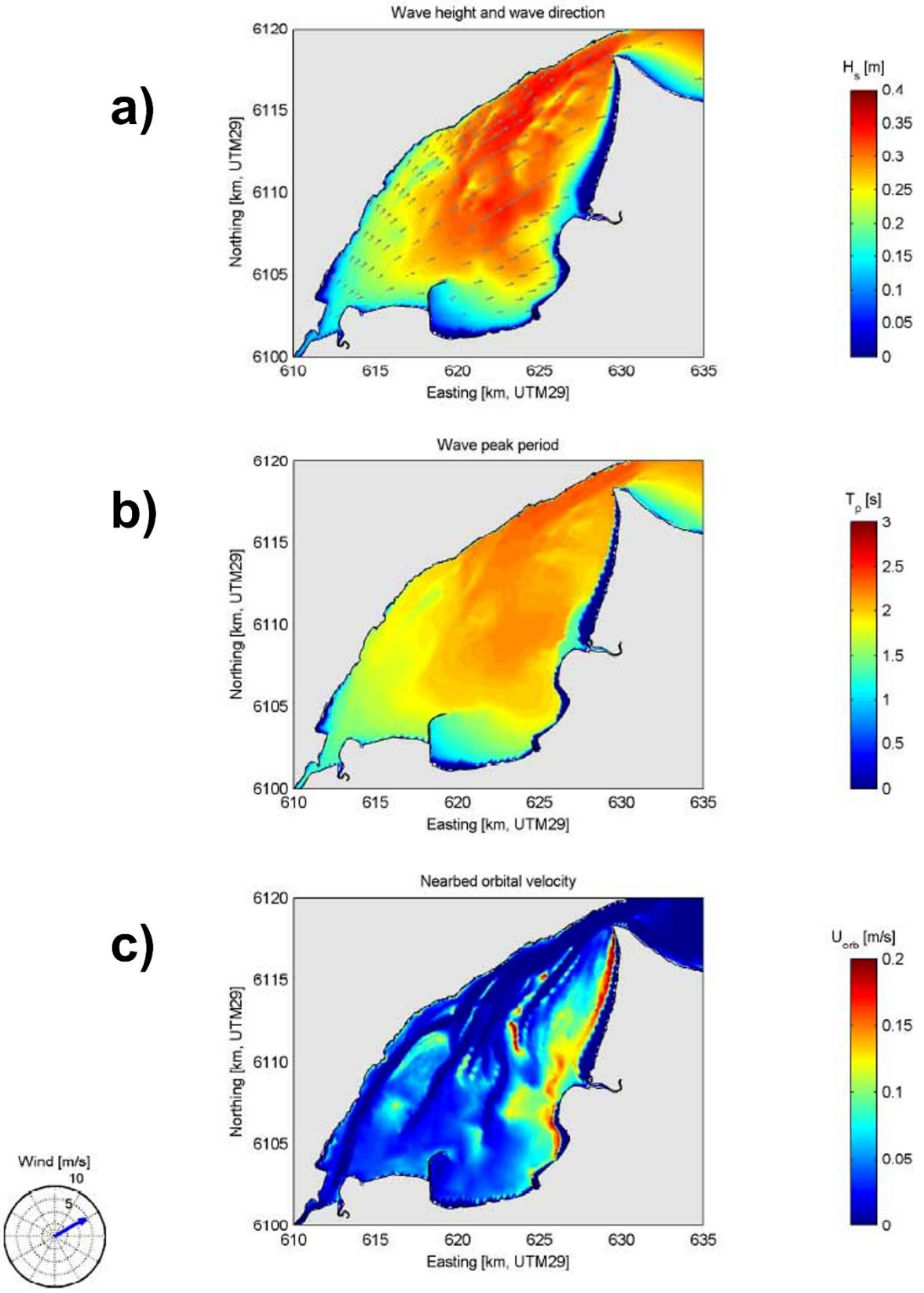

Figure 4-13: Computed wave height (m) (a), peak period (s) (b), and near-bed orbital velocity (c) for wind speed of seven m/s and a wind direction of 240 west-southwest (source: Deltares, 2009).

4.4 River Discharges

Lough Foyle receives significant freshwater input from the Rivers Foyle, Faughan, and Roe (AFBI, 2015). There are three permanent measuring stations managed by the Rivers Agency monitoring these rivers (**Figure 4-14**). Due to the lack of operational measurement data for the Foyle River, a measurement station on the Mourne River, a tributary of Foyle, was used to represent variations in river discharge for the Foyle River (Deltares, 2009). Based on 15-minute interval records from the three stations, strong annual variation in fluvial flow was observed, with peaks in discharge following large rainfall events (Deltares, 2009). The discharge data for the Mourne River (representative of the Foyle River) is shown in **Figure 4-16** for the period 2006-2008. The Mourne River exhibits significant seasonal fluctuations, with the highest discharges typically occurring in late summer and autumn (Deltares, 2009). Average monthly values ranged from 10 to 75 m^3/s (Deltares, 2009). A peak discharge of 1,058 m^3/s, recorded in 1987, was surpassed on 23rd August 2017, when the flow reached 1,145 m^3/s (NRFA, 2023).

Characteristic discharge values have been derived from the three aforementioned rivers, as shown in **Table 4-15**. The Mourne River has the highest average discharge (59.5 m^3/s), making it the largest recorded flow in Northern Ireland (NRFA, 2023). In contrast, the Roe River and the Faughan River have significantly lower average discharges, at 8 m^3/s and 7 m^3/s, respectively (AFBI, 2015). Although precise, permanent discharge records for the Foyle River were unavailable at the time of writing, a mean discharge of 90 m^3/s has been reported (AFBI, 2015).

Tidal influence upriver, vertical current profiles near the river mouth, and the distance the salt wedge penetrates upriver are determined by river discharge levels. The higher salinity incoming tidal waters will penetrate further during periods of low river flows compared to periods of high river flow (Deltares, 2009)

Discharge data from the Mourne River during 2009-2015 shows strong seasonal patterns in river flow, with the largest discharges in late summer and autumn (**Figure 4-17**). Average monthly values over the same period ranged from 6.3 to 205.15 m^3/s (NRFA, 2023). The peak average monthly recorded discharge reached 205.15 m^3/s in November 2009. The peak discharge was 802.8 m^3/s in December 2015 (NRFA, 2023).

Discharge data for the Mourne River during 2016-2022 also shows strong seasonal patterns, with increased discharges in late summer and autumn, similar to those recorded from 2009-2015. The average monthly values range from 10.33 to 215.77 m^3/s, which are comparable to those reported for the period 2009-2015. The peak monthly average recorded discharge of 215.77 m^3/s was reported in February 2020 and the peak discharge for this period was 580.9 m^3/s in February 2022 (NRFA, 2023).

In accordance with European Communities (Water Policy) (Amendment) Regulations 2022 (S.I. 166/2022) and by The Water (Amendment) (Northern Ireland) (EU Exit) Regulations 2019, water bodies must be monitored with the purpose of achieving or maintaining good status or better. Data from the 2016-2021 Water Framework Directive (WFD) status for RoI and data from 2018 WFD 2nd Cycle Interim Status for Northern Ireland have been used in this report (EPA Geoportal; Open Data Northern Ireland). Water quality within Lough Foyle contributing catchment is variable (**Figure 4-15**). Within the western portion of the contributing catchment, there is a large proportion of Poor status river sub-basins, and there is only one sub-basin of High ecological status. In the eastern portion of the contributing catchment, river sub-basin status ranges from Moderate to Good however there were several water bodies of unknown status along the shoreline of Lough Foyle. The Foyle River is of Moderate ecological status.

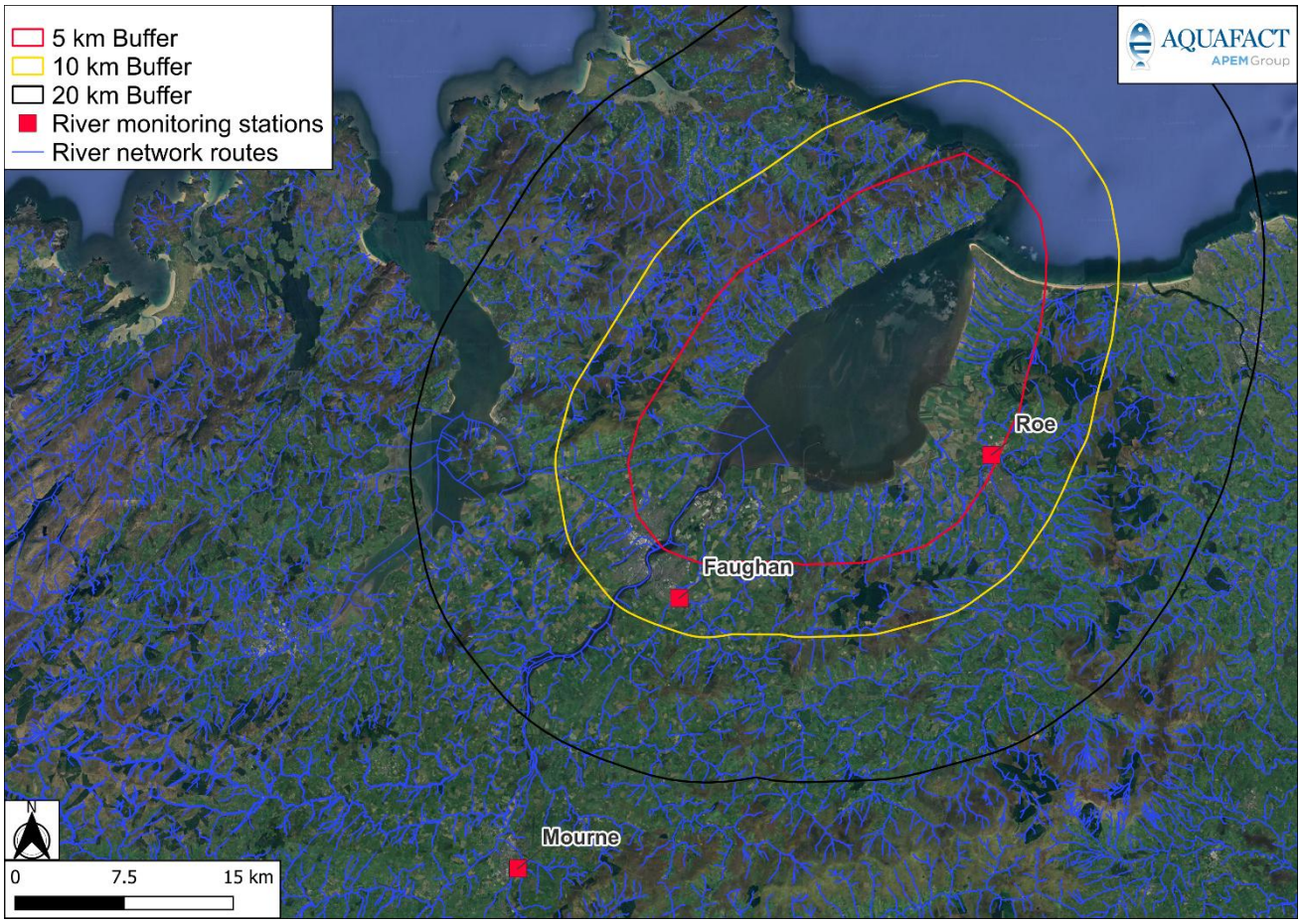

Figure 4-14: Rivers and riverine monitoring stations in the Lough Foyle area (source: NRFA, 2023).

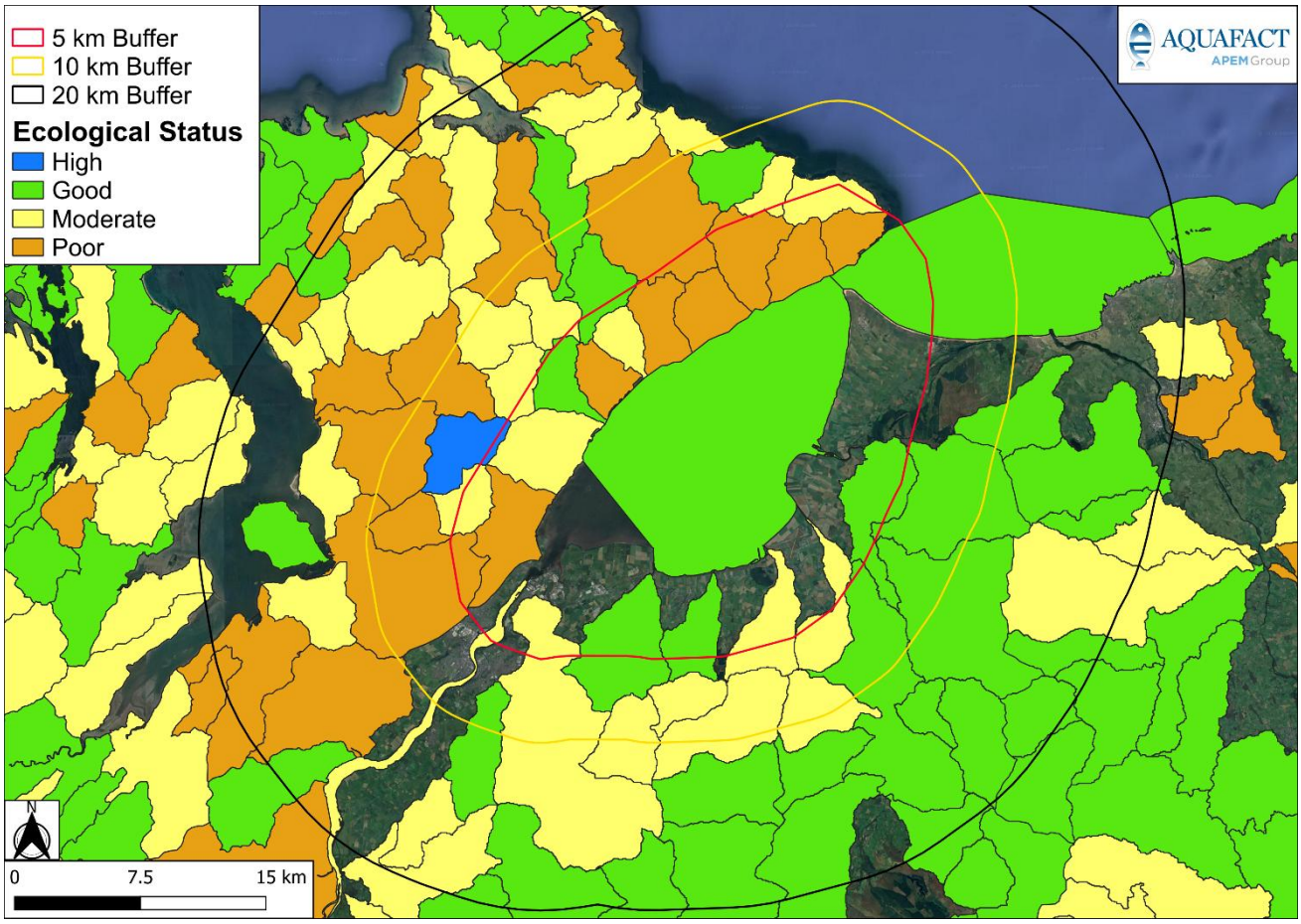

Figure 4-15: Ecological status for river sub-basins in Lough Foyle and surrounding areas. (Republic of Ireland data source: EPA Geoportal for 2016-2021 WFD monitoring period; Northern Ireland data source: Open Data Northern Ireland for WFD 2nd Cycle Interim Status).

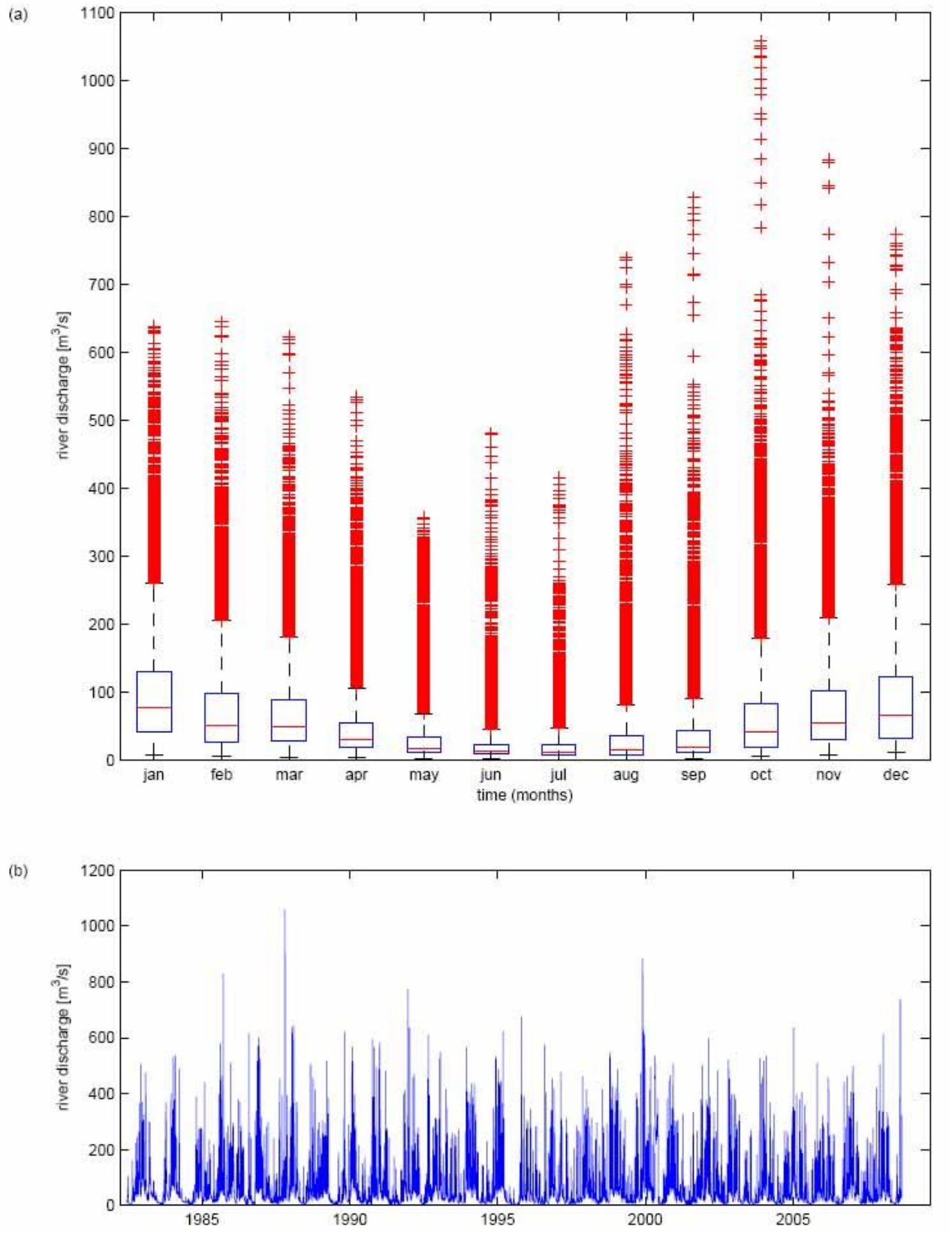

Figure 4-16: The Mourne River (tributary to the Foyle River) discharge (m^3/s) a) boxplot distribution of discharge per month and b) recorded time series (source: Deltares, 2009).

Table 4-15: River discharges m^3/s (source: provided by the Rivers Agency in Deltares, 2009). Locations of river monitoring stations are cross referenced to Figure 4-14.

River	Time Interval	1-percentile	10-percentile	Mean	90-percentile	99-percentile	Max
Mourne (tributary of the Foyle)	17/06/1982-05/09/2008	4	8	58	139	357	1058
Faughan	27/08/1976-15/09/2008	1	2	8	17	51	253
Roe	10/01/1975-15/09/2008	0	1	9	23	71	186

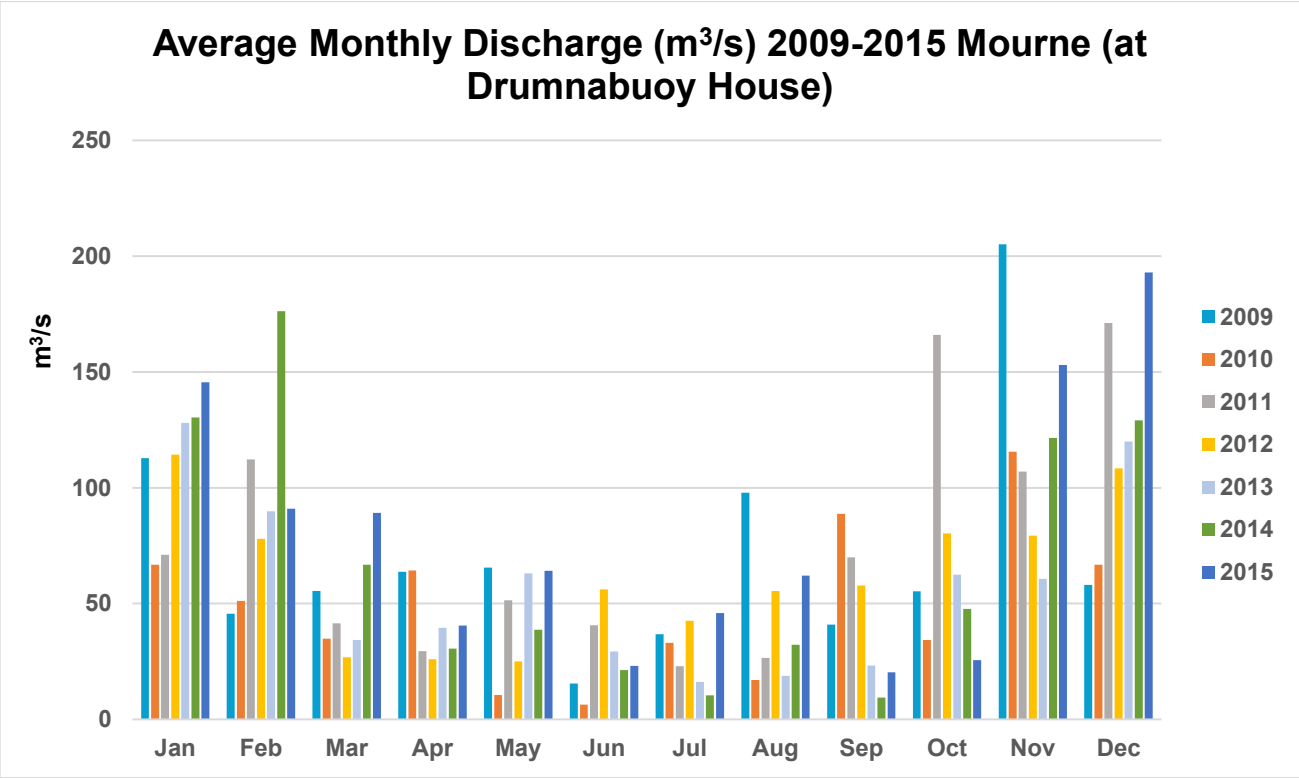

Figure 4-17: Average and monthly flow (m^3/s) data from the Mourne River 2009-2015 (source: National River Flow Archive).

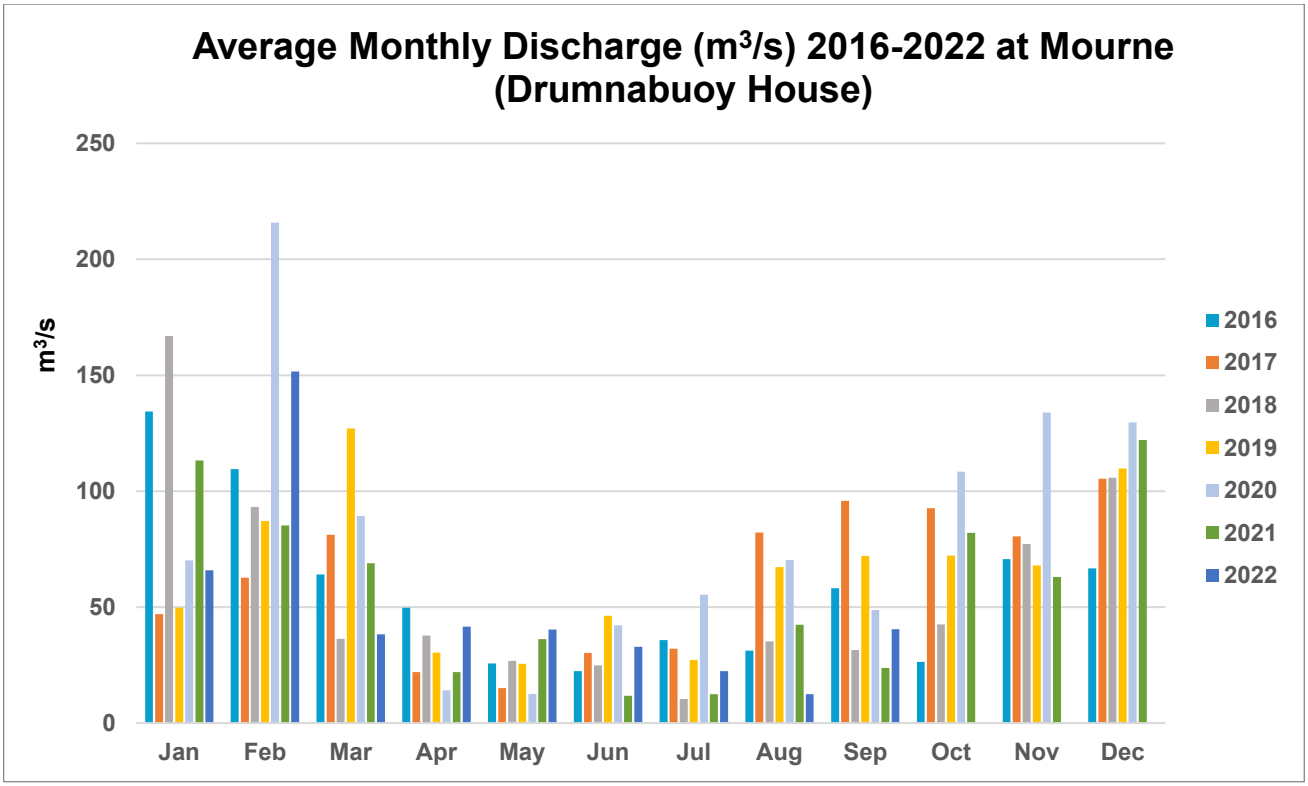

Figure 4-18: Average and monthly flow (m^3/s) data from the Mourne River 2016-2022 (source: National River Flow Archive). Data was missing for October, November, and December 2022.

4.5 Depth

The entrance to the lough is the deepest site at *c.* 18-20 m (MacDonald *et al.*, 1951; Geological Survey Ireland, 2018). Lough Foyle is a wide shallow basin with a reported maximum depth of 15 m and average depth of *c.* 5 m (**Figure 4-19**) (Charlesworth *et al.*, 1999; Ferreira *et al.*, 2022). A series of deep, narrow tidal channels run through extensive intertidal and subtidal mud and sand flats in the lough. The deeper tidal channels reach an average depth of approximately 8 to 12 m, whereas in the entrance channel (within North/South Channel) where width is constrained by the headlands, depths exceed 20 m. The Maintained Commercial Channel is approximately 8 m at chart datum (Ferreira *et al.*, 2022).

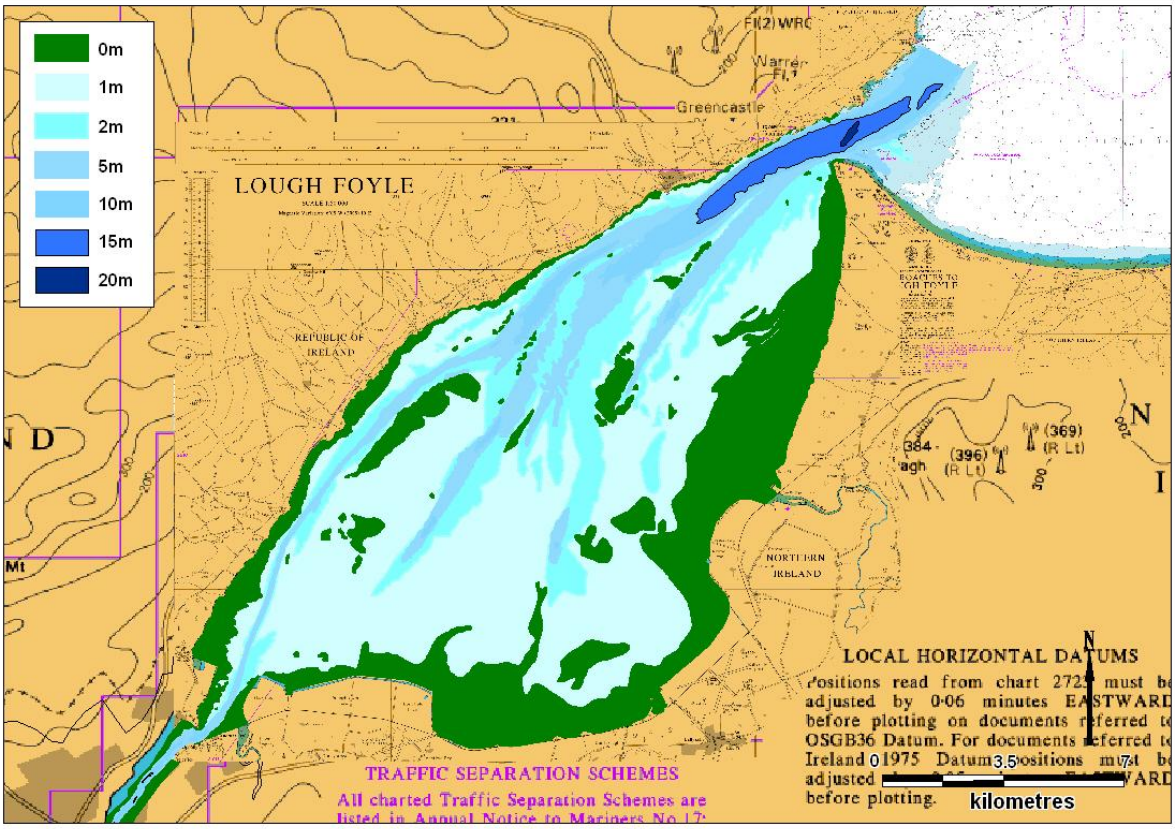

Figure 4-19: Bathymetry (m) of Lough Foyle (source: Loughs Agency).

4.6 Salinity

The Loughs Agency collects data on coastal water quality, including salinity, via a network of remotely moored Environmental Monitoring Stations (EMS) in Lough Foyle. The AFBI manage and process these data. The EMS consists of an electronic unit which houses the data storage devices for capturing real time data and the GSM (Global System for Mobile Communication) telemetry system for communication of these data with an onshore base station. There are two EMS located within Lough Foyle; North and South (**Figure 4-20**); the Lough Foyle North EMS is located at Magilligan Point and the Lough Foyle South EMS is located at Black Braes (**Figure 3-2**).

Density differences and variation in salinity distributions over the water column and spatially over the lough are evident due to the strong freshwater influence interacting with tidal influences (Charlesworth *et al*., 1999). It is an estuarine dominated system with a longitudinal salinity gradient and horizontal stratification is present throughout the year (Ferreira *et al*., 2007). Salinity around the mouth of the Foyle River experiences a halocline (a sharp salinity gradient) due to the less dense freshwater discharge reducing surface

water salinities (South EMS at Black Braes). Low river levels in summer and tidal ingress of seawater lead to higher salinity values during summer months. Bottom salinities are usually higher than surface salinities as the oceanic seawater is denser and resides at the bottom of the water column. Salinity levels near Magilligan Point (North EMS at Magilligan Point) found variable surface and bottom salinities and this can be closely associated with the tidal cycle and river discharge levels (Deltares, 2009).

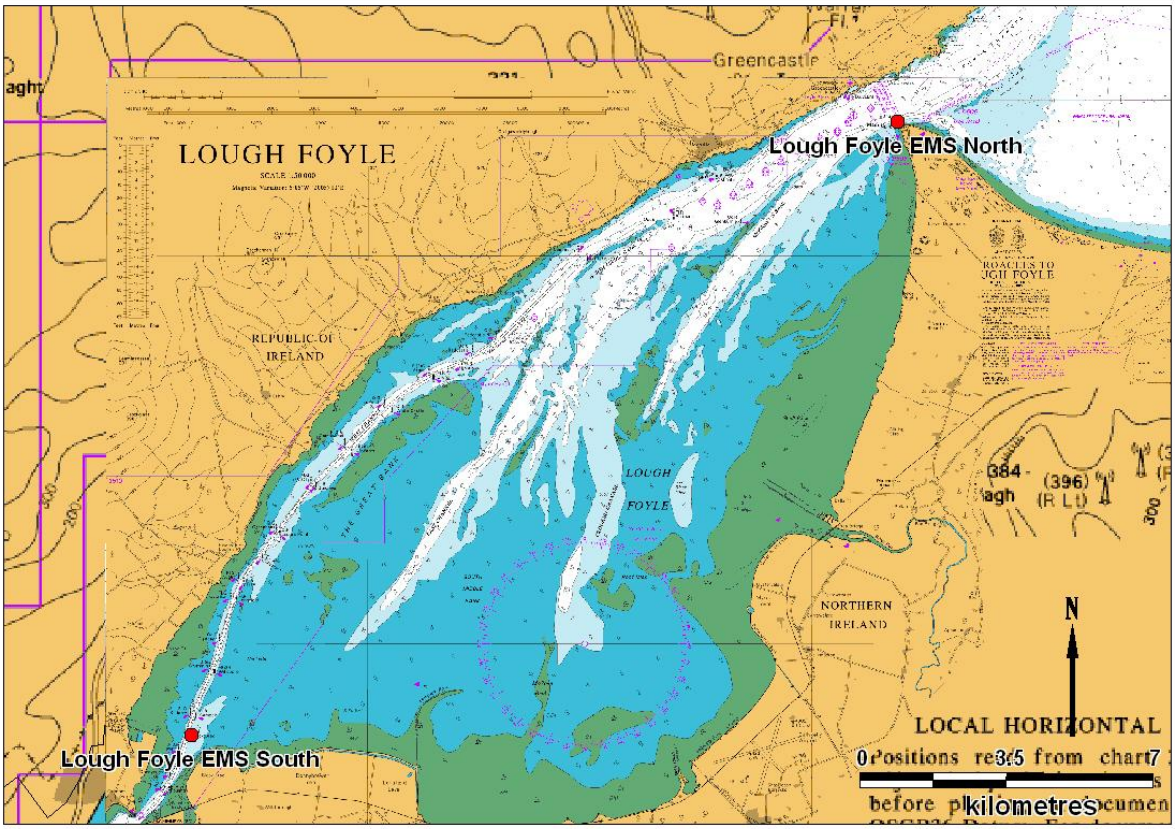

Figure 4-20: Location of the salinity and turbidity Environmental Monitoring Stations (EMSs) in Lough Foyle.

The salinity (psu) data presented in **Figure 4-21** (from the Lough Foyle South EMS) show the seasonal flow of freshwater runoff to the Foyle estuary at Black Braes between September to November 2008. The less dense freshwater stays at the surface of the estuarine water thereby lowering surface salinity and creating a halocline. The results of the salinity measurements at Black Braes (**Figure 4-21**) reveal variable salinity with surface levels as low as 6.34 psu and as high as 28.84 psu in October 2008. Bottom salinity ranged from 11.36 psu to 33.8 psu over the same month.

The results of the salinity measurements at Black Braes in 2020 (**Figure 4-22**) also reveal variable salinity throughout the year with surface levels as low as 15.74 psu in November 2020 and as high as 28 psu in September 2020. Bottom salinity ranged from 20.27 psu in October 2020 to as high as 30.45 psu in September 2020. These results show less variable salinity since 2008. Salinity levels are influenced by rainfall and wind patterns resulting in highly variable salinity levels (Wijesekera & Huyer, 1999), therefore the differences in salinity between the 2008 and 2020 monitoring period is not considered significant.

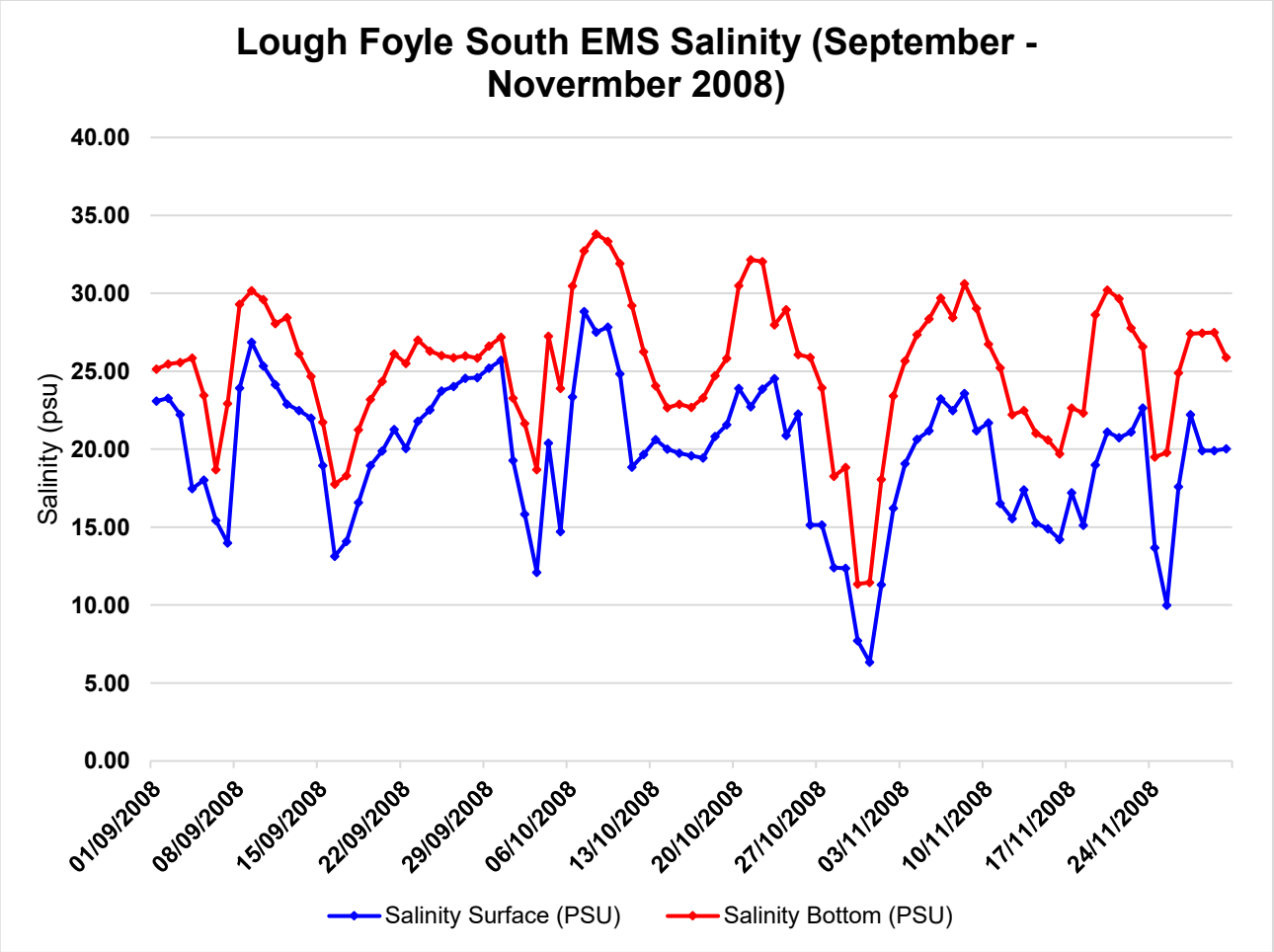

Figure 4-21: Salinity (psu) profile at Lough Foyle South Environmental Monitoring Station (EMS) from September to November 2008 (source: Loughs Agency).

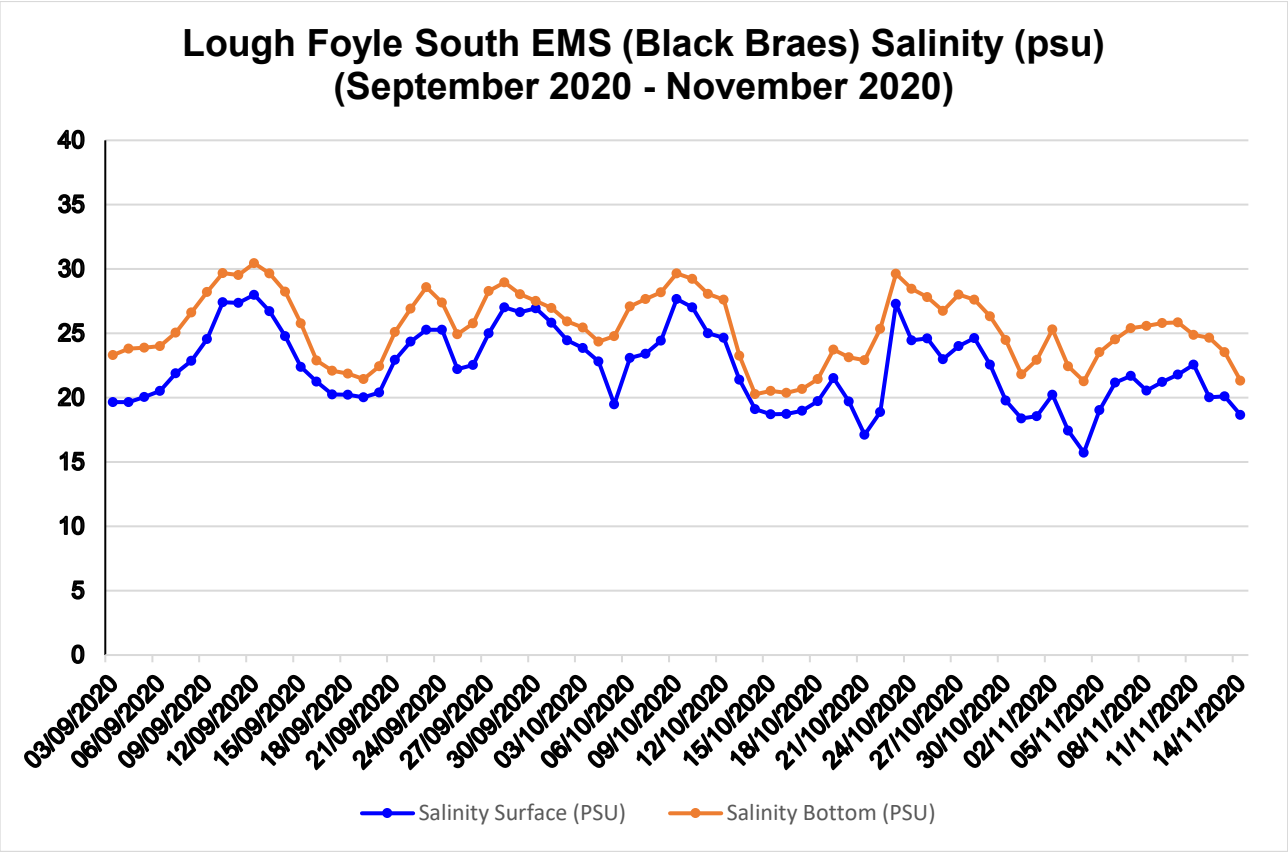

Figure 4-22: Salinity (psu) profile at Lough Foyle South Environmental Monitoring Station (EMS) at Black Braes from September 2020 to November 2020 (source: Loughs Agency).

Salinity levels show less recorded variation at the North EMS (Magilligan Point) in 2008 (**Figure 4-23**) compared to the South EMS (Black Braes) located in the inner lough (**Figure 4-21**). Surface levels ranged from 8.27 psu (October 2008) to 30.91 psu (September 2008) and bottom salinity levels ranged from 28.53 psu (October 2008) to 33.4 psu (September 2008). The variability observed can be associated with the tidal cycle and river discharge levels.

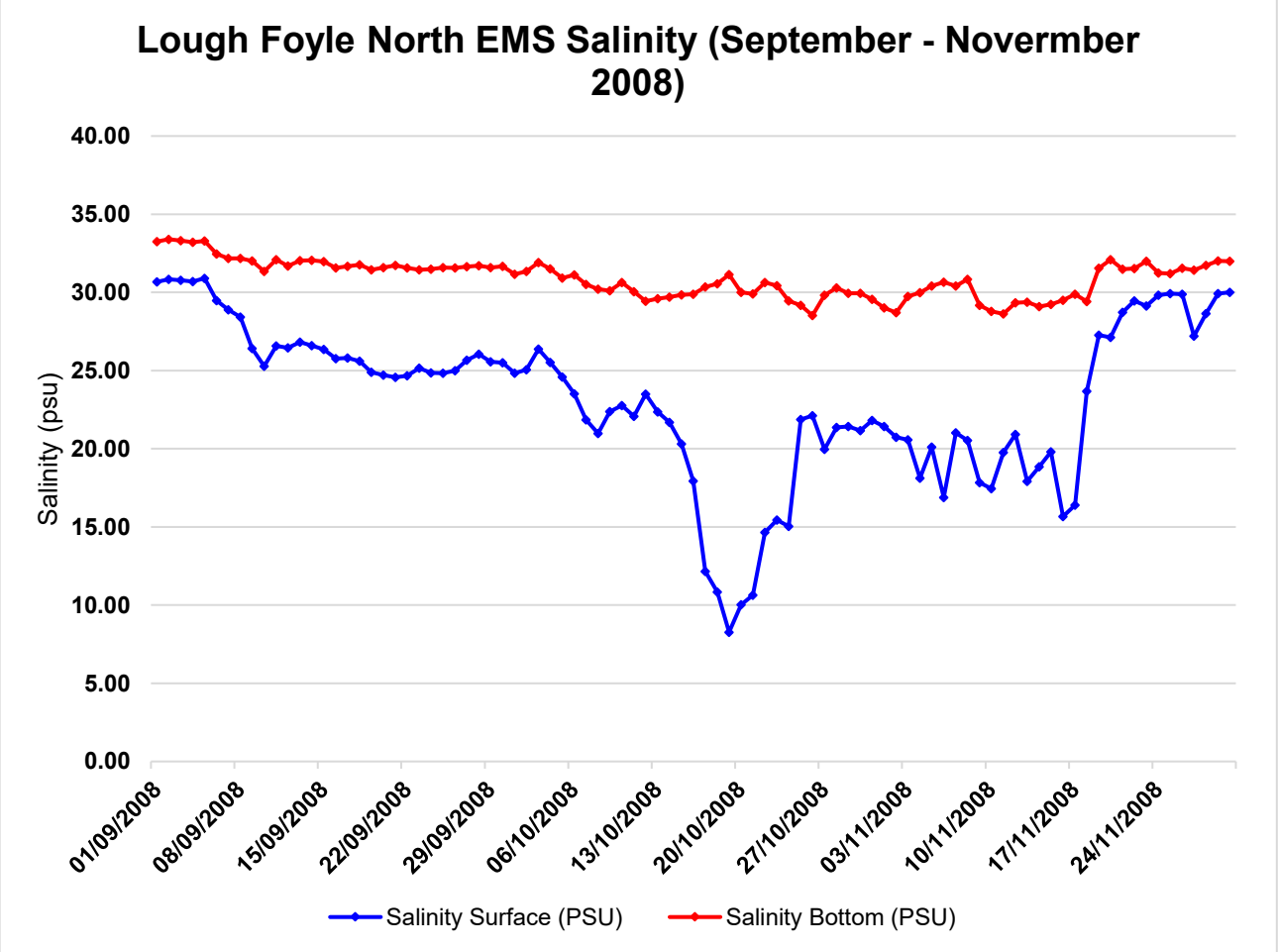

Figure 4-23: Salinity (psu) profile at Lough Foyle North Environmental Monitoring Station (EMS) from September to November 2008 (source: Loughs Agency).

4.7 Turbidity

Turbidity is a measure of the cloudiness or haziness of water caused by suspended particles such as silt, algae, and other microscopic organisms. These particles scatter light, making the water appear murky. Turbidity is an important indicator of water quality, with higher turbidity levels often signifying increased sediment runoff, pollution, or biological activity. It is commonly measured in nephelometric turbidity units (NTU) using a turbidimeter that detects how particles in the water scatter light.

Tidal currents and weather conditions have the most significant impact on turbidity levels in the lough with typically increased turbidity levels during spring tides compared to neap tides, especially on flood tides (Atkins, 1990; Bates, 1996). Bates (1996) also found background levels of turbidity ranged between 5 and 260 parts per million and that

suspended solids were higher close to the bed and surface of the water column, compared to the middle.

Depth and turbidity measurements for the South EMS were taken in metres (m) and NTU, respectively (**Table 4-16**). In depths ranging from 2.46 m to 5.30 m, turbidity mean values ranged from 8.95 to 26.59 NTU in surface waters and 15.49 to 32.24 NTU in bottom waters (**Table 4-16**).

Table 4-16: Depth (m) and turbidity (NTU) in Lough Foyle in September to December 2020.

Month	Lough Foyle South EMS			
	Mean Surface Depth (m)	Mean Surface Turbidity (NTU)	Mean Bottom Depth (m)	Mean Bottom Turbidity (NTU)
September	2.46	12.92	5.01	23.64
October	2.58	15.46	5.21	32.24
November	2.68	8.95	5.3	26.98
December	5.06	26.59	2.73	15.49

4.8 Simple/Complex Models

Londonderry Port & Harbour Commissioners commissioned a Delft3D-FLOW model in 2008 to examine sediment dispersion in Lough Foyle. This work modelled the hydrodynamics of Lough Foyle and the current velocity and direction outputs can be seen in **section 4.1** above and wave outputs can be seen in **section 4.3** above. These model outputs were consulted to aid in the identification of sampling points.

This model was calibrated and validated for the purpose of the sediment dispersion study. It provides an indication of the expected flow in other areas of Lough Foyle but requires additional validation (by means of measurements) in the shallow east and southeast parts of the lough. The presented hydrodynamic flow data were derived from model simulations that simulated normal (tidal) flow conditions, average river discharges, and used a normal wind condition, *i.e.,* seven m/s from west-southwest (240°N).

4.9 Discussion of Hydrodynamic, Salinity, and Sedimentary Processes in Lough Foyle

Lough Foyle is a wide shallow basin with a maximum depth of 15 m and an average depth of *c.* 5 m (Charlesworth *et al.,* 1999; Ferreira *et al*., 2022). A series of deep, narrow tidal channels run through extensive intertidal and subtidal mud and sand flats. Density differences and variations in salinity distributions are evident due to the strong freshwater influence interacting with the tidal influence (Charlesworth *et al*., 1999). Lough Foyle is an estuarine dominated system with a longitudinal salinity gradient and horizontal stratification present year-round (Ferreira *et al*., 2007). Adjacent to the mouth of the Foyle River (North EMS at Black Braes; **Figure 4-20**), a halocline is present with less dense freshwater on the surface reducing surface salinity levels. Lower river levels in summer and seawater ingress with rising tides leads to higher salinity values during summer months. The salinity of deeper waters are typically higher than surface salinities. Salinity readings near Magilligan Point are associated with the tidal cycle and river discharge levels. Reported turbidity averages in Lough Foyle ranged from 8.95 to 26.59 NTU in surface waters and 15.49 to 32.24 NTU in bottom waters.

Lough Foyle experiences a mean tidal range of 2.2 m and a mean neap tidal range of one m, and daily tidal inequalities are present traversing east to west over the lough (Deltares, 2009). The tidal oscillation is amplified as it travels up the lough and is accompanied by a phase difference of approximately one hour between the northern and southern corners of the lough (Deltares, 2009). Tidal forcing is the dominant influence on water level, followed by air pressure and the parameters of the wind setup. Tides and riverine discharges are the main factors influencing the current regime within the lough. Stratified conditions are present due to density differences between the freshwater being discharged from the rivers and the seawater; this results in a three-dimensional flow pattern with complex hydrodynamic regimes and considerable spatial variation in current flow (Deltares, 2009).

The lough is filled by the incoming tide through deep channels before flooding the shallower regions, however tidal emptying of the lough (ebb tides) generally occurs over the shortest route to the entrance channel (within North/South Channel) (Deltares, 2009). Water currents over the lough show a neap-spring variation and a reduction in scale further into the lough, except for the mouth of the Foyle River (Deltares, 2009). The Foyle River discharge levels have been estimated at *c.* 90 m^3/s (AFBI, 2015). Differences between

bottom and surface currents are mainly expressed in the velocity magnitude. During the ebb tide, discharge of the Foyle River reinforces the tidal emptying of the southwest corner of the lough and causes increased velocity in the surface layer, however bottom velocities are reduced due to a penetrating salt wedge (Deltares, 2009). During spring tides, the tidal flow pushes back the river flow redirecting currents upstream in the Foyle River mouth unlike during neap tides in which the tidal flow is less dominant relative to the river flow (Deltares, 2009). A net inland residual current is present, magnified during neap tidal conditions, and effects transport and sediment patterns. The bed load (material carried by a flowing fluid *i.e.,* river or current) has a mainly inward direction over the long term and suspended sediment is affected by inward and outward directed flows (Deltares, 2009).

River discharge determines the limit of tidal influence upriver, the vertical current profiles near the river mouth, and distance the resultant salt wedge travels upriver. There is a strong riverine influence in Lough Foyle. The Rivers Foyle, Roe, and Faughan discharge large quantities of freshwater at characteristic discharge values of 59.5 m^3/s, eight m^3/s, and seven m^3/s, respectively (Deltares, 2009). Peaks in discharge occur in all rivers after large rain events. Discharge for the Mourne River (tributary to the Foyle River) found strong seasonal patterns in river flow with the largest discharges in late summer and autumn (Deltares, 2009). Peak recorded discharge was 1,145 m^3/s in August 2017. An estimated mean discharge value of 90 m^3/s has been reported in the Foyle River (AFBI, 2015).

Precipitation was assessed over two 30-year time periods at Malin Head Met Éireann station. Between 1981-2010, average rainfall ranged from 9.9 mm in February to 250.4 mm in October. Median values ranged from 52.99 mm in May to 113 mm in January. Seasonally, it was driest in spring and wettest in autumn. Comparably, the period 1993 to 2023 found average rainfall ranged from 13.3 mm in August to 272.9 mm in December. Median values ranged from 61.6 mm in April to 121.1 mm in December; both average and median rainfall values have experienced an increase, and a shift in range is evident when compared to the period 1981-2010. Seasonally, in 1981-2010, spring was the driest and autumn was the wettest; in 1993-2023, spring was also the driest, but winter was the wettest. Precipitation was also assessed for five-year periods at Malin Head Met Éireann station. Between 2014-2018, monthly rainfall ranged from 23 mm in September 2014 to 272.1 mm in December 2015. Comparably between 2019-2023, monthly rainfall ranged from 20.1 mm in April 2020

to 214.2 mm in December 2023. For both five-year periods, spring was the driest and winter was the wettest.

In Lough Foyle, wind velocities are lower in summer months with a small increase over winter indicating a minimal seasonal effect (Deltares, 2009). Wind direction was more variable in spring and summer compared to winter and autumn (Deltares, 2009). Monthly median wind velocities varied between six to eight m/s and mean monthly wind direction corresponded to the approximate orientation of the lough at 240˚ west-southwest. In Lough Foyle, wind-induced waves cause sediment resuspension which is magnified in shallow regions. Offshore wave energy and storms tend to dissipate on The Tuns before reaching the entrance channel (within North/South Channel) and there is little offshore wave penetration beyond Greencastle; as such, local wind-induced waves are the strongest force determining the wave climate within the lough (Deltares, 2009). Mild wave conditions are present in the lough throughout the year. The highest waves are found on the northeastern shore of the lough and highest levels of sediment resuspension occur over shallow regions (Deltares, 2009).

The hydrodynamics of Lough Foyle are largely governed by its shallow, estuarine nature, where the interaction of tidal forces and riverine discharge leads to variable flow patterns and salinity distributions. Stratification and salinity gradients are significant features due to freshwater inputs, which reduce surface salinity, particularly near river mouths. Seasonal fluctuations in river discharges add further complexity to the hydrodynamic regime, affecting sediment transport, salinity patterns, and water column stratification.

Tidal forcing creates a dynamic system, with notable differences in flow and current velocity during neap and spring tides. The impact of river discharges becomes more pronounced during neap tides, with a distinct inland residual current shaping sediment transport and deposition. Wind-induced waves play a significant role in sediment resuspension, emphasising the importance of shallow areas in sedimentary processes. These factors contribute to a seasonally variable environment where hydrodynamic, salinity, and sedimentary processes interact in a complex but understood manner.

5. Identification of Pollution Sources

This section of the review documents the relevant pollution sources identified during the desktop and shoreline surveys within Lough Foyle contributing catchment. In the context of this report, pollution encompasses *E. coli* contamination only. The presence of *E. coli* in water is a strong indicator of faecal contamination from sewage or animal waste.

5.1 Desktop Survey

Pollution sources were considered within the contributing catchment of Lough Foyle and a 20 km buffer zone was established as the contributing catchment; 10 km and 5 km buffer zones are included to provide further reference but do not define the contributing catchment (**Figure 5-1**). The contributing catchment covers an area of approximately 2,635 km^2, *c*. 30 km at its longest point and *c.* 13 km at its widest point.

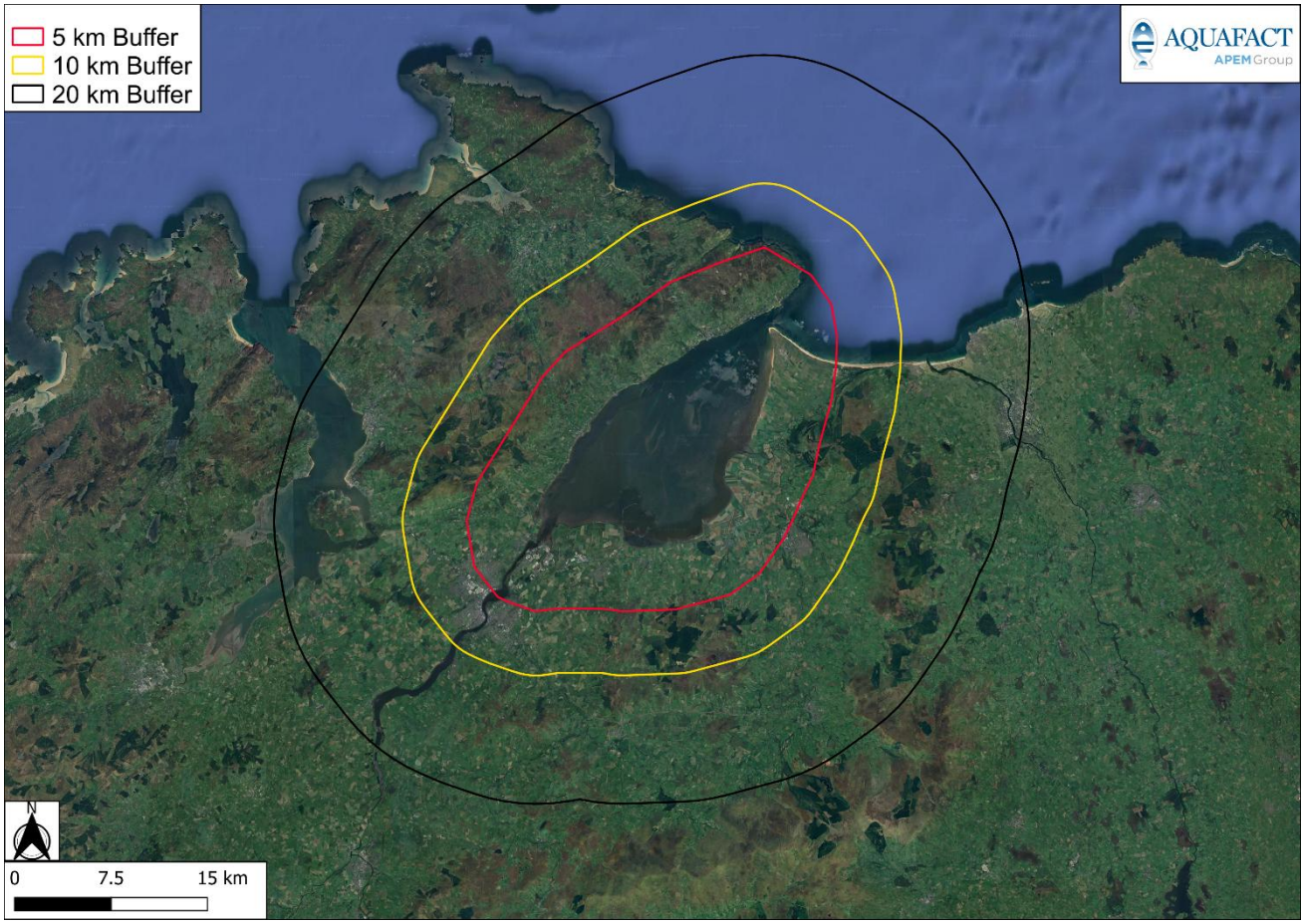

Figure 5-1: Lough Foyle contributing catchment (20 km) established for the assessment of pollution sources into the lough; 5 and 10 km buffer zones are included to provide further reference.

5.1.1 Human Population

Counties Donegal, Tyrone, Derry, and Antrim fall within Lough Foyle contributing catchment. Population census data for Northern Ireland are given in units of Wards, and Electoral Divisions (EDs) are used by the Central Statistics Office (CSO) for Co. Donegal in the Republic of Ireland. **Figure 5-2** shows the Northern Ireland Wards and the Republic of Ireland EDs within Lough Foyle contributing catchment.

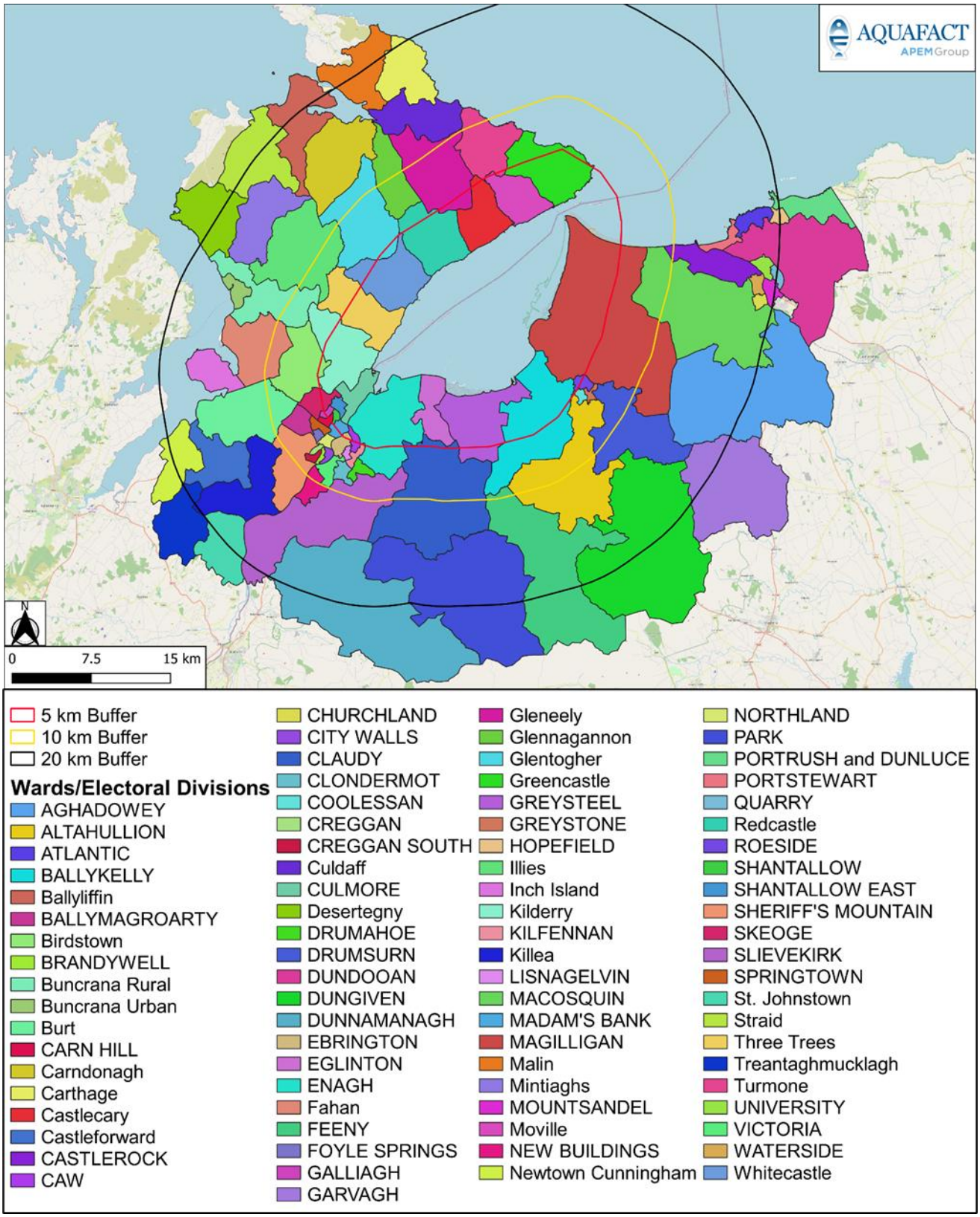

Figure 5-2: Wards and Electoral Divisions (EDs) within Lough Foyle contributing catchment.

Data on human populations for Northern Ireland were obtained from the Northern Ireland Statistics and Research Agency (NISRA) for the 2021 census and the 2016 Mid-Year Population Estimate. The Northern Ireland census occurs once every ten years, and the most recent census was in 2021. The population estimates are for the 30th of June each year and use the components of change method: the previous years' population is aged on by one year and birth rates, mortality rates, and net migration are accounted for. The census in the Republic of Ireland occurs every five years. Census data for the Republic of Ireland was obtained through the Central Statistics Office (CSO) for 2022 and 2016.

In 2016, the largest population centres were Culmore, Eglinton, Greysteel, and Buncrana Rural (**Figure 5-3**). The largest population centres in 2021/22 are Skeoge, Northland, Kilfennan, and Greysteel (**Figure 5-4**). The change in population between 2016 and 2021/22 can be seen in **Figure 5-5** and **Table 5-1**. Along the western shoreline, the highest populations occur in Moville (2,293, -3.1%) which experienced a decrease since 2016, and Kilderry (2,151, +3%). The highest population along the eastern shoreline occurs at Greysteel (4,642, +14.5%), Enagh (4,393, +77.1%), and Eglinton (3,908, -10.9%). The population overall within Lough Foyle contributing catchment increased since 2016 by 64.53% (+ 85,812) to 241,892.

Population values for Skeoge, Sheriff's Mountain, Shantallow, Quarry, Portrush and Dunluce, Madam's Bank, Galliagh, Drumsurn, Drumahoe, City Walls, Ballymagroarty, Altahullion, and Aghadowey were not available for the Northern Ireland 2016 Mid-Year Population Estimate, however, are included in the 2021 data.

Human population in given areas is obtainable from census data; however, relating this information to the level of microbial contamination in coastal waters is difficult and is constrained by the geographical boundaries used. Nonetheless, it is plausible that areas with higher populations will have higher levels of sewage and wastewater entering the Lough Foyle system. Therefore, the highest levels of sewage and waste are expected to enter on the eastern shoreline from Skeoge, followed by Northland and Kilfennan.

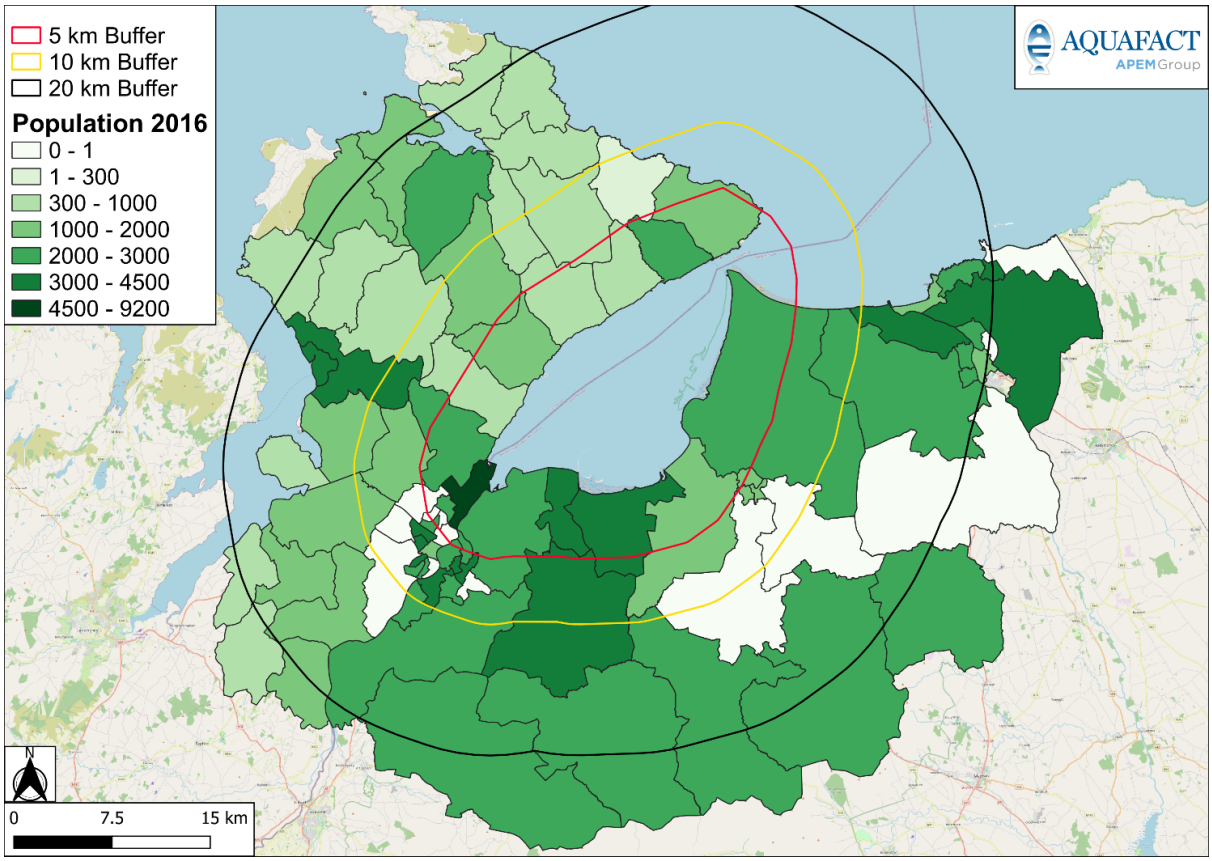

Figure 5-3: Population of Lough Foyle contributing catchment in 2016 for Wards (Northern Ireland) and Electoral Divisions (Republic of Ireland) (sources: NISRA, 2016; CSO, 2016). Note that those Wards that fall within the 0-1 population category are due to changes in boundaries and structure of Wards between 2016 and 2021, and population statistics were not available for these at this time.

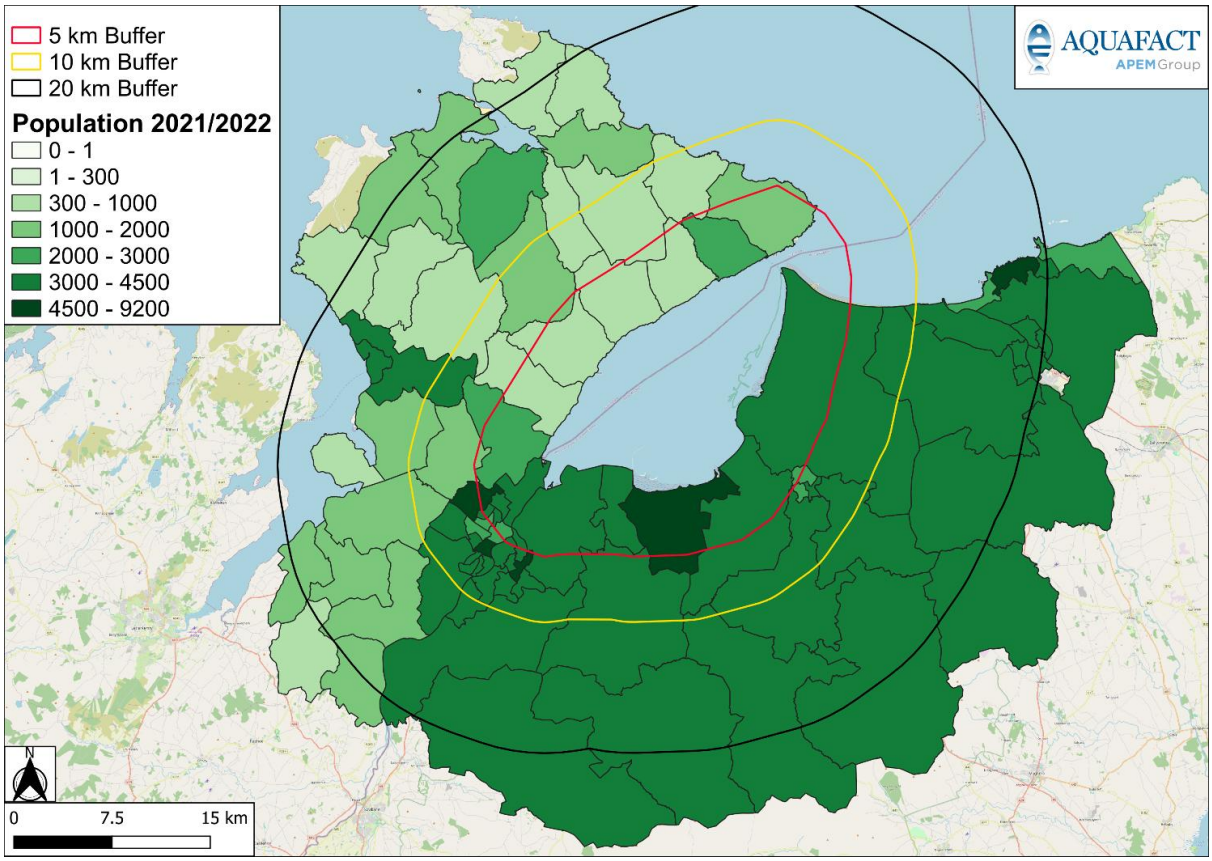

Figure 5-4: Population of Lough Foye contributing catchment in 2021 for Wards (Northern Ireland) and in 2022 for Electoral Divisions (Republic of Ireland) (sources: NISRA, 2021; CSO, 2022).

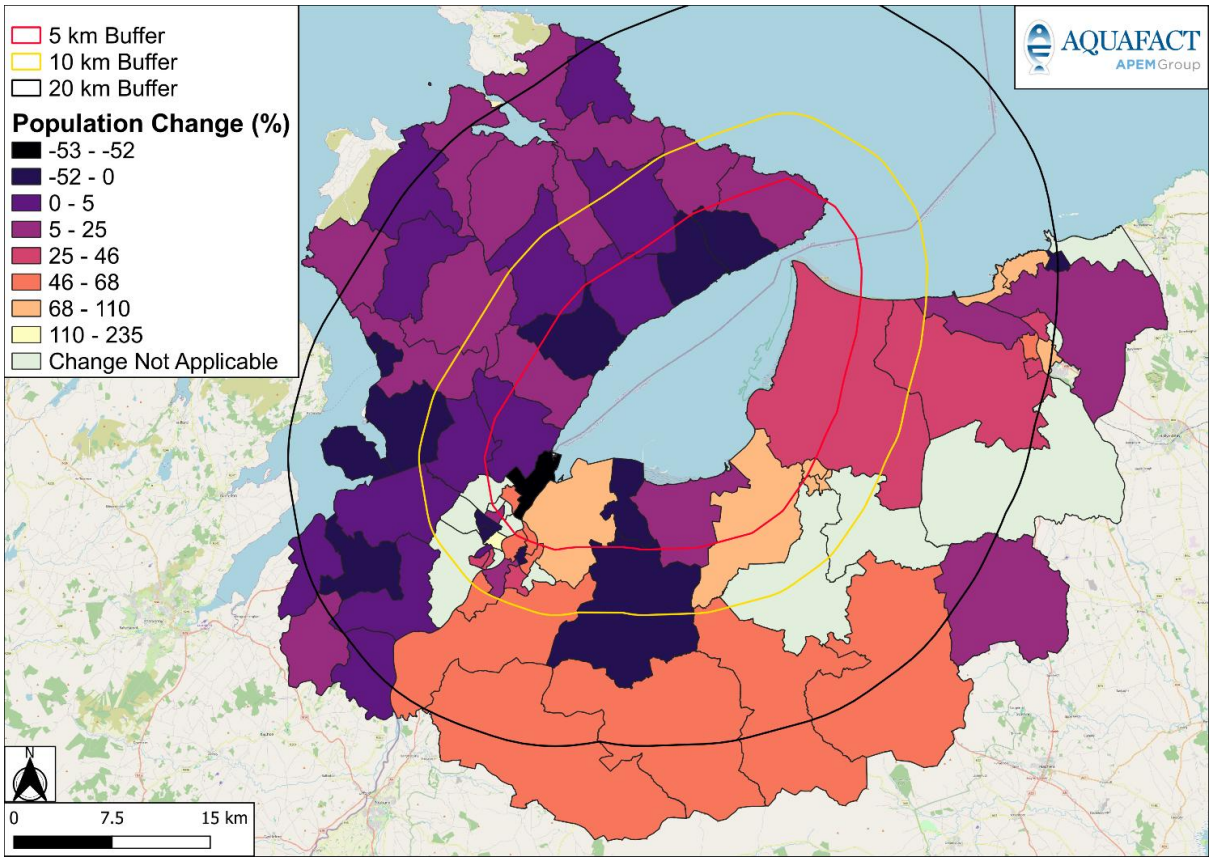

Figure 5-5: Population change in Lough Foyle contributing catchment between 2016 and 2021/22 (source: CSO, 2016; CSO, 2022; NISRA, 2016; NISRA, 2021). Note that for Change Not Applicable, the Wards in 2021 were not comparable to data from 2016 due to changes in the structure of Wards.

Table 5-1: Human population within Lough Foyle contributing catchment (source: NISRA, 2021; CSO, 2022). Note that due to changes in geographic divisions in Northern Ireland not all former and current wards are comparable, and this is indicated by 'N/A'. NI = Northern Ireland; RoI = Republic of Ireland.

Ward/ED	Region	2021/2022	2016	Population Change (number)	Population Change (%)
Waterside	NI	4,302	2,664	1,638	61.5
Victoria (Derry City and Strabane Local Government District (LGD))	NI	4,467	3629	838	23.1
University	NI	3,655	2,638	1,017	38.6
Springtown	NI	2,885	3,051	-166	-5.4
Slievekirk	NI	3,577	2,448	1,129	46.1
Skeoge	NI	6,385	N/A	N/A	N/A
Sheriff's Mountain	NI	3,341	N/A	N/A	N/A
Shantallow East	NI	4,265	2,542	1,723	67.8
Shantallow	NI	3,669	N/A	N/A	N/A
Roeside	NI	2,653	1,454	1,199	82.5
Quarry	NI	4,454	N/A	N/A	N/A
Portstewart	NI	2,915	1,670	1,245	74.6
Portrush and Dunluce	NI	2,760	N/A	N/A	N/A

Ward/ED	Region	2021/2022	2016	Population Change (number)	Population Change (%)
Park (Derry City and Strabane LGD)	NI	3,531	2,358	1,173	49.7
Northland	NI	4,845	1,458	3,387	232.3
New Buildings	NI	3,829	2,512	1,317	52.4
Mountsandel	NI	3,811	1,973	1,838	93.2
Magilligan	NI	3,481	2,487	994	40.0
Madam's Bank	NI	2,864	N/A	N/A	N/A
Macosquin	NI	3,432	2,363	1,069	45.2
Lisnagelvin	NI	3,162	3,244	-82	-2.5
Kilfennan	NI	4,737	3,020	1,717	56.9
Hopefield	NI	3,586	3,774	-188	-5.0
Greystone (Causeway Coast and Glens LGD)	NI	3,488	1864	1,624	87.1
Greysteel	NI	4,642	4,055	587	14.5
Garvagh	NI	3,512	2,860	652	22.8
Galliagh	NI	3,747	N/A	N/A	N/A
Foyle Springs	NI	3,042	3,748	-706	-18.8
Feeny	NI	3,611	2,306	1,305	56.6
Enagh	NI	4,393	2,481	1,912	77.1

Ward/ED	Region	2021/2022	2016	Population Change (number)	Population Change (%)
Eglinton	NI	3,908	4,384	-476	-10.9
Ebrington	NI	4,022	2,642	1,380	52.2
Dunnamanagh	NI	3,511	2,231	1,280	57.4
Dungiven	NI	3,297	2,047	1,250	61.1
Dundooan	NI	3,908	3,307	601	18.2
Drumsurn	NI	3,663	N/A	N/A	N/A
Drumahoe	NI	4,494	N/A	N/A	N/A
Culmore	NI	4,323	9,113	-4,790	-52.6
Creggan South	NI	3,848	2,752	1,096	39.8
Creggan	NI	3,474	3,458	16	0.5
Coolessan	NI	2,919	1,392	1,527	109.7
Clondermot	NI	3,850	2,974	876	29.5
Claudy	NI	3,496	3,534	-38	-1.1
City Walls	NI	3,240	N/A	N/A	N/A
Churchland	NI	3,640	2,528	1,112	44.0
Caw	NI	4,334	2,712	1,622	59.8
Castlerock	NI	3,389	3,125	264	8.4
Carn Hill	NI	2,852	2,692	160	5.9
Brandywell	NI	3,186	2,384	802	33.6

Ward/ED	Region	2021/2022	2016	Population Change (number)	Population Change (%)
Ballymagroarty	NI	3,983	N/A	N/A	N/A
Ballykelly	NI	3,101	1,792	1,309	73.0
Atlantic	NI	4,537	2,347	2,190	93.3
Altahullion	NI	3,192	N/A	N/A	N/A
Aghadowey	NI	3,452	N/A	N/A	N/A
Ballyliffen	RoI	1,529	1381	148	10.7
Birdstown	RoI	1324	1312	12	0.9
Buncrana Rural	RoI	4039	3836	203	5.3
Buncrana Urban	RoI	3279	3396	-117	-3.4
Burt	RoI	1333	1310	23	1.8
Carndonagh	RoI	2519	2339	180	7.7
Carthage	RoI	917	886	31	3.5
Castlecary	RoI	692	705	-13	-1.8
Castleforward	RoI	1345	1356	-11	-0.8
Culdaff	RoI	1027	935	92	9.8
Desertegny	RoI	751	713	38	5.3
Fahan	RoI	1634	1697	-63	-3.7
Gleneely	RoI	859	827	32	3.9
Gleneganon	RoI	791	730	61	8.4

Ward/ED	Region	2021/2022	2016	Population Change (number)	Population Change (%)
Glentogether	RoI	1240	1184	56	4.7
Greencastle	RoI	1140	1016	124	12.2
Illies	RoI	945	865	80	9.2
Inch Island	RoI	396	461	-65	-14.1
Kilderry	RoI	2151	2089	62	3.0
Killea	RoI	1802	1793	9	0.5
Malin	RoI	770	668	102	15.3
Mintiaghs	RoI	890	866	24	2.8
Moville	RoI	2293	2366	-73	-3.1
Newtown Cunningham	RoI	1028	996	32	3.2
Redcastle	RoI	967	935	32	3.4
St. Johnstown	RoI	1396	1343	53	3.9
Straid	RoI	1298	1288	10	0.8
Three Trees	RoI	724	675	49	7.3
Treantaghmucklagh	RoI	860	802	58	7.2
Turmone	RoI	316	296	20	6.8
Whitecastle	RoI	977	1001	-24	-2.4

5.1.2 Tourism

In 2019, there were an estimated 5.3 million visitors to Northern Ireland of which three million were out of state visitors (Tourism Northern Ireland, 2019). In 2008, there were 2,076,000 external visitors to Northern Ireland which at the time was a decrease from 2007. In 2019, of the three million estimated overnight trips by external visitors to Northern Ireland staying an estimated 11.8 million nights, 39% of the trips were for holiday/pleasure/leisure (NISRA, 2021). Growth observed in trips between 2018 and 2019 was driven by increased holidays (14% increase) (Tourism Northern Ireland, 2019). The Giant's Causeway (approximately 30 km from Magilligan Point) and the Causeway Coastal Route were influencing factors on external visitors coming to Ireland in 2019, at 29% and 14%, respectively (NISRA, 2020). The Causeway Coastal Route is within the contributing catchment and includes attractions listed on the Causeway Coast and Glens visitors' attractions, and they both may increase tourism in the area.

Full national statistics have not been published by Northern Ireland for 2020 or the following years, however statistics from 2019 found that of the 3,001,000 trips, 43% were visiting family and friends, 39% were holidaying. Of the total visitors to Northern Ireland in 2019, 29% arrived between July and September, 28% arrived between April and June, 23% arrived between October to December, and 20% arrived between January to March (Tourism Northern Ireland, 2019). In 2019, 39% of trips by external visitors were for pleasure and vacation (NISRA, 2020). Five-hundred and seventy-three trips to Co. Donegal occurred in 2022 by domestic tourists and 1,924 nights were spent over the same period (Fáilte Ireland, 2023). In 2019, there were 10,808,000 trips from overseas visitors to Ireland (CSO, Statistical Yearbook of Ireland, 2020) and 768,000 visited the border region (Fáilte Ireland, 2021).

The 2010 sanitary survey for Lough Foyle used data from a tourism audit conducted by the Loughs Agency. However, since these data were not available for verification, they were not included in the current report. As a result, there are differences between the tourism data reported in the 2010 sanitary survey and the current report. The current report endeavours to identify and assess all relevant tourist facilities which may increase levels of pollution within the contributing catchment. Tourism data from 2010 can be seen in **Figure 5-6** and data for 2024 can be seen in **Figure 5-7**.

There are a range of tourist activities within Lough Foyle contributing catchment including water activities, golf, cycling, equestrian, spa and wellness, culture and heritage, nature, and wildlife (**Figure 5-7**). In Derry-Londonderry City, Discover Northern Ireland lists 69 activities within the city centre (Discover Northern Ireland – Derry-Londonderry (City)). Northern Ireland Holidays provides an Interactive Tourist Map and key tourist attractions in the area include the Grianán of Aileach, Magilligan Point, Magilligan Martello tower, Binevenagh, Downhill and Mussenden Temple, Castlerock, and Limavady. The Lough Foyle ferry connects the Wild Atlantic Way in Co. Donegal and the Causeway Coastal and Glens in Co. Derry/Londonderry through the Greencastle Harbour terminal and Magilligan Point terminal.

167 cruise ships docked at ports in Northern Ireland in 2019 which represents a 23.4% increase from the 128 cruise ships that docked in Northern Ireland in 2018 and a 62.8% increase from the 62 in 2013 (NISRA, 2021). Since 2013, the number of passengers/crew on cruise ships docking in Northern Ireland has more than doubled from 103,000 to 290,000 in 2019 (NISRA, 2021).

Pier and rock fishing at Moville, Greencastle, Malin, Magilligan Point, and Culdaff (**Figure 5-7**) offers species like herring, crab, conger, bass, sea trout, mackerel, and more (CEFAS, 2007).

Tourism facilities within Lough Foyle contributing catchment from a variety of online resources were compiled however these are not all inclusive due to availability of information and the information included in particular datasets. Data from DAERA, Canoe Northern Ireland, Loughs Agency, Open Data Northern Ireland, and Fáilte Ireland recorded one airport, one picnic area, one view point, two diving sites, two ferry terminals, three yacht/sailing clubs, three touring companies (Donegal Tour Guide, Explore North Tours, and Irish Ancestral Tours and Research), four marinas, four harbours/ports, five beaches (of which four were Blue Flag beaches), five golf clubs, seven galleries/museums, eight sites within the Causeway Coast and Glens tourism attractions, 13 recreational centres, 14 sea angling spots, 18 wildlife and nature attractions, 22 historic attractions, canoe trails, and wildfowling regions (**Figure 5-7**). It is evident that tourism is an important industry within the contributing catchment and has significantly increased since 2010, with a range of activities

dispersed throughout the contributing catchment but concentrated around the lough and the major towns/hubs of human activity.

Increases in population in the local area due to tourism may result in an increase in the quantity of sewage discharged into the Lough Foyle contributing catchment. In addition, Papadakis *et al.* (1997) found significant correlations between the number of swimmers present on beaches and the presence of pathogenic bacteria. In 2007, Elmir *et al*. (2007) showed the role of human skin as an intermediate mechanism of pathogen transmission to the water column. In Lough Foyle contributing catchment, there were five listed beaches of which four were Blue Flag beaches, and high level of water sporting activities may increase the possibility of transmission of *E. coli* to the water body, however these are expected to be low in comparison to land-based sources of pollution.

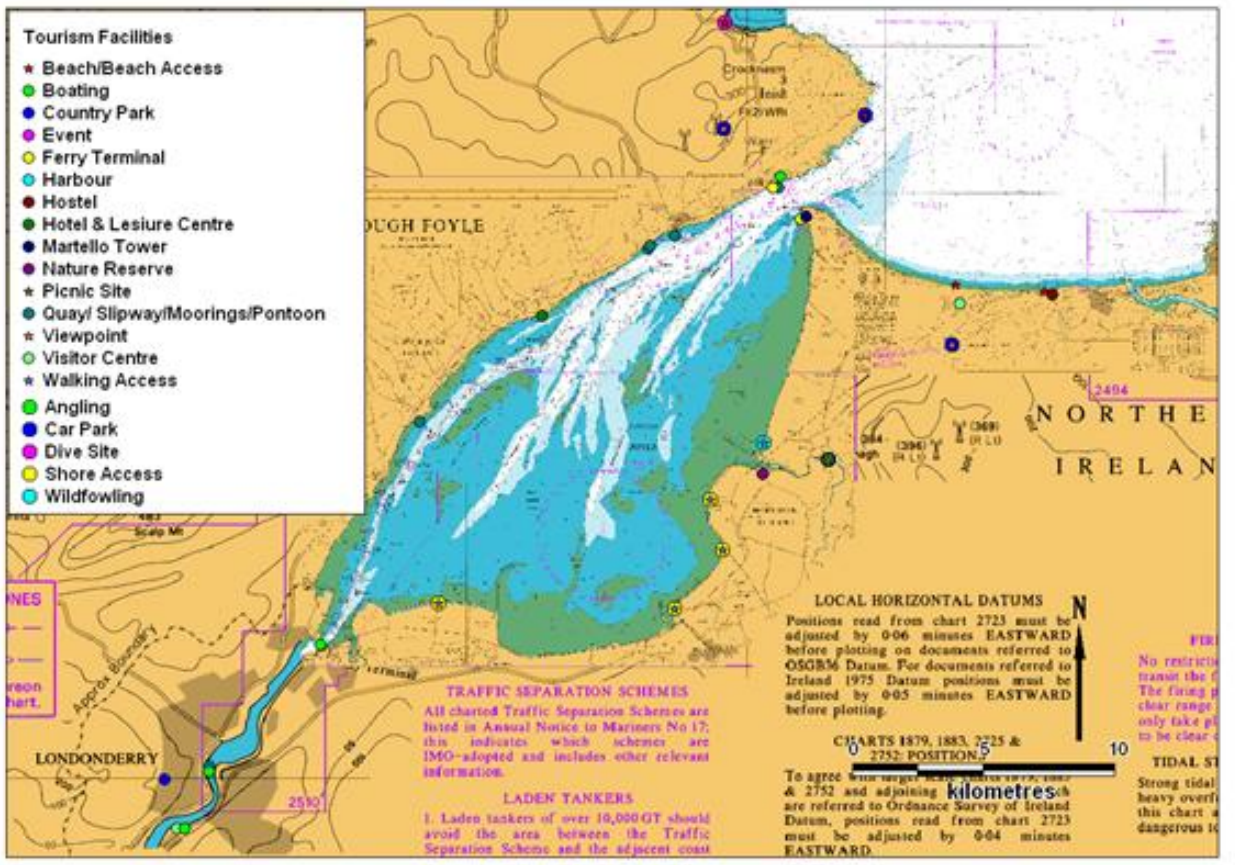

Figure 5-6: Tourism facilities around Lough Foyle (2010).

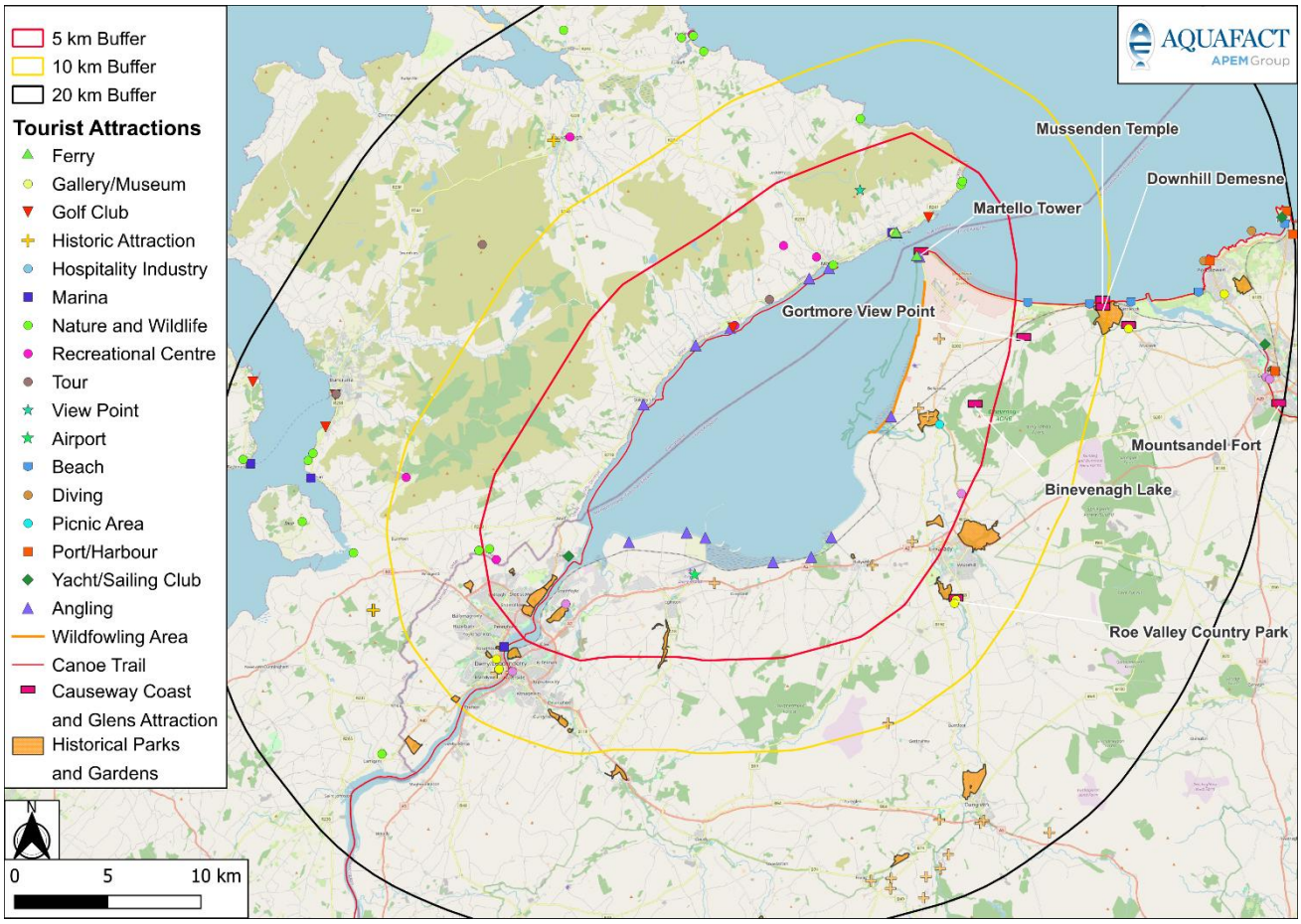

Figure 5-7: Tourist attractions and facilities within Lough Foyle contributing catchment (source: DAERA; Canoe Northern Ireland; Loughs Agency (Sea Fishing); Open Data Northern Ireland; Fáilte Ireland).

5.1.3 Sewage Discharges

Sewage effluent can vary in nature depending on the degree to which the sewage has been treated. Discharges of sewage effluent can arise from a variety of sources and be continuous or intermittent in nature:

- treated effluent from urban sewage treatment plants (continuous).
- storm discharges from urban sewage treatment plants (intermittent).
- effluent from 'package' sewage treatment plants serving small populations (continuous).
- septic tanks (intermittent).
- crude sewage discharges at some estuarine and coastal locations (continuous).

Treatment of sewage ranges from:

- none at all (crude sewage).
- preliminary (screening and/or maceration to remove/disguise solid matter).
- primary (settling to remove suspended solids as sewage sludge). Typically removes 40% of BOD (Biochemical Oxygen Demand), 60% of suspended solids, 17% of nitrogen, and 20% of phosphorus from the untreated sewage.
- secondary (settling and biological treatment to reduce the organic matter content). Typically removes 95% of BOD, 95% of suspended solids, 29% of nitrogen, and 35% of phosphorus from the untreated sewage. Nutrient removal steps can be incorporated into secondary treatment which can reduce ammonia – nitrogen down to 5 mg/l and phosphorus to 2 mg/l.
- tertiary (settling, biological treatment, and an effluent polishing step which may involve a reed bed (unlikely for coastal works) or a treatment to reduce the load of microorganisms in the effluent). Typically removes 100% of BOD, 100% of suspended solids, 33% of nitrogen, and 38% of phosphorus from the untreated sewage.

Figure 5-8 shows all 64 wastewater treatment works (WwTW) within the Lough Foyle contributing catchment, serving a population of approximately 187,782 population equivalent (p.e.); **Table 5-2** shows the coordinates and p.e. of these plants. The major works are those at Culmore, Limavady, Magilligan Point Road, Donnybrewer, Dungiven, Ballykelly, Claudy, and Greysteel. These eight works together account for 92.9% of the total p.e. of the contributing catchment. Of the 64 WwTW, 97.5% (56) are below/at capacity and eight are over capacity. The eight plants that are over capacity account for the remaining 2.5% of the load. Notably, Culmore WwTW which alone accounts for 71% of the load in the contributing catchment is operating at 16,184 p.e. below capacity.

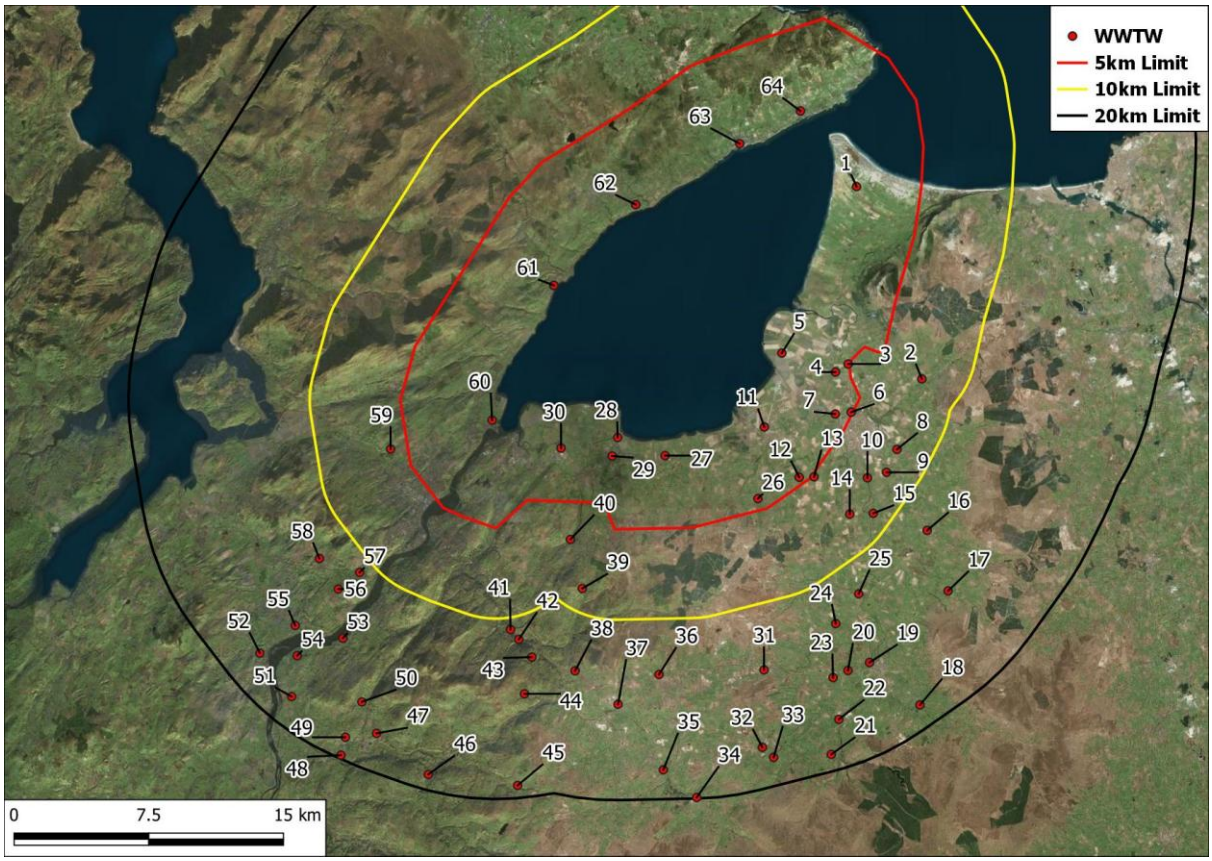

Figure 5-8: WwTW within Lough Foyle contributing catchment (source: Northern Ireland Water and see UWW Plant Locations at EPA Maps). Map IDs are cross-referenced to Table 5-2.

Table 5-2: WwTW within Lough Foyle contributing catchment (source: Northern Ireland Water/ EPA Maps). Those WwTW operating above/over capacity are highlighted in bold. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid.

Map ID	Name	Easting	Northing	Longitude	Latitude	Current p.e.	Design p.e.	Available capacity
1	Magilligan Point Road WwTW	267499.6	436177.2	-6.9416	55.1681	5674	8696	3022
2	Bolea WwTW	271278.2	425617.4	-6.8849	55.0728	113	130	17
3	Aghanloo 1 WwTW	267187.8	426375	-6.9488	55.0802	841	550	**-291**
4	Myroe WwTW	266492.2	425921.4	-6.9598	55.0762	178	200	22
5	Carrowclare WwTW	263509.3	426928.1	-7.0062	55.0856	286	280	**-6**
6	Limavady WwTW	267394.1	423715.8	-6.9462	55.0562	16258	20490	4232
7	Lisnakilly WwTW	266516	423601	-6.9599	55.0553	33	48	15
8	Drummond WwTW	269962	421701	-6.9065	55.0378	22	31	9
9	Edenmore Road WwTW	269404.7	420420	-6.9155	55.0264	12	12	0
10	Ardgarvan WwTW	268348.8	420097.2	-6.9321	55.0236	164	191	27
11	Ballykelly WwTW	262592.9	422829.1	-7.0215	55.0489	3649	7840	4191
12	Drumraighland WwTW	264568	420076.2	-6.9912	55.0239	81	180	99
13	Dromore Highlands WwTW	265390.4	420108.2	-6.9783	55.0241	116	150	34
14	Largy Limavady WwTW	267399.3	418077.5	-6.9474	55.0056	151	200	49
15	Ballyquin WwTW	268706	418137.9	-6.9270	55.0060	101	107	6
16	Drumsurn WwTW	271705.8	417241.4	-6.8803	54.9975	592	696	104

Map ID	Name	Easting	Northing	Longitude	Latitude	Current p.e.	Design p.e.	Available capacity
17	Ballymacallion WwTW	272921.7	413910.7	-6.8622	54.9674	18	22	4
18	Crebarkey WwTW	271462	407560	-6.8866	54.9106	24	48	24
19	Dungiven WwTW	268623.3	409873.8	-6.9303	54.9318	4744	5742	998
20	Owenbeg WwTW	267431	409414	-6.9490	54.9278	30	44	14
21	Caugh Hill East WwTW	266576.3	404741.3	-6.9634	54.8859	9	26	17
22	Carnanbane WwTW	266965.2	406690.2	-6.9569	54.9034	75	49	**-26**
23	Dernaflaw WwTW	266608	409004.4	-6.9619	54.9242	394	224	**-170**
24	Gortnahey WwTW	266715.1	412001.7	-6.9595	54.9511	395	470	75
25	Bonnanaboigh WwTW	267965.5	413673.2	-6.9396	54.9660	273	400	127
26	Glack Laurel Road WwTW	262294.5	418858.5	-7.0270	55.0133	219	300	81
27	Greysteel 1 WwTW	257120.5	421170.3	-7.1074	55.0347	2181	2300	119
28	Longfield Eglinton WwTW	254480.1	422140.6	-7.1485	55.0437	232	130	**-102**
29	Killylane Eglinton WwTW	254189	421112.3	-7.1533	55.0345	103	190	87
30	Donnybrewer WwTW	251347.2	421520.6	-7.1976	55.0384	5246	7888	2642
31	Foreglen WwTW	262765.4	409376.9	-7.0217	54.9281	489	518	29
32	Feeny WwTW	262732.9	405078.4	-7.0232	54.8895	924	1353	429
33	Fincarn WwTW	263369.5	404526.1	-7.0134	54.8844	87	100	13
34	Park WwTW	259121.3	402247.4	-7.0800	54.8645	766	1087	321
35	Gortscreagan WwTW	257243.3	403755	-7.1090	54.8782	68	100	32

Map ID	Name	Easting	Northing	Longitude	Latitude	Current p.e.	Design p.e.	Available capacity
36	Mulderg WwTW	256935.1	409046.3	-7.1127	54.9258	55	99	44
37	Claudy WwTW	254678.6	407365	-7.1482	54.9109	2722	3409	687
38	Killaloo WwTW	252268.6	409189.9	-7.1855	54.9276	92	150	58
39	Ervey Road WwTW	252618	413762.2	-7.1792	54.9686	14	47	33
40	Tamnaherin WwTW	251925	416471	-7.1895	54.9930	393	470	77
41	Knockbrack WwTW	248657.9	411438.3	-7.2414	54.9482	22	36	14
42	Gosheden Two WwTW	249126.6	410900.4	-7.2342	54.9433	92	120	28
43	Legaghory WwTW	249860.2	409921.7	-7.2229	54.9344	30	50	20
44	Ardground WwTW	249473.9	407879	-7.2293	54.9161	69	100	31
45	Moneycanon WwTW	249148	402794.3	-7.2352	54.8705	37	82	45
46	Donemana WwTW	244175	403355	-7.3126	54.8760	1040	634	**-406**
47	Mountcastle WwTW	241269.5	405602.7	-7.3575	54.8964	11	18	7
48	Milltown Burndennet WwTW	239301.3	404376.5	-7.3884	54.8855	49	54	5
49	Donagheady WwTW	239541.9	405371	-7.3845	54.8945	188	300	112
50	Cullion WwTW	240437.9	407346	-7.3703	54.9121	79	100	21
51	Magheramason WwTW	239354.2	410870.8	-7.3867	54.9439	591	1200	609
52	Creaghcor WwTW	236824	409874	-7.4263	54.9351	30	18	**-12**
53	Bready WwTW	236533.3	407605.1	-7.4311	54.9148	301	400	99
54	St Johnston WWTP	234750	410000	-7.4586	54.9364	330	1050	720

Map ID	Name	Easting	Northing	Longitude	Latitude	Current p.e.	Design p.e.	Available capacity
55	Carrigans WWTP	236698	411554	-7.4280	54.9502	280	347	67
56	Molenan WwTW	239072.2	413586.9	-7.3907	54.9683	36	44	8
57	Nixons Corner WwTW	240250.8	414520.9	-7.3722	54.9766	285	520	235
58	Killea WWTP	238010	415272	-7.4071	54.9835	520	800	280
59	Glenabbey WwTW	241902.3	421369.7	-7.3454	55.0380	45	47	2
60	Culmore 2 WwTW	247510.6	423020.9	-7.2574	55.0523	133891	150075	16184
61	Greenbank No.1 Housing Scheme	250851	430502	-7.2038	55.1192	28	28	0
62	Redcastle Housing Scheme	255319	435013	-7.1329	55.1592	40	40	0
63	Moville WWTP	261019	438445	-7.0428	55.1894	1820	0	**-1820**
64	Greencastle Housing Scheme	264345	440292	-6.9901	55.2055	90	90	0

5.1.3.1 Continuous Sewage Discharges

Figure 5-9 shows the continuous sewage discharges associated with the WwTW within the Lough Foyle contributing catchment. **Table 5-3** shows the coordinates for the continuous discharges from the WwTW.

All of the WwTW shown in **Figure 5-8** above have continuous discharge pipes associated with them, however, coordinates for some discharge pipes were not available (those marked with * in **Table 5-3**). Assumptions as to the locations of their discharge pipes were made based on the plant's location in relation to the nearest water body.

In total, there were six direct discharges into Lough Foyle and the remainder discharged into rivers which ultimately discharge into the lough.

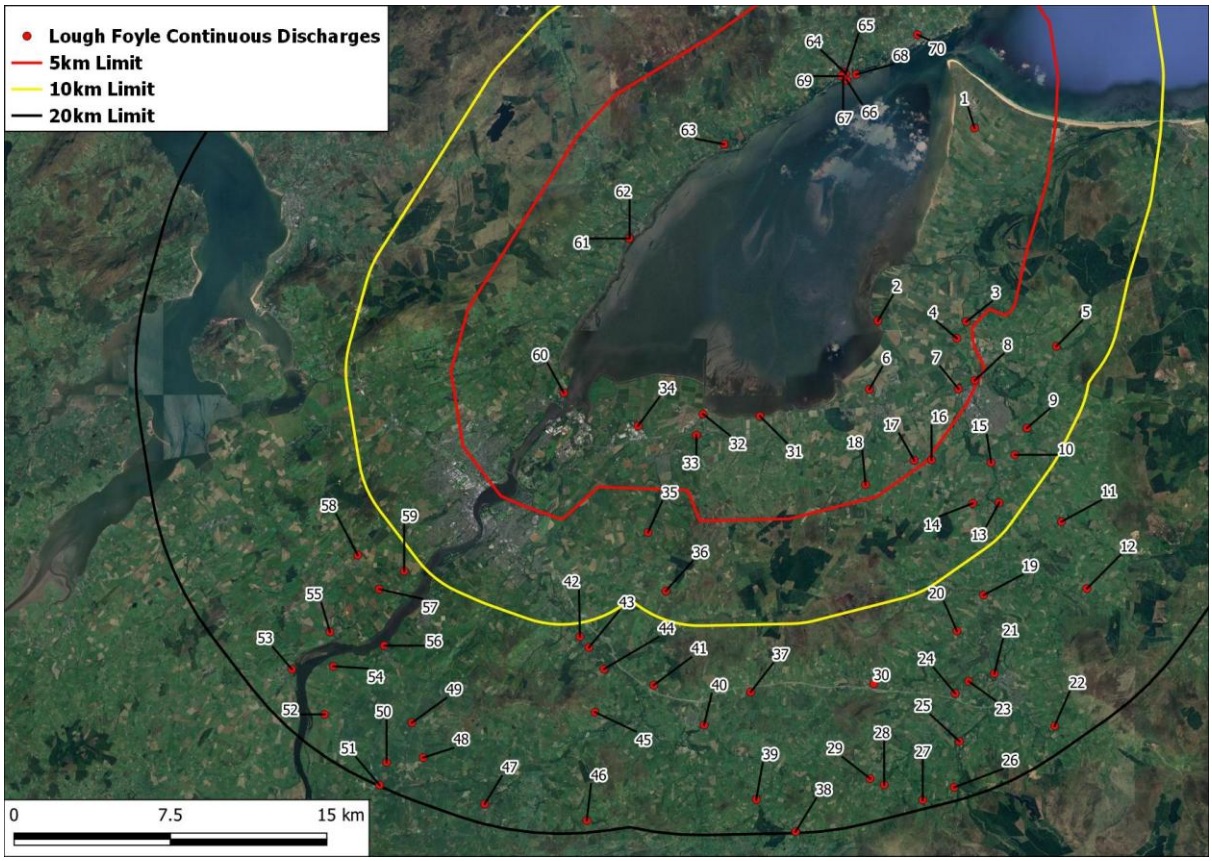

Figure 5-9: Location of continuous sewage discharges within Lough Foyle contributing catchment (source: Northern Ireland Water/EPA Maps). Map IDs are cross-referenced to Table 5-3.

Table 5-3: Wastewater Treatment Works (WwTW) continuous discharges within Lough Foyle contributing catchment (source: Northern Ireland Water/EPA Maps). Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid coordinate reference system.

Map ID	WwTW	Easting	Northing	Longitude	Latitude
1	Magilligan Point Road WwTW*	267230	435940	-6.9459	55.1661
2	Carrowclare WwTW*	262756	426701	-7.0181	55.0837
3	Aghanloo 1 WwTW	266974	426720	-6.9520	55.0833
4	Myroe WwTW	266537	425920	-6.9591	55.0762
5	Bolea WwTW	271290	425618	-6.8847	55.0728
6	Ballykelly WwTW	262397	423432	-7.0244	55.0543
7	Lisnakilly WwTW	266643	423516	-6.9580	55.0545
8	Limavady WwTW	267417	423930	-6.9458	55.0582
9	Drummond WwTW	269947	421700	-6.9067	55.0378
10	Edenmore Road WwTW	269394	420412	-6.9157	55.0263
11	Drumsurn WwTW	271668	417261	-6.8809	54.9977
12	Ballymacallion WwTW	272931	414083	-6.8620	54.9690
13	Ballyquin WwTW	268676	418121	-6.9275	55.0058
14	Largy Limavady WwTW	267412	418067	-6.9472	55.0055
15	Ardgarvan WwTW	268257	420024	-6.9335	55.0230

Map ID	WwTW	Easting	Northing	Longitude	Latitude
16	Dromore Highlands WwTW	265409	420107	-6.9780	55.0241
17	Drumraighland WwTW	264581	420078	-6.9910	55.0239
18	Glack Laurel Road WwTW	262274	418890	-7.0273	55.0136
19	Bonnanaboigh WwTW*	267998	413697	-6.9391	54.9662
20	Gortnahey WwTW	266746	411963	-6.9591	54.9508
21	Dungiven WwTW	268568	409957	-6.9311	54.9325
22	Crebarkey WwTW	271492	407496	-6.8861	54.9100
23	Owenbeg WwTW	267343	409566	-6.9503	54.9292
24	Dernaflaw WwTW	266705	408983	-6.9604	54.9240
25	Carnanbane WwTW	266939	406689	-6.9573	54.9034
26	Caugh Hill East WwTW	266730	404488	-6.9610	54.8836
27	Unknown	265230	403853	-6.9845	54.8781
28	Fincarn WwTW	263367	404563	-7.0134	54.8848
29	Feeny WwTW	262687	404851	-7.0239	54.8874
30	Foreglen WwTW	262806	409385	-7.0211	54.9281
31	Greysteel 1 WwTW	257188	422084	-7.1062	55.0429
32	Longfield Eglinton WwTW*	254473	422149	-7.1486	55.0438
33	Killylane Eglinton WwTW	254164	421135	-7.1537	55.0347
34	Donnybrewer WwTW*	251370	421545	-7.1973	55.0387

Map ID	WwTW	Easting	Northing	Longitude	Latitude
35	Tamnaherin WwTW*	251914	416478	-7.1897	54.9931
36	Ervey Road WwTW*	252795	413684	-7.1764	54.9679
37	Mulderg WwTW	256914	408908	-7.1131	54.9246
38	Park WwTW	259155	402261	-7.0795	54.8646
39	Gortscreagan WwTW	257244	403772	-7.1089	54.8784
40	Claudy WwTW	254702	407310	-7.1479	54.9105
41	Killaloo WwTW	252272	409187	-7.1854	54.9276
42	Knockbrack WwTW*	248710	411463	-7.2406	54.9484
43	Gosheden Two WwTW	249143	410946	-7.2339	54.9437
44	Legaghory WwTW*	249874	409924	-7.2227	54.9344
45	Ardground WwTW	249466	407860	-7.2294	54.9159
46	Moneycanon WwTW	249131	402669	-7.2355	54.8693
47	Donemana WwTW	244229	403413	-7.3117	54.8765
48	Mountcastle WwTW	241264	405603	-7.3576	54.8964
49	Cullion WwTW	240706	407267	-7.3661	54.9114
50	Donagheady WwTW*	239505	405368	-7.3851	54.8944
51	Milltown Burndennet WwTW	239181	404268	-7.3903	54.8846
52	Bready WwTW*	236514	407631	-7.4314	54.9150

Map ID	WwTW	Easting	Northing	Longitude	Latitude
53	St Johnston WWTP	234933	409773	-7.4558	54.9343
54	Creaghcor WwTW*	236924	409930	-7.4247	54.9356
55	Carrigans WWTP	236740	411575	-7.4274	54.9504
56	Magheramason WwTW*	239349	410941	-7.3867	54.9445
57	Molenan WwTW	239087	413633	-7.3905	54.9687
58	Killea WWTP	238038	415251	-7.4066	54.9833
59	Nixons Corner WwTW*	240268	414512	-7.3719	54.9765
60	Culmore 2 WwTW*	247810	423091	-7.2527	55.0529
61	Greenbank No. 1 housing scheme	250850	430466	-7.2038	55.1188
62	Greenbank No. 1 housing scheme	250868	430492	-7.2035	55.1191
63	Redcastle housing scheme	255311	435005	-7.1330	55.1591
64	Moville WWTP	261001	438502	-7.0430	55.1899
65	Moville WWTP	261057	438421	-7.0422	55.1891
66	Moville WWTP	261119	438119	-7.0413	55.1864
67	Moville WWTP	260940	438308	-7.0440	55.1881
68	Moville WWTP	261566	438400	-7.0342	55.1889
69	Moville WWTP	260850	438313	-7.0454	55.1882

Map ID	WwTW	Easting	Northing	Longitude	Latitude
70	Greencastle housing scheme	264445	440330	-6.9885	55.2058

5.1.3.2 Rainfall Dependent Sewage Discharges

Figure 5-10 to **Figure 5-15** show all rainfall dependent discharges *i.e.,* overflows, group septic tanks, and private sewage treatment, for which data was available within Lough Foyle contributing catchment. **Table 5-4** documents the Combined Sewer Overflows (CSO) and Sewage Pumping Station (SPS) overflows which discharge either directly or via a tributary into Lough Foyle. A combined sewer outflow collects both sewage and rainwater in a single pipe system, whereas a foul sewer outflow is designed to collect and transport wastewater discharges only. **Table 5-5** documents the septic tanks within the contributing catchment and **Figure 5-14** represents this information visually. There is no database showing the location of private sewage treatment facilities in the Republic of Ireland, however according to CSO data derived from the 2022 census, in Co. Donegal there are 31,576 individual septic tanks, 2,155 other individual treatment, and 607 other treatments not stated.

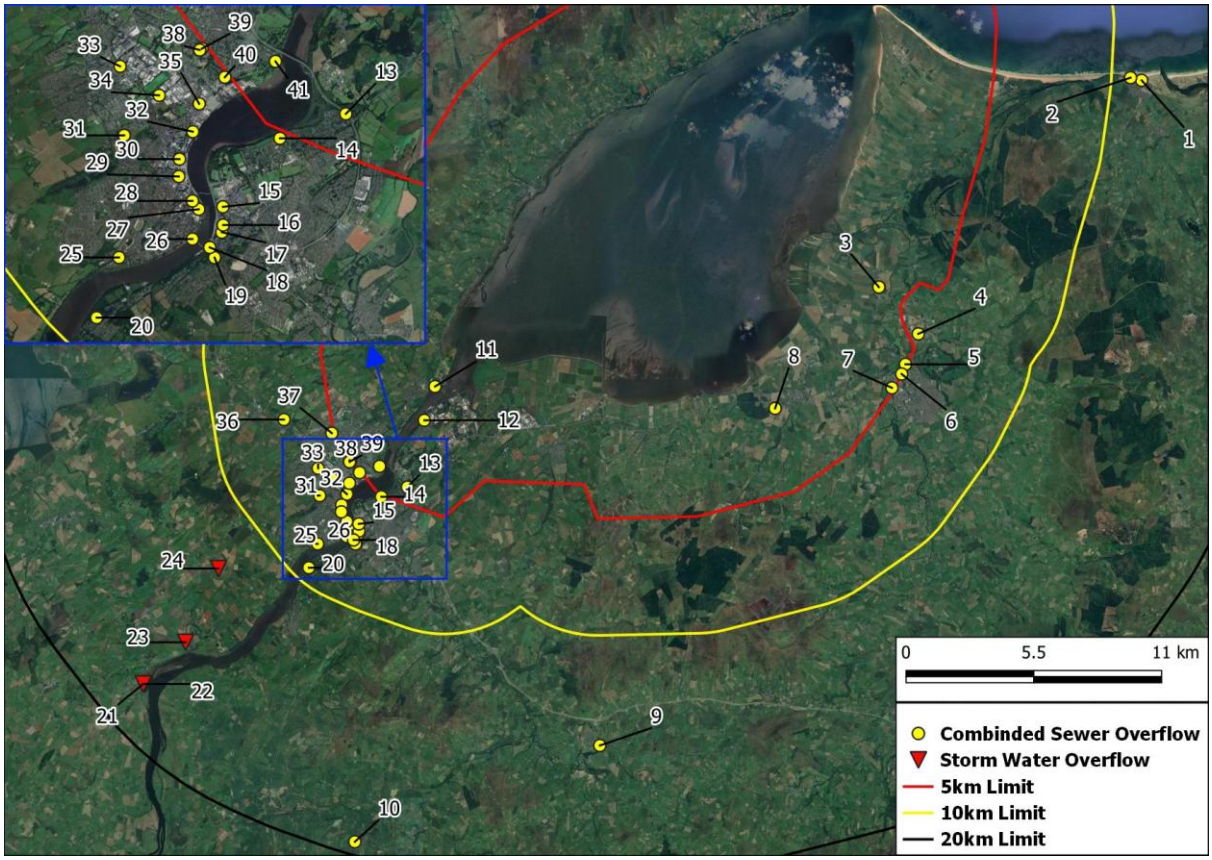

Figure 5-10: All storm water and combined sewer overflow discharges within Lough Foyle contributing catchment (source: Northern Ireland Water/EPA Maps). Map IDs are cross-referenced to Table 5-4.

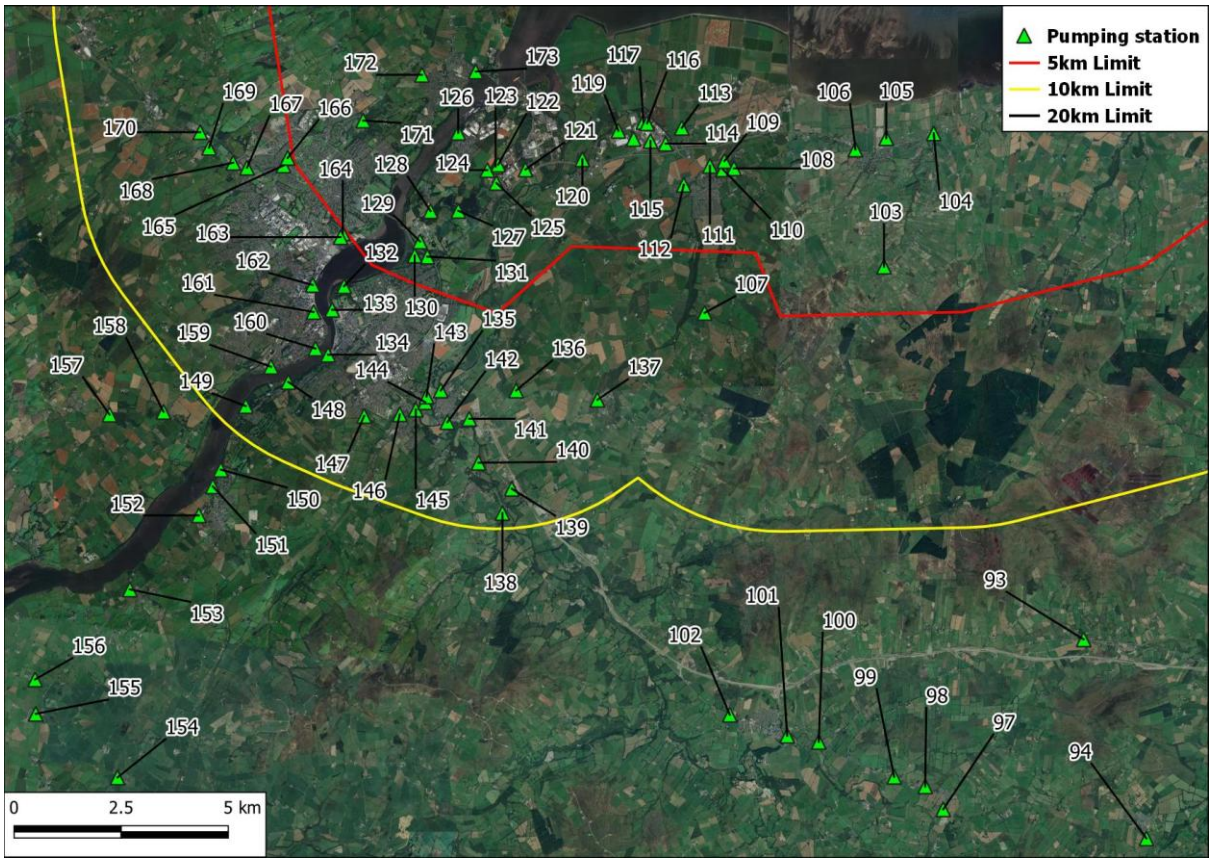

Figure 5-11: All pumping station overflow discharges within the contributing catchment to the south of Lough Foyle (source: Northern Ireland Water). Map IDs cross-referenced to Table 5-4.

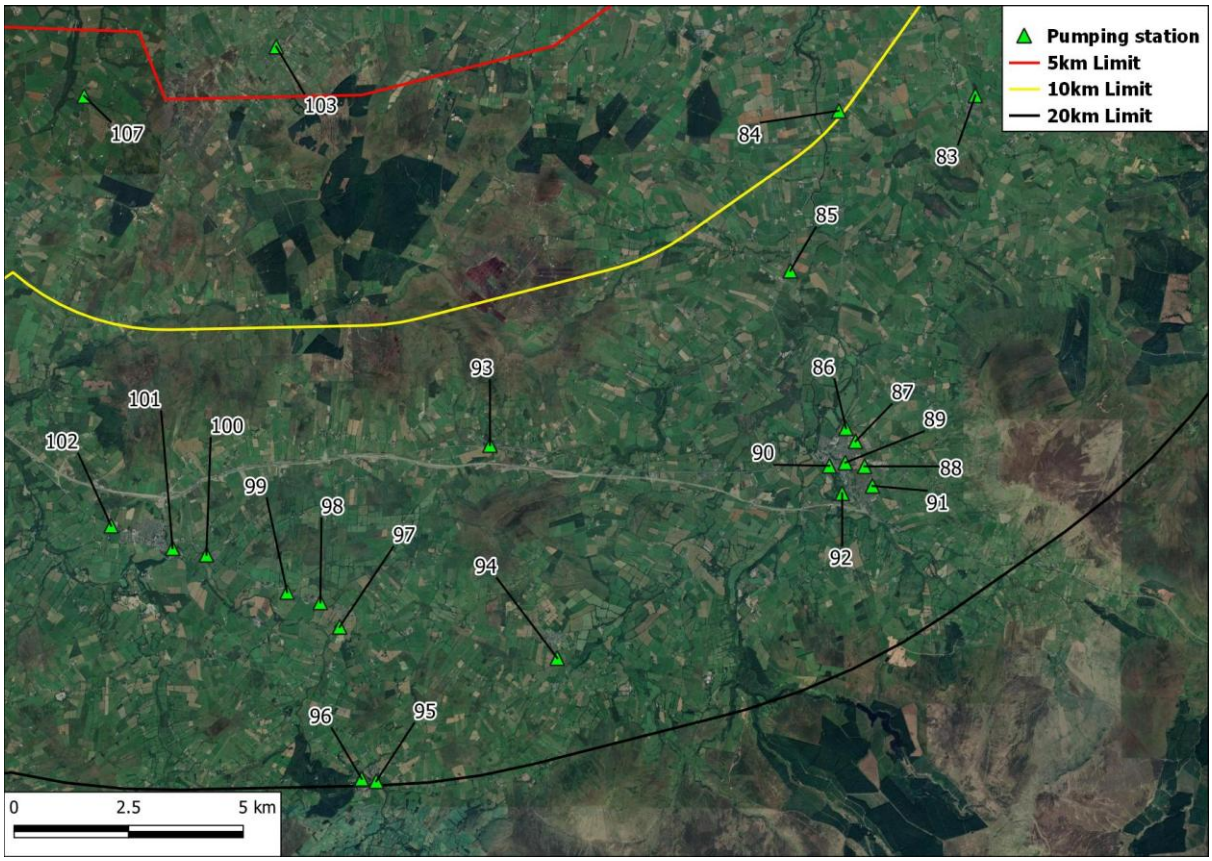

Figure 5-12: All pumping station overflow discharges within the contributing catchment to the southeast of Lough Foyle (source: Northern Ireland Water). Map IDs cross-referenced to Table 5-4.

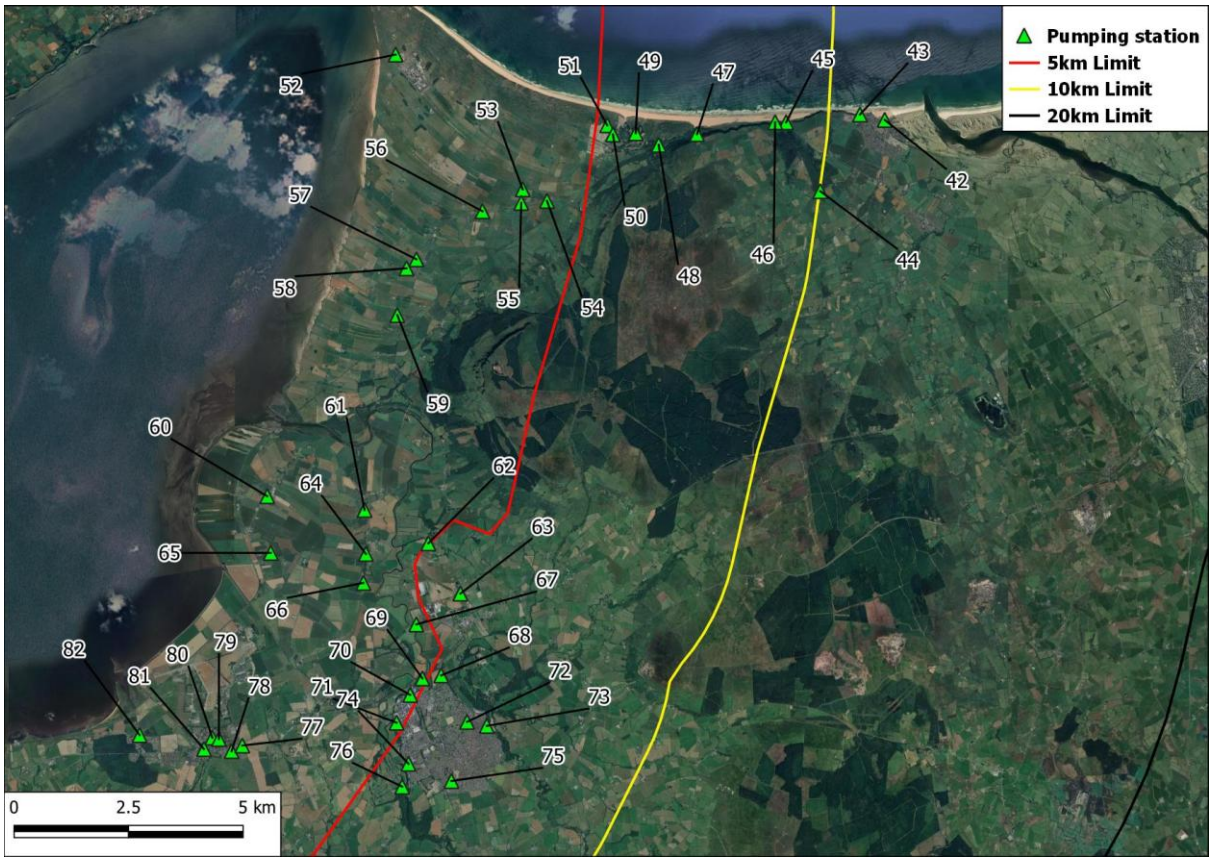

Figure 5-13: All pumping station overflow discharges within the contributing catchment to the east of Lough Foyle (source: Northern Ireland Water). Map IDs cross-referenced to Table 5-4.

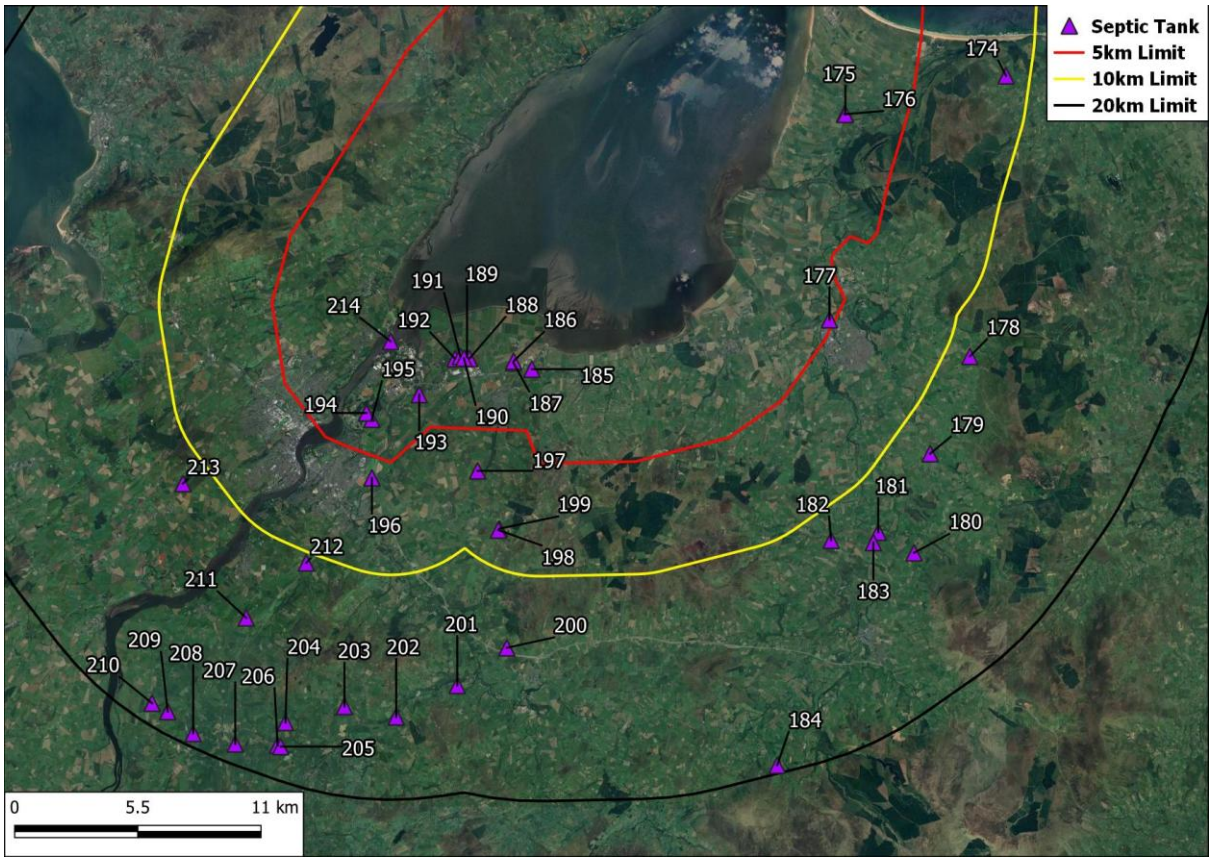

Figure 5-14: All septic tanks within Lough Foyle contributing catchment (source: Northern Ireland Water). Map IDs cross-referenced to Table 5-5.

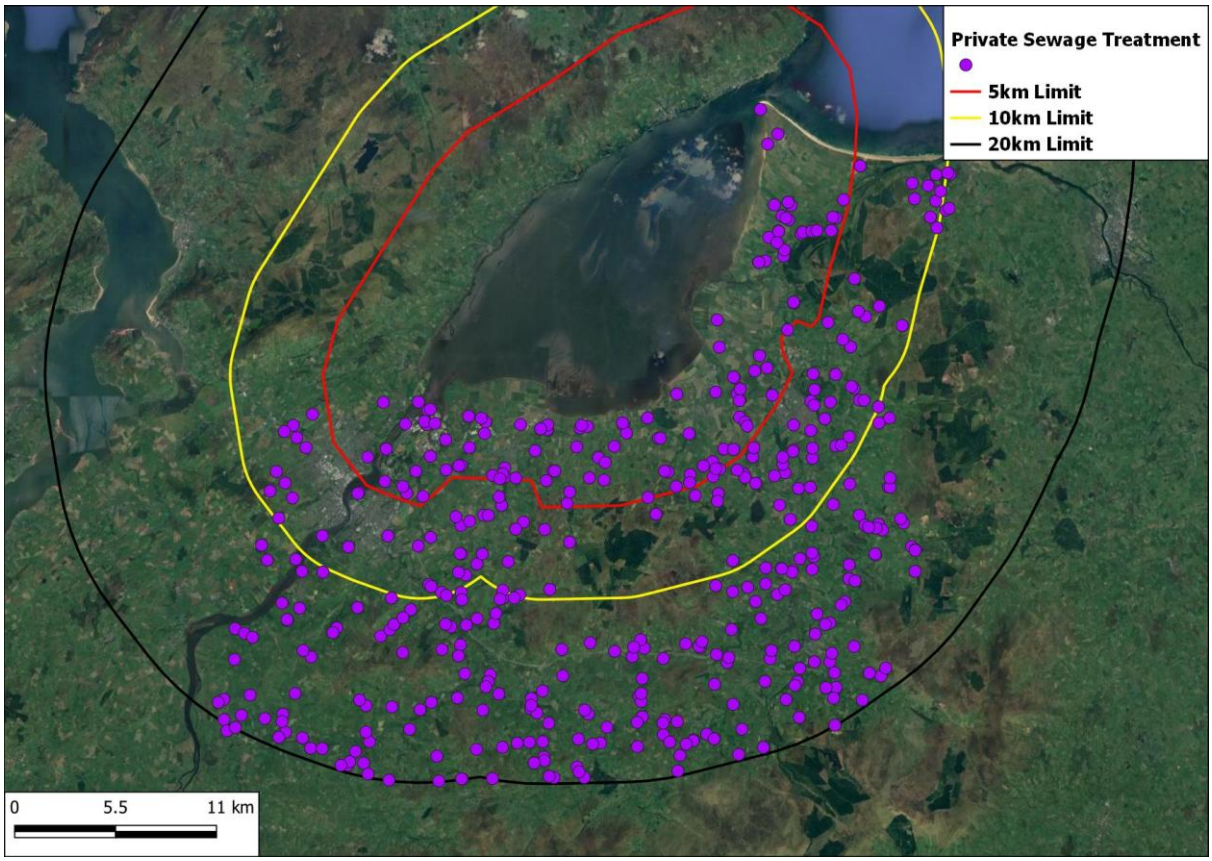

Figure 5-15: All private sewage systems within Lough Foyle contributing catchment (source: Northern Ireland Water).

Table 5-4: Combined Sewer Overflow (CSO), Sewage Pumping Station (SPS), and Wastewater Pumping Station (WwPS) overflows within Lough Foyle contributing catchment (source: Northern Ireland Water/EPA Maps). Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid coordinate reference system.

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
1	Promenade Castlerock CSO	-6.7863	55.1663	277349.832	436159	Combined
2	Main Street Swimming Pool CSO	-6.7937	55.1673	276875.884	436264	Combined
3	Seacoast Road CSO	-6.9625	55.0870	266251.6857	427149	Combined
4	Road Service Yard CSO	-6.9361	55.0690	267969.104	425173	Combined
5	Limavady CSO	-6.9446	55.0574	267441.599	423865	Combined
6	Ballyclose Street CSO	-6.9472	55.0536	267284.368	423446	Combined
7	Roemill Road CSO	-6.9537	55.0483	266877.821	422849	Combined
8	Foyle Drive CSO	-7.0321	55.0404	261881.274	421897	Foul
9	Pinewood Crescent CSO	-7.1496	54.9106	254541.988	407350	Combined
10	Berryhill Road Dunamanagh CSO	-7.3139	54.8735	244046.537	403099	Combined
11	Culmore Point Coney CSO	-7.2601	55.0488	247290.95	422655	Combined
12	Strathfoyle CSO	-7.2673	55.0358	246846.568	421205	Combined
13	Caw CSO	-7.2786	55.0101	246152.675	418337	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
14	Caw Park CSO	-7.2961	55.0064	245037.915	417911	Combined
15	Alfred Street Florence CSO	-7.3112	54.9960	244081.557	416740	Combined
16	Bonds Hill CSO	-7.3112	54.9932	244089.0538	416432	Combined
17	Duke Street Roundabout CSO	-7.3115	54.9921	244066.755	416310	Combined
18	Duke Street CSO	-7.3147	54.9898	243864.68	416050	Combined
19	Dunfield Terrace 2 CSO	-7.3135	54.9883	243948.503	415879	Combined
20	Victoria Road Prehen CSO	-7.3447	54.9791	241955.157	414841	Combined
21	St Johnston SW004	-7.4558	54.9343	234933	409773	Storm water overflow
22	St Johnston SW003	-7.4548	54.9343	234999	409771	Storm water overflow
23	Carrigans	-7.4274	54.9504	236740	411575	Storm water overflow
24	Killea	-7.4053	54.9788	238126	414747	Storm water overflow
25	Lone Moor Road Brandywell CSO	-7.3388	54.9883	242325.318	415865	Combined
26	Foyle Road Craigavon Bridge CSO	-7.3193	54.9911	243570.489	416189	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
27	Orchard Street CSO	-7.3177	54.9956	243672.146	416695	Combined
28	Union Hall Place CSO	-7.3193	54.9969	243563.998	416836	Combined
29	Clarendon Terrace CSO	-7.3229	55.0006	243328.07	417247	Combined
30	Lawrence Hill CSO	-7.3228	55.0032	243336.346	417542	Combined
31	Glen Road Derry CSO	-7.3374	55.0069	242394.21	417936	Combined
32	Rock Road CSO	-7.3192	55.0074	243558.001	418009	Combined
33	Northland Road Spring Town CSO	-7.3385	55.0174	242313.6558	419104	Combined
34	Northland Playing Fields CSO	-7.3282	55.0130	242981.018	418619	Combined
35	Duncreggan Road CSO	-7.3175	55.0117	243661.89	418482	Combined
36	Buncrana Road CSO	-7.3614	55.0361	240832.292	421177	Foul
37	Fairview Knockalla Shantallow CSO	-7.3293	55.0309	242887.8745	420613	Combined
38	Racecourse Road One CSO	-7.3174	55.0199	243661.997	419394	Combined
39	Racecourse Road Two CSO	-7.3168	55.0201	243698.999	419418	Combined
40	Culmore Road Belmont CSO	-7.3107	55.0157	244092.839	418937	Combined
41	Gleneagles CSO	-7.2973	55.0181	244948.828	419214	Combined
42	Castlerock Promenade WwPS	-6.7873	55.1668	277329.16	436183	Combined
43	Castlerock Coastguard WwPS	-6.7958	55.1678	276788.25	436291	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
44	Ballywoodock WwPS	-6.8093	55.1528	275953.59	434611	Combined
45	Downhill Hotel WwPS	-6.8210	55.1663	275185.01	436095	Combined
46	Downhill Roadside WwPS	-6.8248	55.1663	274946.12	436093	Combined
47	Umbra Waterfall WwPS	-6.8514	55.1640	273249.64	435806	Foul
48	Umbra Level Crossing WwPS	-6.8645	55.1619	272419.99	435559	Foul
49	Benone Tourist Complex WwPS	-6.8724	55.1642	271915.7	435804	Foul
50	Benone Avenue North WwPS	-6.8801	55.1639	271420.67	435769	Foul
51	Benone One WwPS	-6.8821	55.1657	271292.77	435967	Foul
52	Lower Doaghs Magilligan TPS	-6.9543	55.1795	266665.67	437430	Foul
53	Aughil St Aidans TPS	-6.9110	55.1532	269475.75	434545	Combined
54	Aughil Seacoast East WwPS	-6.9027	55.1509	270008.47	434302	Foul
55	Aughil Tircreven TPS	-6.9115	55.1506	269447.87	434251	Foul
56	Clooney 504-524 TPS	-6.9247	55.1489	268606.83	434056	Combined
57	Carriage Court WwPS	-6.9472	55.1395	267185.05	432988	Foul
58	Drumavally WwPS	-6.9506	55.1378	266971.99	432789	Combined
59	Oughtymoyle 2 WwPS	-6.9538	55.1287	266786.89	431770	Combined
60	Carrowclare Road WwPS	-6.9982	55.0933	264010.53	427788	Foul
61	Crindle WwPS	-6.9650	55.0906	266135.7	427520	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
62	Dowland WwPS	-6.9432	55.0841	267537.98	426815	Foul
63	Aghanloo Industrial Estate WwPS	-6.9322	55.0742	268254.06	425731	Foul
64	Myroe Sids WwPS	-6.9645	55.0820	266179.13	426564	Combined
65	Ballymacran WwPS	-6.9970	55.0822	264105.38	426556	Foul
66	Lomond WwPS	-6.9653	55.0763	266135.06	425932	Combined
67	Aghanloo Dowland Park WwPS	-6.9473	55.0682	267302.36	425046	Combined
68	The Brickfields WwPS	-6.9388	55.0582	267861.33	423943	Foul
69	Limavady IPS	-6.9452	55.0576	267453.46	423871	Final Effluent
70	Roeville Terrace WwPS	-6.9494	55.0544	267192.49	423508	Foul
71	Catherine Street WwPS	-6.9540	55.0490	266903.93	422898	Combined
72	Castle Park Limavady WwPS	-6.9300	55.0491	268441.87	422940	Foul
73	Bovally WwPS	-6.9232	55.0483	268872.67	422858	Foul
74	Coolessan WwPS	-6.9500	55.0409	267176.81	422008	Foul
75	Whitehill WwPS	-6.9353	55.0375	268120.39	421646	Foul
76	Radison Roe Park WwPS	-6.9521	55.0364	267047.95	421506	Foul
77	Kings Lane 62 WwPS	-7.0067	55.0445	263543.56	422351	Foul
78	Drummond Park WwPS	-7.0104	55.0434	263310.99	422227	Foul
79	Church Hill House WwPS	-7.0147	55.0458	263031.64	422487	Foul

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
80	Dukes Lane WwPS	-7.0170	55.0460	262886.08	422515	Foul
81	Plantation Road WwPS	-7.0198	55.0438	262708.87	422263	Foul
82	Walworth WwPS	-7.0418	55.0465	261298.58	422548	Foul
83	Drumsurn Rushie WwPS	-6.8758	54.9988	271992.27	417389	Foul
84	Ballyquin Road WwPS	-6.9222	54.9958	269029.71	417007	Foul
85	Burnfoot WwPS	-6.9387	54.9645	268026.26	413516	Foul
86	Browns Bridge WwPS	-6.9198	54.9338	269292.01	410113	Foul
87	Rannyglas WwPS	-6.9165	54.9313	269503.95	409831	Foul
88	OCahan Place WwPS	-6.9135	54.9264	269708.5	409291	Foul
89	Hass Road WwPS	-6.9200	54.9271	269288.96	409364	Foul
90	Kevin Lynch Park WwPS	-6.9254	54.9265	268942.62	409289	Foul
91	Greenhaven WwPS	-6.9108	54.9225	269887.87	408867	Foul
92	Bleech Green Lane WwPS	-6.9211	54.9211	269229.54	408699	Foul
93	Muldonagh WwPS	-7.0407	54.9305	261542.65	409632	Combined
94	Glenedra Road WwPS	-7.0179	54.8889	263072.76	405020	Foul
95	Altinure Road WwPS	-7.0794	54.8648	259162.55	402285	Combined
96	Millside Crescent WwPS	-7.0843	54.8653	258842.43	402334	Combined
97	Clagan Claudy WwPS	-7.0918	54.8950	258318.98	405635	Foul
98	Killycor WwPS	-7.0984	54.8998	257891.41	406163	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
99	Glenshane Road WwPS	-7.1097	54.9018	257164.5	406377	Combined
100	Kinculbrack WwPS	-7.1371	54.9091	255395.04	407167	Combined
101	Claudy IPS	-7.1486	54.9104	254656.31	407301	Foul
102	Cregg WwPS	-7.1695	54.9148	253311.36	407774	Foul
103	Killywool WwPS	-7.1134	55.0083	256776.56	418229	Foul
104	Faughanvale WwPS	-7.0953	55.0361	257894.01	421336	Foul
105	Foyle Avenue WwPS	-7.1125	55.0351	256791.56	421210	Foul
106	Clooney Road Greysteel WwPS	-7.1238	55.0327	256077.1	420939	Foul
107	Gortinreid Bridge WwPS	-7.1786	54.9987	252614.09	417106	Combined
108	Killylane Muff WwPS	-7.1680	55.0288	253257.21	420466	Combined
109	St Canices Park One WwPS	-7.1714	55.0303	253033.82	420634	Combined
110	St Canices Park Two WwPS	-7.1719	55.0286	253002.4	420440	Foul
111	Eglinton Cottage Way WwPS	-7.1767	55.0293	252697.71	420517	Combined
112	Dunboyne Park WwPS	-7.1862	55.0254	252094.37	420073	Foul
113	Station Road Eglinton WwPS	-7.1870	55.0372	252031.34	421391	Foul
114	Decks WwPS	-7.1928	55.0339	251660.19	421021	Foul
115	Courtauld Way One WwPS	-7.1983	55.0345	251306.76	421079	Foul
116	Donnybrewer IPS	-7.1995	55.0382	251225.32	421489	Final Effluent

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
117	Courtauld Way Three WwPS	-7.2009	55.0384	251139.65	421519	Foul
118	Courtauld Way Two WwPS	-7.2045	55.0349	250914.18	421122	Combined
119	Transtec WwPS	-7.2100	55.0366	250558.51	421305	Combined
120	Campsie Eglinton WwPS	-7.2231	55.0307	249728.17	420635	Combined
121	Carrakeel Drive WwPS	-7.2438	55.0285	248407.5	420385	Combined
122	Maydown Carrakeel 2 WwPS	-7.2537	55.0296	247772.84	420492	Combined
123	PSNI Maydown Two WwPS	-7.2547	55.0291	247710.85	420445	Foul
124	PSNI Maydown One WwPS	-7.2577	55.0284	247520.89	420362	Foul
125	Templetown Park WwPS	-7.2544	55.0257	247734.69	420066	Foul
126	Strathfoyle 2 WwPS	-7.2683	55.0362	246833.66	421222	Combined
127	Judges Road WwPS	-7.2682	55.0199	246855.43	419409	Foul
128	Gransha Park 2 WwPS	-7.2783	55.0199	246208.79	419396	Combined
129	Gransha Hospital WwPS	-7.2822	55.0135	245971.55	418688	Foul
130	Waterfoot Caw WwPS	-7.2841	55.0106	245849.72	418361	Foul
131	Caw WwPS	-7.2795	55.0104	246145.39	418339	Foul
132	St Columbs Park Clooney WwPS	-7.3098	55.0042	244213.03	417634	Foul
133	Browning Drive WwPS	-7.3141	54.9993	243942.2	417083	Foul
134	Duke Street 2 WwPS	-7.3156	54.9899	243857.23	416039	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
135	Faughan Crescent WwPS	-7.2746	54.9825	246488.99	415236	Combined
136	Gortree Road WwPS	-7.2472	54.9824	248245.55	415252	Combined
137	Lettershendony 2 WwPS	-7.2176	54.9805	250140.68	415059	Combined
138	Berryburn Ardkill WwPS	-7.2522	54.9569	247956.33	412405	Foul
139	Cross Drumahoe WwPS	-7.2488	54.9619	248167.64	412969	Combined
140	Bleach Green WwPS	-7.2609	54.9674	247387.04	413566	Combined
141	Beeches Drumahoe WwPS	-7.2643	54.9766	247160.27	414586	Foul
142	Old Mill Mews Drumahoe WwPS	-7.2722	54.9759	246651.78	414502	Foul
143	Three Mile WwPS	-7.2798	54.9812	246159.08	415091	Combined
144	Drumahoe WwPS	-7.2803	54.9800	246131.17	414959	Combined
145	Riverside Park WwPS	-7.2837	54.9785	245912.01	414787	Foul
146	Tullyally West WwPS	-7.2895	54.9775	245541.26	414672	Foul
147	Trench Road 18 WwPS	-7.3025	54.9772	244710.27	414627	Combined
148	Boat House Prehen WwPS	-7.3301	54.9842	242936	415397	Foul
149	Prehen WwPS	-7.3456	54.9792	241951.48	414828	Combined
150	Dunhugh Manor WwPS	-7.3546	54.9659	241382.99	413345	Foul
151	New Buildings WwPS	-7.3576	54.9624	241200.66	412956	Combined

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
152	New Buildings Desmonds WwPS	-7.3626	54.9564	240881.45	412279	Foul
153	Dunnalong Road WwPS	-7.3877	54.9409	239288.69	410543	Foul
154	Tamnabryan WwPS	-7.3922	54.9017	239037.8	406168	Combined
155	Bready Church WwPS	-7.4220	54.9149	237116.8	407631	Foul
156	Bready Primary School WwPS	-7.4222	54.9221	237094.5	408431	Foul
157	Ballougry Hill Road Killea WwPS	-7.3951	54.9774	238779.22	414601	Foul
158	Ballinacross Meadows WwPS	-7.3755	54.9780	240036.59	414677	Foul
159	Coshowen Foyle Road WwPS	-7.3364	54.9874	242530.71	415746	Combined
160	Foyle Road Craigavon Bridge WwPS	-7.3202	54.9912	243562	416179	Combined
161	Victoria Market Car Park WwPS	-7.3209	54.9988	243509.49	417028	Combined
162	Queens Quay WwPS	-7.3212	55.0045	243483.73	417655	Combined
163	Bay Road Shell WwPS	-7.3111	55.0144	244121	418771	Surface
164	Pennyburn WwPS	-7.3103	55.0152	244170.95	418859	Combined
165	Galliagh Park WwPS	-7.3318	55.0294	242777.09	420420	Foul
166	Fairview Knockalla 2 WwPS	-7.3303	55.0310	242871.7	420599	Foul
167	Upper Galliagh Road WwPS	-7.3451	55.0289	241927.72	420361	Foul

Map ID	Name	Longitude	Latitude	Easting	Northing	Function
168	Skeoge Link Roundabout WwPS	-7.3501	55.0299	241605.99	420473	Foul
169	Coshquin West WwPS	-7.3589	55.0331	241039.44	420816	Foul
170	Buncrana Road WwPS	-7.3622	55.0363	240830.8	421176	Foul
171	Ballyarnet Springfield WwPS	-7.3029	55.0387	244617.76	421480	Foul
172	Spruce Meadows WwPS	-7.2815	55.0483	245976.6	422556	Foul
173	Culmore Point Front Strand WwPS	-7.2619	55.0489	247226.55	422645	Combined

Table 5-5: Septic tanks within Lough Foyle contributing catchment (source: Northern Ireland Water). Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid coordinate reference system.

Map ID	Name	Longitude	Latitude	Easting	Northing
174	Ballyhacket Road 2-8 ST	-6.8264	55.1525	274865	434550
175	Limestone Road Two ST	-6.9382	55.1371	267767	432726
176	Limestone Road One ST	-6.9389	55.1372	267724	432732
177	Roeside ST	-6.9492	55.0554	267200	423615

Map ID	Name	Longitude	Latitude	Easting	Northing
178	Ballyavelin Road ST	-6.8516	55.0408	273464	422090
179	Drumsurn Road 234-238 ST	-6.8793	55.0020	271765	417740
180	Gortnagross Road 38-40 ST	-6.8904	54.9624	271121	413323
181	Drumneechy ST	-6.9153	54.9706	269513	414213
182	Bovevagh Road 37-41 ST	-6.9481	54.9674	267419	413826
183	Derryork Road 33-35 ST	-6.9187	54.9665	269303	413752
184	Glenedra Road 109-111 ST	-6.9856	54.8774	265163	403774
185	Brisland Road 3-5 ST	-7.1562	55.0357	254001	421243
186	Airfield Road ST	-7.1689	55.0388	253184	421587
187	Airfield Road Meat Plant ST	-7.1690	55.0382	253176	421517
188	McLean Road One ST	-7.1996	55.0399	251220	421680
189	McLean Road Two ST	-7.2012	55.0405	251114	421750
190	Donnybrewer Road 97-99 ST	-7.2034	55.0400	250974	421694
191	Donnybrewer Road 98-100 ST	-7.2059	55.0408	250817	421776
192	Donnybrewer Road 88 ST	-7.2096	55.0398	250579	421667
193	Faughan ST	-7.2345	55.0255	249005	420057
194	Gransha Stradreagh More ST	-7.2712	55.0182	246667	419216
195	Stradreagh Grandha Park ST	-7.2675	55.0157	246910	418936
196	Ardlough Road ST	-7.2674	54.9923	246939	416336

Map ID	Name	Longitude	Latitude	Easting	Northing
197	Edenreagh Road 39-41 ST	-7.1939	54.9951	251640	416701
198	Ervey Road 62 ST	-7.1795	54.9715	252594	414078
199	Ervey Road 66 ST	-7.1788	54.9720	252638	414140
200	Foreglen Road 51-53 ST	-7.1736	54.9244	253032	408847
201	Bonds Glen Road 149-151 ST	-7.2081	54.9094	250843	407146
202	Bonds Glen Road 65-67 ST	-7.2505	54.8968	248134	405715
203	Glenagoorland ST	-7.2865	54.9010	245821	406156
204	Castlemellan Upper ST	-7.3275	54.8946	243198	405420
205	Tullyard Donemana ST	-7.3309	54.8849	242991	404341
206	Castlemellan Lower ST	-7.3330	54.8855	242855	404405
207	Ballyheather Road121-123 ST	-7.3625	54.8860	240963	404437
208	Whin Road 21-23 ST	-7.3917	54.8902	239083	404892
209	Willow Road ST	-7.4094	54.8989	237941	405855
210	Victoria Road 277-279 ST	-7.4203	54.9023	237237	406222
211	Duncastle Road 52-60 ST	-7.3548	54.9364	241402	410058
212	Trench Road 66-70 ST	-7.3131	54.9584	244053	412527
213	Killea ST	-7.3988	54.9900	238532	416003
214	Culmore Point ST	-7.2544	55.0467	247710	422403

5.1.4 Industrial Discharges

Industrial discharges and the associated discharge licenses vary, those that include the discharge of wastewater to aquatic environments have been considered in this review. **Figure 5-16** shows all the industrial discharges within Lough Foyle contributing catchment accounted for in the previous desk-based assessment (2021) and **Figure 5-17** shows the current industrial discharges identified in the current desk-based assessment (2024). In 2021, there were 194 industrial consents in Northern Ireland (DAERA information request viewer) of which there were 144 site drainage sites, 21 waste disposal sites, eight mineral extraction facilities, eight vehicle washing facilities, four timber processing sites, three textile facilities, two food processing facilities (fish farm and fish hatchery), one water cooling facility and one wheel washing facility. In 2024, there were 342 industrial consents of which there were 249 site drainages, 37 waste disposal sites, 19 mineral extraction facilities, 13 food processing facilities, ten vehicle washing facilities, five timber processing facilities, four water cooling facilities, two swimming pool facilities, one wheel washer, one boiler blow down facility, and one electroplating facility.

A Section 4 discharge licence allows for the discharge of trade or sewage effluent to waters. Under the Local Government (Water Pollution) Acts 1977 and 1990, Donegal County Council grants licences within the Republic of Ireland for Lough Foyle contributing catchment. There are eight Section 4 discharge licences within the Donegal area of the contributing catchment, as identified on EPA Maps (EPA Maps). Each Section 4 discharge licence has various stipulations to reduce pollution and monitor discharges, however this information was not available at the time of writing this report. There were two industrial facilities with industrial emissions licences within the contributing catchment, however only one of these has emissions to water that may impact pollution as defined in this sanitary survey. Donegal Meat Processors Limited operates a cattle slaughtering and processing plant at Drumnashear whereby processed effluent is treated on-site prior to discharge to the Foyle and Faughan estuaries and sludge from the WWTP is land-spread according to relevant legislation at the time of licence approval (see Licence Registration No P0187-03 at EPA Licensing). Control and monitoring measures include sampling, analysis, measurements, examinations, maintenance, and calibrations (see Licence Registration No P0187-03 at EPA Licensing). **Table 5-6** provides further details on the facilities within the

Republic of Ireland whereby Map IDs are cross-referenced to the Section 4/Industrial Emissions licences.

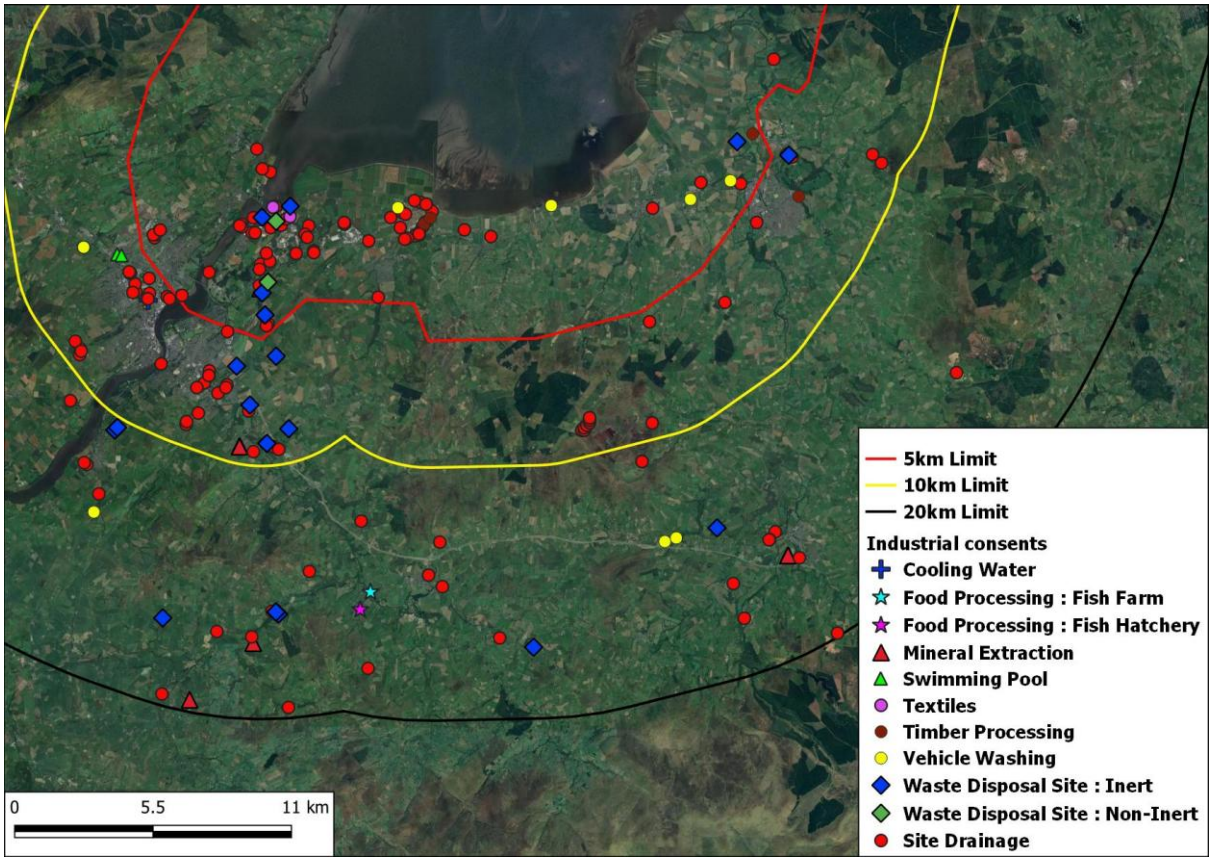

Figure 5-16: All industrial discharges within Lough Foyle contributing catchment in 2021 (Source: NIEA water information request viewer).

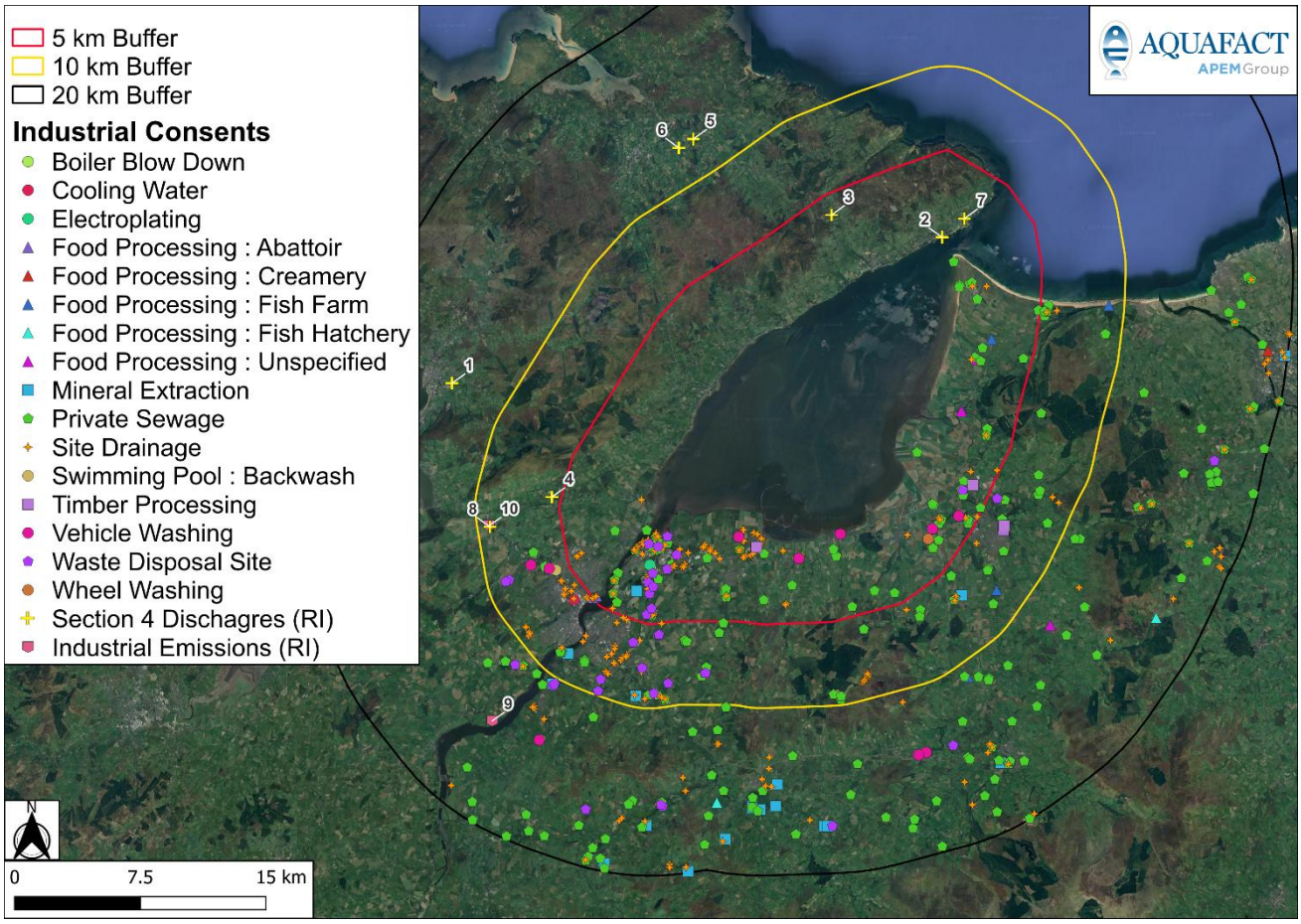

Figure 5-17: All current industrial discharges within Lough Foyle contributing catchment (source: NIEA Water). Section 4 and industrial emissions licensed facilities in the Republic of Ireland are included and data are cross-referenced to Table 5-6. This information is not included for Northern Ireland as there is no available additional information to provide in relation to these industrial consents.

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Table 5-6: Licensed Section 4 discharges and industrial emissions in Lough Foyle contributing catchment (source: EPA).

Map ID	Licence ID	Licence Holder	Facility Address	Emission Type	Discharge (m^3/day)	Receiving water body	Facility Type
1	Lwat5	Cassidy Brothers Concrete Products Ltd.	Gransha, Buncrana, Co. Donegal	Section 4	200	River Mill	Quarry
2	Lwat38	Castle Inn (Greencastle) Ltd.	Greencastle, Liford, Co. Donegal	Section 4	Not Available	N/A	N/A
3	Lwat39	Davey Transport Ltd.	Terryrone, Moville, Lifford, Co. Donegal	Section 4	50	Bredagh River	Quarry
4	Lwat43	J Barr Manufacturers	Burnfoot, Lifford, Co. Donegal	Section 4	60	Burnfoot River	Quarry
5	Lwat60	Roadstone Ltd.	Cashel, Carndonagh, Lifford, Co. Donegal	Section 4	2107	Culdaff River	Quarry
6	Lwat61	Roadstone Ltd.	Carrickfoden, Carndonagh, Lifford, Co. Donegal	Section 4	845	Culdaff River	Quarry

Map ID	Licence ID	Licence Holder	Facility Address	Emission Type	Discharge (m^3/day)	Receiving water body	Facility Type
7	Lwat72	Greencastle Cove Caravan Park	Greencastle, Co. Donegal (Post: Carrowhugh Investments Ltd., T/A Greencastle Cove Leisure Homes, 22 Academy Court, Oliver Plunkett Road, Letterkenny)	Section 4	112	coastal waterbody	Caravan and Holiday Park
8	Lwat85	E & I Engineering	E & I Engineering Ltd., Ballyderowen & Inch Level, Burnfoot, Lifford, Co. Donegal	Section 4	15	Groundwater	Quarry
9	P0187-03	Donegal Meat Processors	Drumnashear, Carrigans, Donegal	Industrial Emission	N/A	Foyle and Faughan estuaries	Emissions resultant from a Slaughter House and associated WWTP.

5.1.5 Land Use Discharges

Figure 5-18 and **Figure 5-19** shows the CORINE land cover within Lough Foyle contributing catchment for the 2006 and 2018 monitoring periods, respectively. Further categorisations of CORINE land cover within the contributing catchment can be seen in **Figure 5-20** and **Figure 5-21** for 2006 and 2018, respectively.

Within Lough Foyle contributing catchment, land cover types have changed little between the two monitoring periods (2006 and 2018). The dominant land use type remains pastures (increased from 47% to 50%), followed by peat bogs (decreased from 13.9% to 13.2%) and moors and heathland (increased from 6.2 % to 7.5%) (**Table 5-7**). Forestry (coniferous, broad-leafed, and mixed) has increased from 4% to 6.2% of the land cover within the contributing catchment. Land associated with agricultural activities (non-irrigated arable land, pastures, complex cultivation patterns, and land principally occupied by agriculture, with significant areas of natural vegetation) has increased moderately from 59.1% to 59.8% (**Table 5-7**).

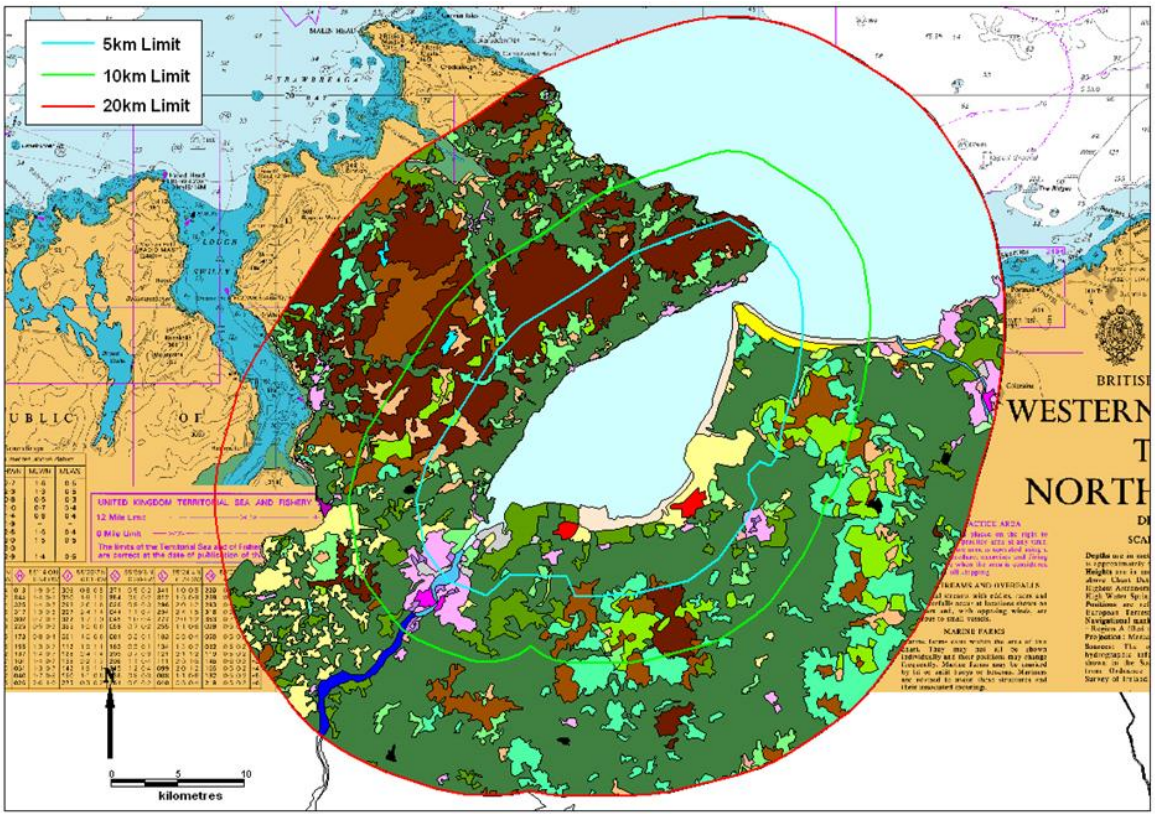

Figure 5-18: CORINE land cover within Lough Foyle contributing catchment 2006 (source: CORINE land cover 2006 accessed from EPA Maps).

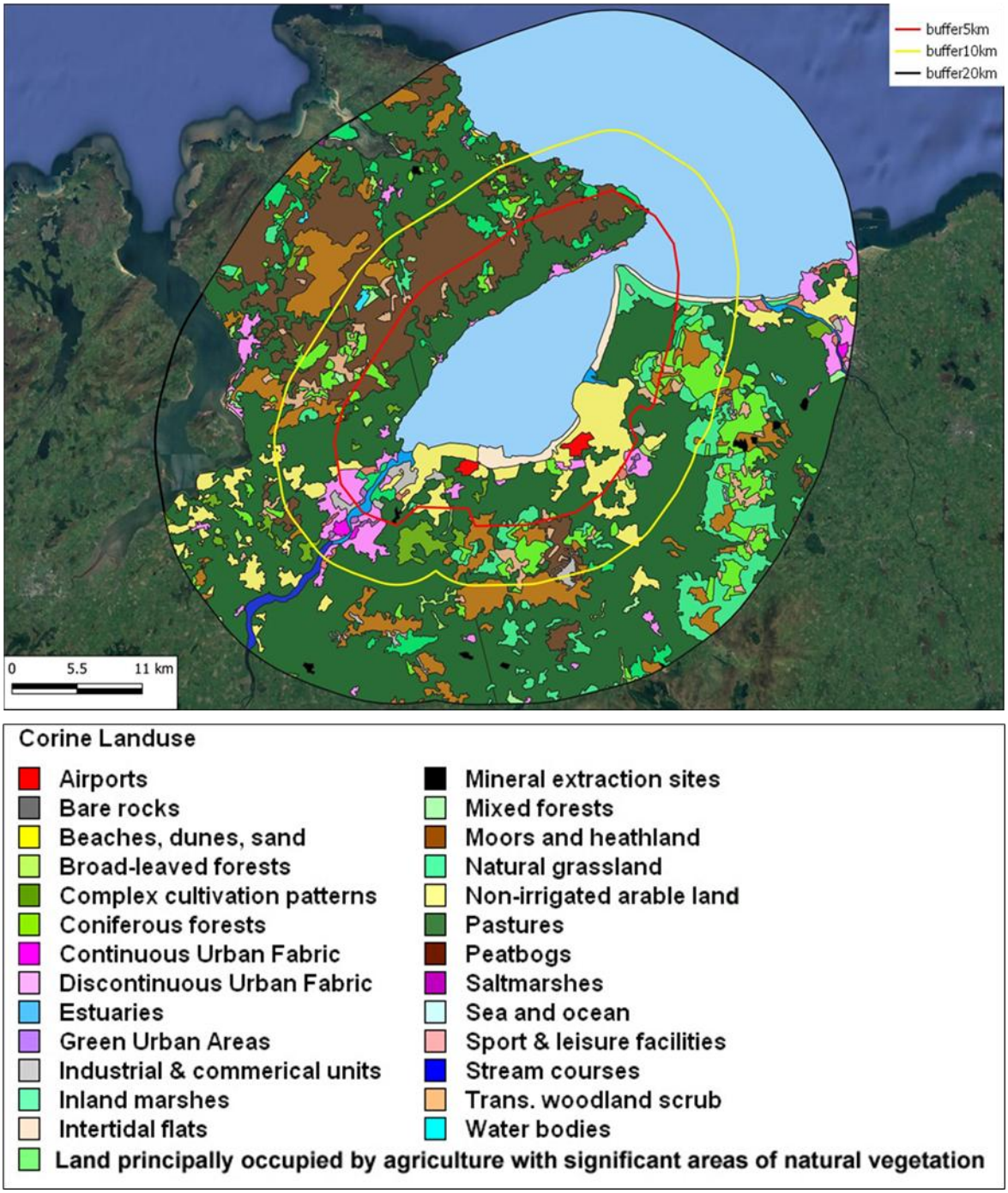

Figure 5-19: CORINE land cover within Lough Foyle contributing catchments 2018 (source: CORINE land cover 2018 accessed from EPA Maps).

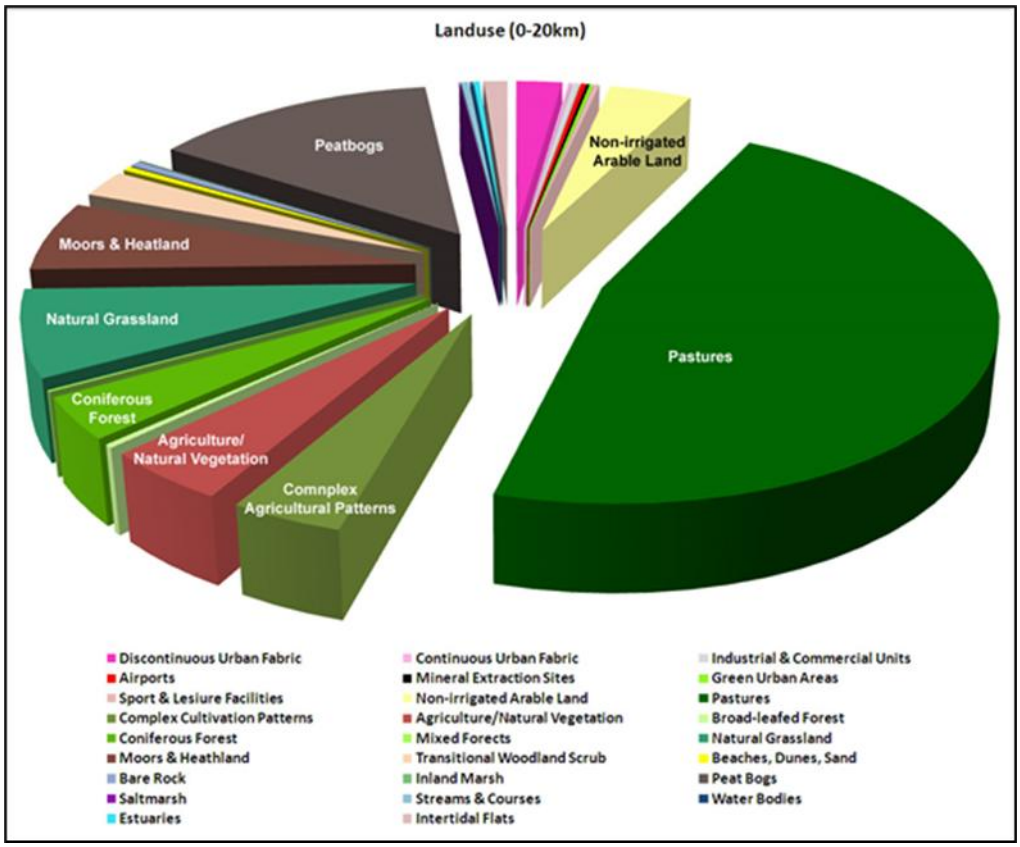

Figure 5-20: Breakdown of the 2006 CORINE land cover within Lough Foyle contributing catchment.

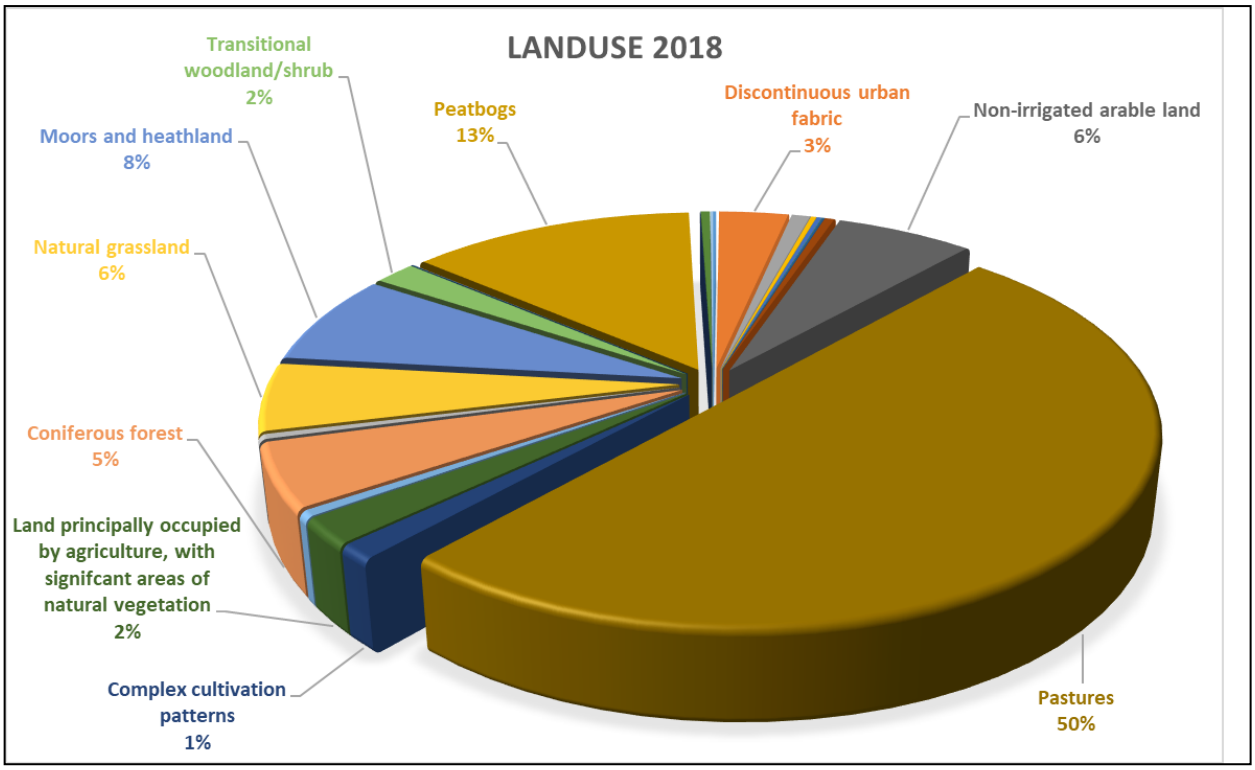

Figure 5-21: Break down of the 2018 CORINE land cover within Lough Foyle contributing catchment (percentages have been rounded to the nearest whole number and only land uses 1% are labelled)

Table 5-7: Change in CORINE land cover between 2006 and 2018. Land cover types that have experienced a decrease between 2006 and 2018 are highlighted bold.

CORINE Land Cover	Area km^2 2006	Area km^2 2018	% Change
Airports	4.36	4.64	6.4
Bare rock	0.12	0.1	**-23.1**
Beaches, dunes, sands	7.85	0.44	**-94.4**
Broad-leaved forest	5.87	9.05	54.2
Complex cultivation patterns	74.71	23.15	**-69**
Coniferous forest	68.32	96.68	41.5
Continuous urban fabric	2.77	2.78	0.5
Discontinuous urban fabric	46.91	59.12	26
Green urban areas	2.78	2.01	**-27.8**
Industrial or commercial units	6.29	15.79	151.1
Land principally occupied by agriculture, with significant areas of natural vegetation	83.88	39.71	**-52.7**
Mineral extraction sites	2.2	4.1	86.1
Mixed forest	2.46	7.23	194.1
Moors and heathland	115.59	139.01	20.3
Natural grassland	141.4	103.47	**-26.8**
Non-irrigated arable land	75.41	117.2	55.4
Pastures	875.34	924.15	5.6
Peatbogs	259.67	242.83	**-6.5**
Salt marshes	0.69	0.26	**-61.8**
Sports and leisure facilities	5.16	8.13	57.6
Stream courses	7.35	7.74	5.3
Transitional woodland/shrub	45	35.7	**-20.7**
Water bodies	1.87	1.92	2.6

Agricultural data used in the 2022 sanitary survey were organised by Wards for Northern Ireland, however in previous reports these were organised by Super Output Areas and the boundaries have since varied. Changes in agricultural data from 2018 to 2023 were

compared both visually and statistically to assess the distribution of farm practices in the contributing catchment. The data from the Republic of Ireland are grouped by ED.

In 2022, the greatest number of farms within the contributing catchment were in the south and the east, with lower numbers surrounding the Foyle River. The most intensive farming area was in the east and south of the lough. Total crops have not varied extensively throughout the contributing catchment between the survey periods. Total grass and rough grazing have also experienced very little change, with higher amounts in the south and east. Total cattle has not experienced much variation throughout the Wards/EDs and has experienced a small increase, however sheep distribution has declined by small amounts in the south and increased on a small scale in the west. The total number of pigs has decreased in Northern Ireland on a small scale, however total poultry has increased, mainly in the southern regions.

In Northern Ireland, the Nutrient Action Programme Regulations (Statutory Rule 81 of 2019) governs the application of slurry or organic fertilisers. These regulations cover aspects such as the method by which it is spread, the amount, temporal limitations and control measures, the environmental conditions (climatic and topographic including incline), livestock densities, and the required distances from water courses. The Nutrient Action Programme Regulations (Northern Ireland) 2019 prohibits the application of organic manure, excluding farmyard manure and dirty water, to any land from the 15th of October to the 31st of January; the application of farmyard manure from 31st October to 31st January; the application of chemical fertiliser from 15th September to 31st January.

In the Republic of Ireland Statutory Instrument (S.I.) No. 113/2022 sets out regulations on the application of slurry and organic fertilisers, notably the method by which it is spread, the amount, the environmental conditions, and the required distance from water courses. The Fifth Nitrates Action Programme 2022-2025, given effect by S.I. 113 of 2022, restricts slurry spreading before October 1st of a given year. The programme prohibits the spreading of soiled water between December 1st and 31st, effective from January 1st, 2024 (see the Fifth Nitrates Action Programme publication on overview of the programme for exceptions).

The Geological Survey of Ireland (GSI) provides a Groundwater Data Viewer that contains detailed information on various groundwater-related aspects. This includes data on groundwater wells and springs, historical and predictive groundwater flood maps, live

groundwater level data, and guidelines for groundwater protection schemes. The groundwater data viewer illustrates areas of high to extreme groundwater vulnerability within the contributing catchment and notably, along the eastern shoreline of the lough (**Figure 5-23**). The Northern Ireland regions of the lough are monitored by Geological Survey of Northern Ireland (GSNI) and demonstrates similar results, with Classes 5 and 4 (Most Extreme and Extreme, respectively) occurring within the contributing catchment and primarily along the shoreline of the lough (**Figure 5-22**). Class 4 is further divided based on the nature of the pathway (Balls *et al*., 2005) and Class 4e (where superficial aquifers are present) is highly prevalent along the shoreline, indicating that the aquifer is close to the surface and that these areas are more susceptible to contamination from surface activities.

These areas of high groundwater vulnerability predominantly coincide with pasture lands, particularly along the eastern and western shores (**Figure 5-19**). On the eastern shore of the lough, the dominant pastureland cover is interspersed with intertidal flats and non-irrigated arable land. Meanwhile, on the western shore, inland from the pastures along the coast, there are peat bogs, moors, and heathlands, along with patches of agricultural land that are significantly covered by natural vegetation on both shores.

According to S.I. No. 113/2022 for the Republic of Ireland, “soiled water” cannot be spread on land classified as "Extreme Vulnerability Areas on Karst Limestone Aquifers" if the amount exceeds 25,000 L/ha over a 42-day period or if the irrigation rate exceeds three mm/hr on land with a soil thickness of less than one metre. While there is no equivalent regulation in Northern Ireland based on the GSNI groundwater vulnerability index, S.R. 81/2019 specifies that organic manures, including dirty water, must not be applied within 15 m of karstified limestone features.

Although specific data on the levels of slurry and soiled water spreading in Lough Foyle contributing catchment were unavailable at the time of writing, the dominance of pastures in the area suggests potentially high levels of spreading, which may contribute to groundwater discharge and, subsequently, affect the designated shellfish waters (DSW) in the lough.

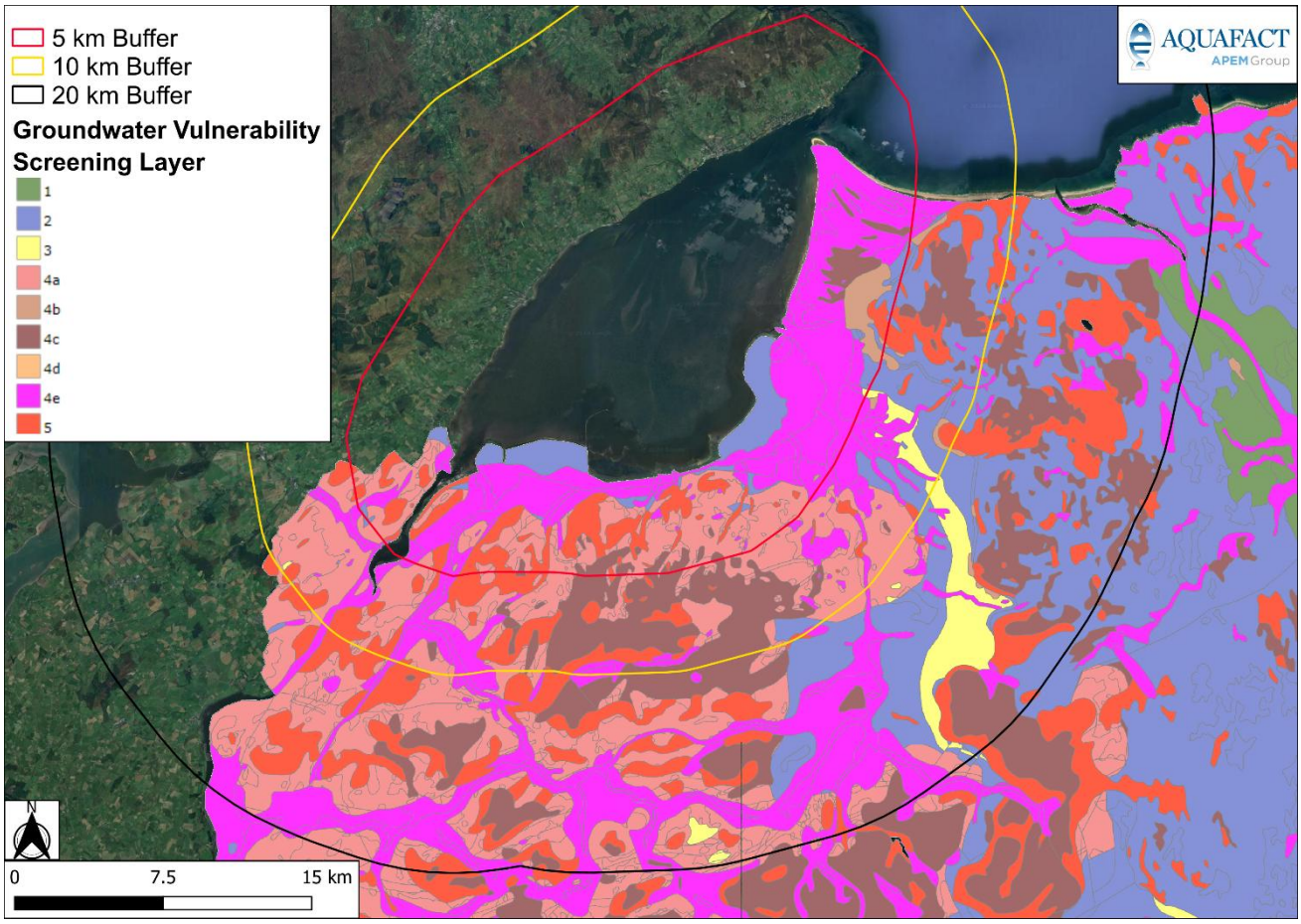

Figure 5-22: Groundwater vulnerability screening layer in Northern Ireland (source: Geographical Survey of Northern Ireland (GSNI) Geoindex produced by NIEA). Class 1 is Low vulnerability and Class 5 is Most Extreme. Class 4 is subdivided based on the nature of the pathway (See Ball *et al.*, 2005).

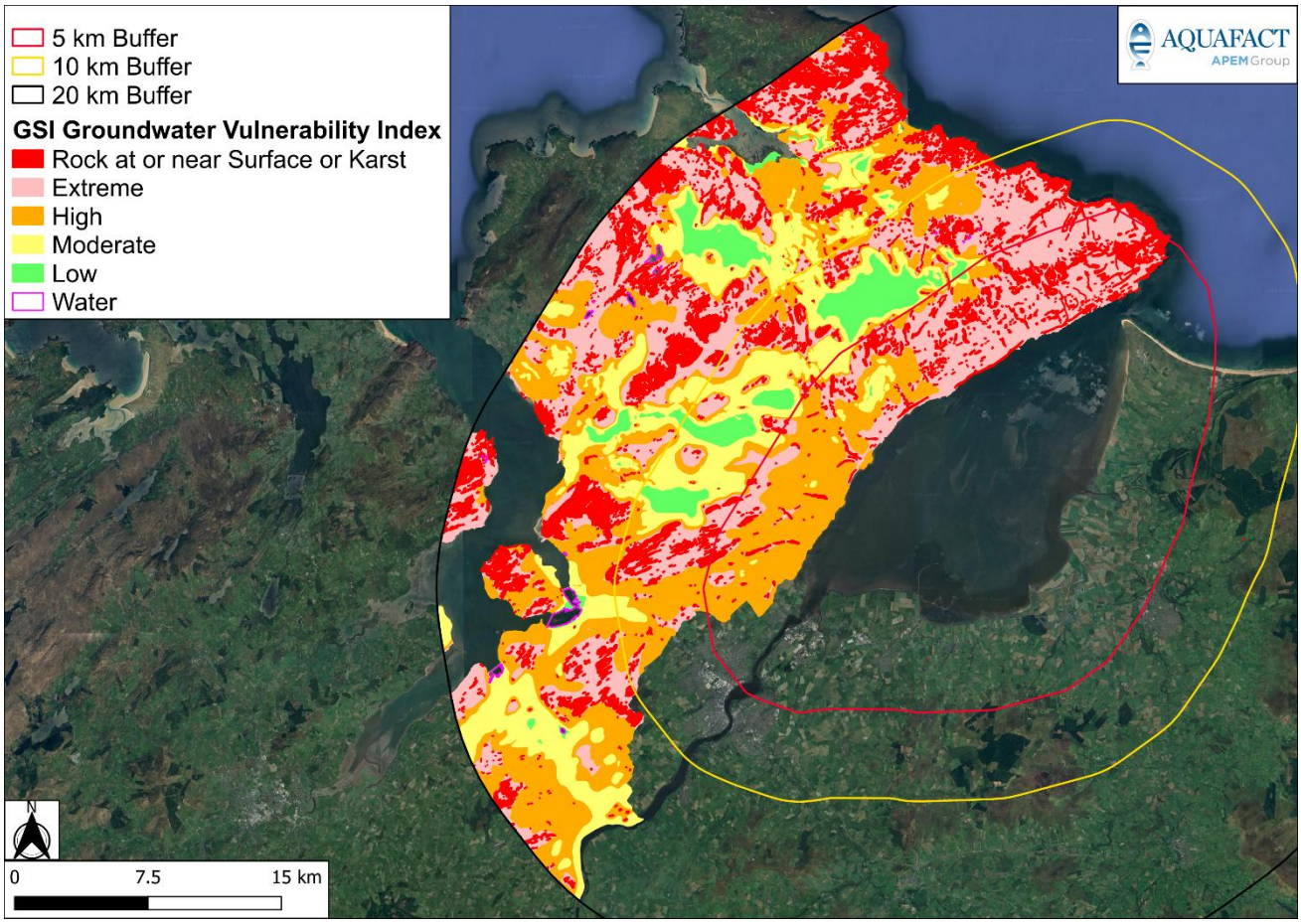

Figure 5-23: Geological Survey of Ireland (GSI) groundwater vulnerability within the Republic of Ireland Lough Foyle contributing catchment. Contains Irish Public Sector Data (Geological Survey Ireland) licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence.

Table 5-8: Farm census data for the Electoral Divisions and Wards that overlap with Lough Foyle contributing catchment for the Republic of Ireland (RoI) in 2020 and Northern Ireland (NI) in 2023 (source: CSO AgriMap 2020 and NISRA Data Portal Farm census maps).

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
RoI	Ballyliffin	110	1706.4	0	1700.1	1246	9825	/	/
RoI	Birdstown	57	1305.4	0	1257.9	1544	8062	/	/
RoI	Buncrana Rural	62	1664.2	0	1655.2	1328	5630	/	/
RoI	Buncrana Urban	5	65.1	0	61.5	0	0	/	/
RoI	Burt	64	4078.1	708.7	2798.1	3473	12345	/	/
RoI	Carndonagh	91	1582.2	0	1573.9	1158	9766	/	/
RoI	Carthage	93	1400.2	0	1388.5	1294	5134	/	/
RoI	Castlecary	52	1159.3	0	1106.5	1729	1499	/	/
RoI	Castleforward	33	1428	397.9	971.6	1633	3240	/	/
RoI	Culdaff	78	1806.8	19.8	1775.2	2206	5450	/	/
RoI	Desertegny	76	1172.8	0	1166.6	864	5032	/	/
RoI	Fahan	64	1910.4	0	1855	2106	6841	/	/
RoI	Gleneely	95	2369.6	0	2351.5	2709	11755	/	/
RoI	Glennagannon	52	1053.2	0	1028.8	1166	1951	/	/
RoI	Glentogher	58	2230.9	0	2229.1	346	8758	/	/
RoI	Greencastle	77	1796.2	0	1757.4	1187	8616	/	/

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
RoI	Illies	113	3589	0	3585.3	987	11284	/	/
RoI	Inch Island	21	1015.1	126.7	850.2	715	3241	/	/
RoI	Kilderry	57	2022.8	0	1986.4	1945	4784	/	/
RoI	Killea	61	2661.5	445.6	2069.4	4720	3193	/	/
RoI	Malin	72	1877.2	0	1859.5	1412	6846	/	/
RoI	Mintiaghs	82	1589.5	0	1575.5	764	5852	/	/
RoI	Moville	44	746.7	0	716.9	975	2670	/	/
RoI	Newtown Cunningham	42	1571	348.8	1127.1	3600	3227	/	/
RoI	Redcastle	53	1077.3	0	1029.4	722	6614	/	/
RoI	St. Johnstown	53	2548.2	335.8	2113.2	5763	1533	/	/
RoI	Straid	90	1505.7	0	1499.9	603	7644	/	/
RoI	Three Trees	37	1593.2	0	1561.4	1240	6741	/	/
RoI	Treantaghmucklagh	72	1890	129.1	1674.5	3237	4792	/	/
RoI	Turmone	59	1694.2	0	1671.9	1559	6581	/	/
RoI	Whitecastle	73	1838.6	0	1813.9	1374	10040	/	/
NI	Aghadowey	179	8913.4	489.38	8170.4	18461	14967	1996	338970
NI	Altahullion	106	6829.5	897.7	5893.4	8050	15779	19	75200
NI	Atlantic	3	3	3	3	3	3	3	3
NI	Ballykelly	70	3482.7	1029.98	2416.9	3602	4878	0	500

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
NI	Ballymagroarty	3	3	3	3	3	3	3	3
NI	Brandywell	3	3	3	3	3	3	3	3
NI	Carn Hill	/	/	/	/	/	/	/	/
NI	Castlerock	14	951.8	177.98	768.6	1910	608	0	0
NI	Caw	/	/	/	/	/	/	/	/
NI	Churchland	3	3	3	3	3	3	3	3
NI	City Walls	3	3	3	3	3	3	3	3
NI	Claudy	116	4973.6	104.48	4717.3	3619	14179	77	30
NI	Clondermot	3	3	3	3	3	3	3	3
NI	Coolessan	3	3	3	3	3	3	3	3
NI	Creggan	3	3	3	3	3	3	3	3
NI	Creggan South	/	/	/	/	/	/	/	/
NI	Culmore	9	403.1	93.2	309.9	681	395	0	0
NI	Drumahoe	5	64.5	0	64.5	81	394	0	0
NI	Drumsurn	61	3329.7	281.68	3020.1	4817	12549	0	0
NI	Dundooan	116	6139.9	706.32	5351.4	15793	6532	0	156715
NI	Dungiven	97	7492.9	67.62	7351.3	3285	34750	0	65449
NI	Dunnamanagh	212	12646.7	358.81	11961.9	13156	40077	54	37917
NI	Ebrington	3	3	3	3	3	3	3	3

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
NI	Eglinton	22	865.9	36.22	821	666	1550	0	0
NI	Enagh	44	2805.7	704.87	2069.8	3918	3339	0	0
NI	Feeny	106	7504.8	60.29	7245.8	4291	27510	0	72493
NI	Foyle Springs	/	/	/	/	/	/	/	/
NI	Galliagh	3	3	3	3	3	3	3	3
NI	Garvagh	149	7309.8	123.59	7113.9	6413	18286	3	124582
NI	Greysteel	83	2816.3	312.22	2444.2	2771	5381	11	7
NI	Greystone (Causeway Coast and Glens)	8	203	22.15	174.7	92	518	0	0
NI	Hopefield	3	3	3	3	3	3	3	3
NI	Kilfennan	3	3	3	3	3	3	3	3
NI	Lisnagelvin	3	3	3	3	3	3	3	3
NI	Macosquin	104	5712.1	302.63	5370.1	9619	13310	2136	16
NI	Madam's Bank	/	/	/	/	/	/	/	/
NI	Magilligan	134	8279.7	1102.4	7023.1	9301	22329	133	55
NI	Mountsandel	3	3	3	3	3	3	3	3
NI	New Buildings	3	3	3	3	3	3	3	3
NI	Northland	3	3	3	3	3	3	3	3

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
NI	Park (Derry and Strabane)	201	11481.5	82.25	11309.9	8390	49489	714	15466
NI	Portrush and Dunluce	16	1753.3	195.94	1551.7	3716	1311	0	0
NI	Portstewart	3	3	3	3	3	3	3	3
NI	Quarry	/	/	/	/	/	/	/	/
NI	Roeside	3	3	3	3	3	3	3	3
NI	Shantallow	/	/	/	/	/	/	/	/
NI	Shantallow East	3	3	3	3	3	3	3	3
NI	Sheriff's Mountain	21	1350.3	399.5	913.9	1476	1293	0	0
NI	Skeoge	3	3	3	3	3	3	3	3
NI	Slievekirk	101	6706.14	549.88	6059.4	14252	14694	5	60404
NI	Springtown	3	3	3	3	3	3	3	3
NI	University	3	3	3	3	3	3	3	3
NI	Victoria (Derry and Strabane)	5	193.7	21.2	172	708	216	0	0
NI	Waterside	3	3	3	3	3	3	3	3

Table 5-9: Estimated farm census data for the Electoral Divisions and Wards within Lough Foyle contributing catchment (%) for the Republic of Ireland (RoI) in 2020 and Northern Ireland (NI) in 2023 (source: CSO AgriMap 2020 and NISRA Data Portal Farm census maps).

Region	ED/Ward Name	Number of Farms	Area Farmed (ha)	Crops (ha)	Grass (ha)	Cattle	Sheep	Pigs	Poultry
RoI	Ballyliffin	66	1025.4	0	1021.7	749	5904	/	/
RoI	Birdstown	57	1305.2	0	1257.7	1544	8061	/	/
RoI	Buncrana Rural	62	1663.9	0	1654.9	1328	5629	/	/
RoI	Buncrana Urban	5	65.1	0	61.5	0	0	/	/
RoI	Burt	64	4077.5	708.6	2797.7	3472	12343	/	/
RoI	Carndonagh	91	1582	0	1573.7	1158	9765	/	/
RoI	Carthage	88	1323.5	0	1312.5	1223	4853	/	/
RoI	Castlecary	52	1159.2	0	1106.4	1729	1499	/	/
RoI	Castleforward	33	1427.8	397.8	971.4	1633	3239	/	/
RoI	Culdaff	78	1806.6	19.8	1775	2206	5449	/	/
RoI	Desertegny	30	469	0	466.5	346	2012	/	/
RoI	Fahan	64	1910.1	0	1854.7	2106	6840	/	/
RoI	Gleneely	95	2369.3	0	2351.2	2709	11754	/	/
RoI	Glennagannon	52	1053.1	0	1028.7	1166	1951	/	/
RoI	Glentogher	58	2230.6	0	2228.8	346	8757	/	/
RoI	Greencastle	77	1796	0	1757.2	1187	8615	/	/

RoI	Illies	113	3588.5	0	3584.8	987	11282	/	/
RoI	Inch Island	21	1014.9	126.7	850.1	715	3240	/	/
RoI	Kilderry	57	2022.5	0	1986.1	1945	4783	/	/
RoI	Killea	60	2634	441	2048	4671	3160	/	/
RoI	Malin	31	805	0	797.4	606	2936	/	/
RoI	Mintiaghs	82	1589.3	0	1575.3	764	5851	/	/
RoI	Moville	44	746.6	0	716.8	975	2670	/	/
RoI	Newtown Cunningham	23	865.5	192.2	621	1983	1778	/	/
RoI	Redcastle	53	1077.2	0	1029.3	722	6613	/	/
RoI	St. Johnstown	22	1045.1	137.7	866.7	2364	629	/	/
RoI	Straid	41	686	0	683.4	275	3483	/	/
RoI	Three Trees	37	1593	0	1561.2	1240	6740	/	/
RoI	Treantaghmucklagh	6	162.3	11.1	143.8	278	411	/	/
RoI	Turmone	59	1694	0	1671.7	1559	6580	/	/
RoI	Whitecastle	73	1838.4	0	1813.7	1374	10039	/	/
NI	Aghadowey	84	4174.8	229.2	3826.8	8647	7010	935	158763
NI	Altahullion	106	6829	897.6	5892.9	8049	15778	19	75194
NI	Atlantic	3	3	3	3	3	3	3	3
NI	Ballykelly	70	3482.4	1029.9	2416.7	3602	4878	0	500
NI	Ballymagroarty	3	3	3	3	3	3	3	3

NI	Brandywell	3	3	3	3	3	3	3	3
NI	Carn Hill	/	/	/	/	/	/	/	/
NI	Castlerock	14	951.8	178	768.6	1910	608	0	0
NI	Caw	/	/	/	/	/	/	/	/
NI	Churchland	3	3	3	3	3	3	3	3
NI	City Walls	3	3	3	3	3	3	3	3
NI	Claudy	116	4973	104.5	4716.7	3619	14177	77	30
NI	Clondermot	3	3	3	3	3	3	3	3
NI	Coolessan	3	3	3	3	3	3	3	3
NI	Creggan	3	3	3	3	3	3	3	3
NI	Creggan South	/	/	/	/	/	/	/	/
NI	Culmore	9	403	93.2	309.9	681	395	0	0
NI	Drumahoe	5	64.5	0	64.5	81	394	0	0
NI	Drumsurn	61	3329.5	281.7	3019.9	4817	12548	0	0
NI	Dundooan	20	1065	122.5	928.3	2739	1133	0	27184
NI	Dungiven	48	3710	33.5	3639.9	1627	17206	0	32406
NI	Dunnamanagh	83	4975	141.1	4705.6	5175	15766	21	14916
NI	Ebrington	3	3	3	3	3	3	3	3
NI	Eglinton	22	865.8	36.2	820.9	666	1550	0	0
NI	Enagh	44	2805.3	704.8	2069.5	3917	3339	0	0

NI	Feeny	63	4477.7	36	4323.2	2560	16414	0	43252
NI	Foyle Springs	/	/	/	/	/	/	/	/
NI	Galliagh	3	3	3	3	3	3	3	3
NI	Garvagh	27	1302.3	22	1267.4	1143	3258	1	22195
NI	Greysteel	83	2816	312.2	2443.9	2771	5380	11	7
NI	Greystone (Causeway Coast and Glens)	8	203	22.1	174.7	92	518	0	0
NI	Hopefield	2	1.5	1.5	1.5	2	2	2	2
NI	Kilfennan	3	3	3	3	3	3	3	3
NI	Lisnagelvin	3	3	3	3	3	3	3	3
NI	Macosquin	101	5523.1	292.6	5192.4	9301	12870	2065	15
NI	Madam's Bank	/	/	/	/	/	/	/	/
NI	Magilligan	134	8279.1	1102.3	7022.6	9300	22327	133	55
NI	Mountsandel	2	2.2	2.2	2.2	2	2	2	2
NI	New Buildings	3	3	3	3	3	3	3	3
NI	Northland	3	3	3	3	3	3	3	3
NI	Park (Derry and Strabane)	131	7504.6	53.8	7392.4	5484	32347	467	10109
NI	Portrush and Dunluce	1	96.5	10.8	85.4	204	72	0	0
NI	Portstewart	3	3	3	3	3	3	3	3
NI	Quarry	/	/	/	/	/	/	/	/

NI	Roeside	3	3	3	3	3	3	3	3
NI	Shantallow	/	/	/	/	/	/	/	/
NI	Shantallow East	3	3	3	3	3	3	3	3
NI	Sheriff's Mountain	21	1350.1	399.4	913.8	1476	1293	0	0
NI	Skeoge	3	3	3	3	3	3	3	3
NI	Slievekirk	97	6420.2	526.4	5801.1	13644	14068	5	57829
NI	Springtown	3	3	3	3	3	3	3	3
NI	University	3	3	3	3	3	3	3	3
NI	Victoria (Derry and Strabane)	5	193.7	21.2	172	708	216	0	0
NI	Waterside	3	3	3	3	3	3	3	3

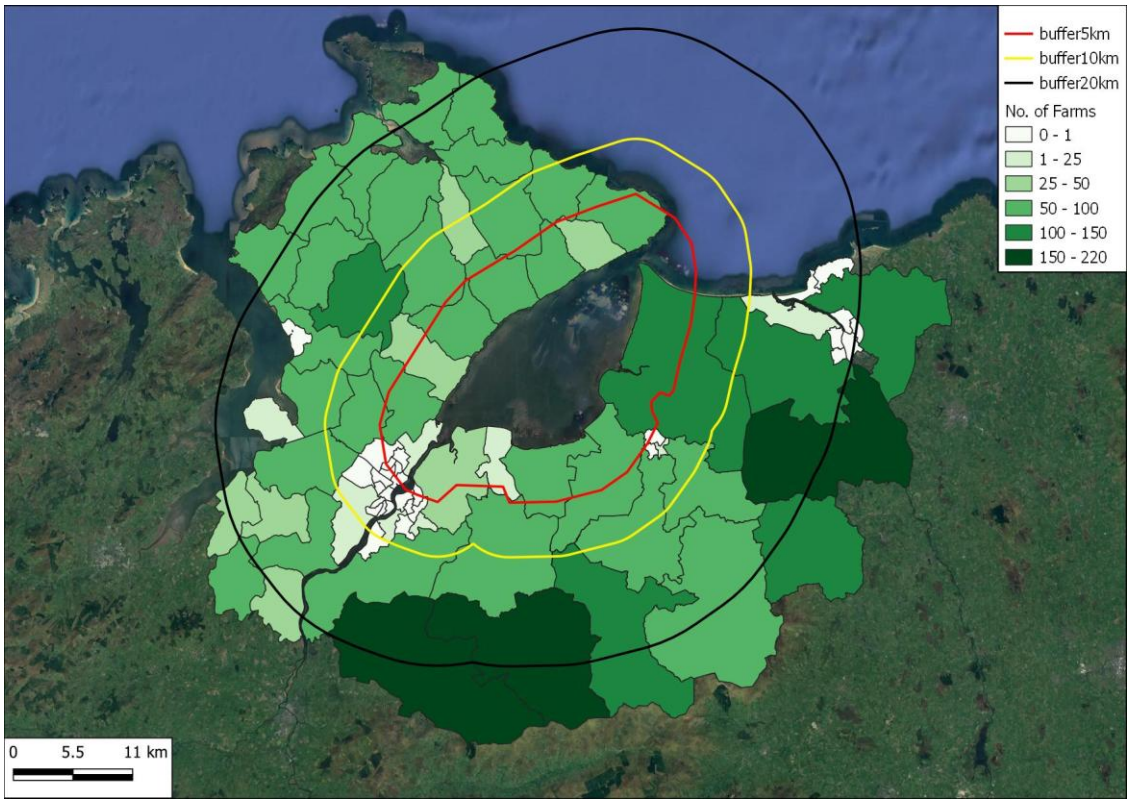

Figure 5-24: Number of farms within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020).

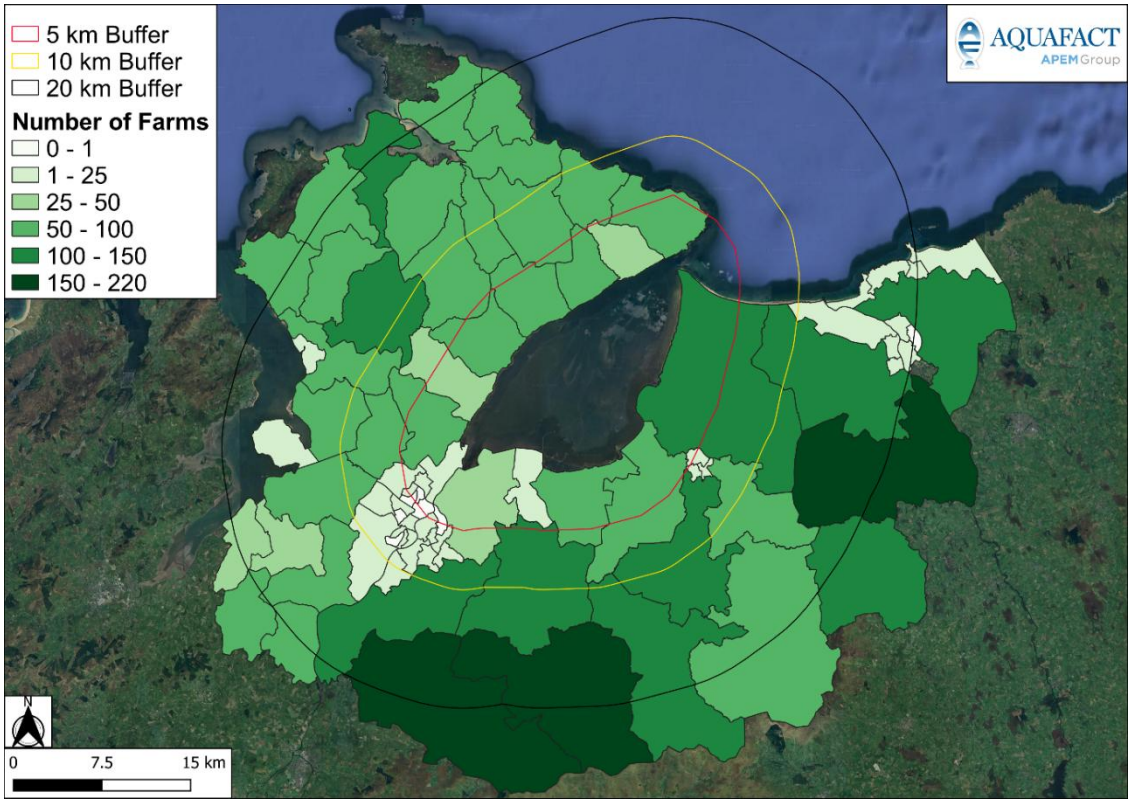

Figure 5-25: Number of farms within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

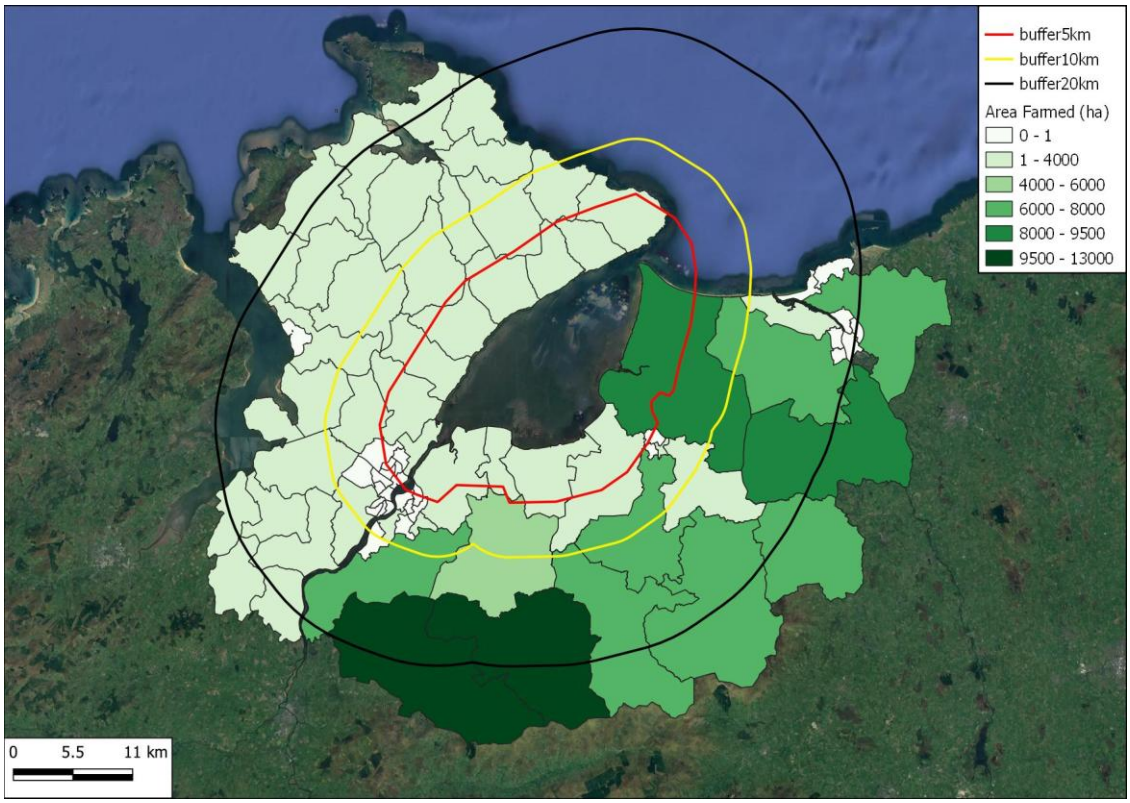

Figure 5-26: Area farmed (ha) within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020).

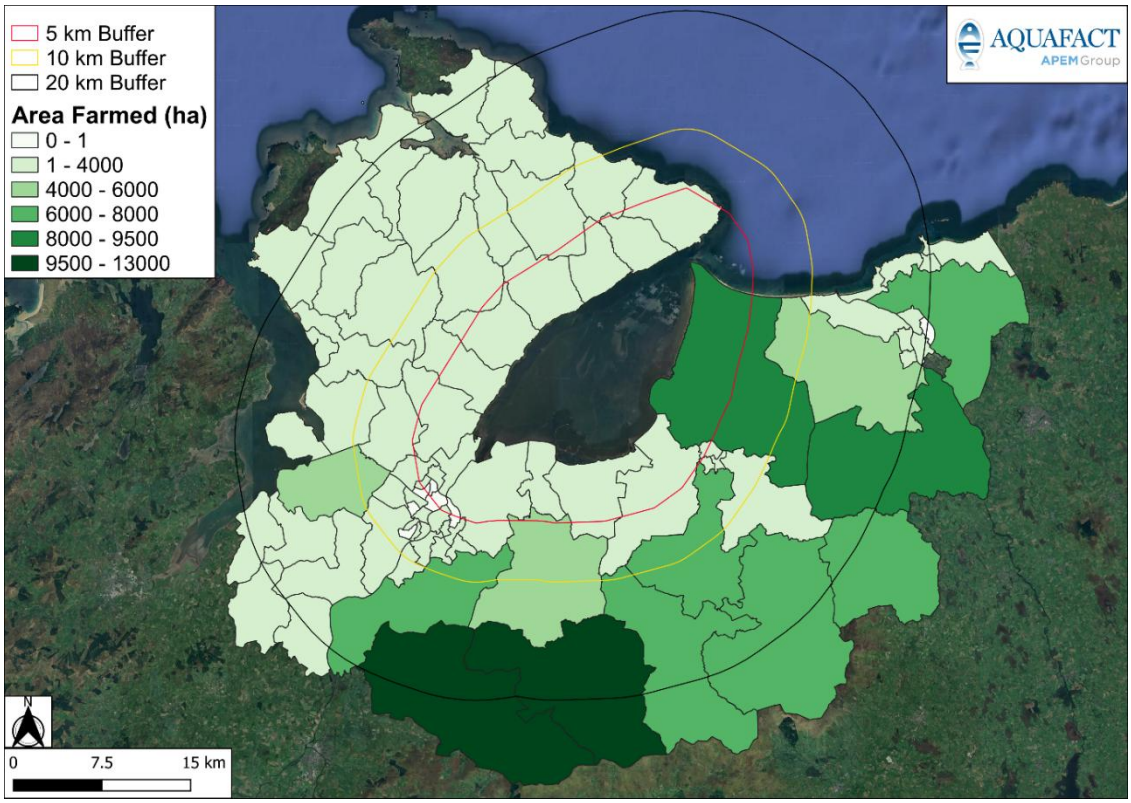

Figure 5-27: Area farmed (ha) within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

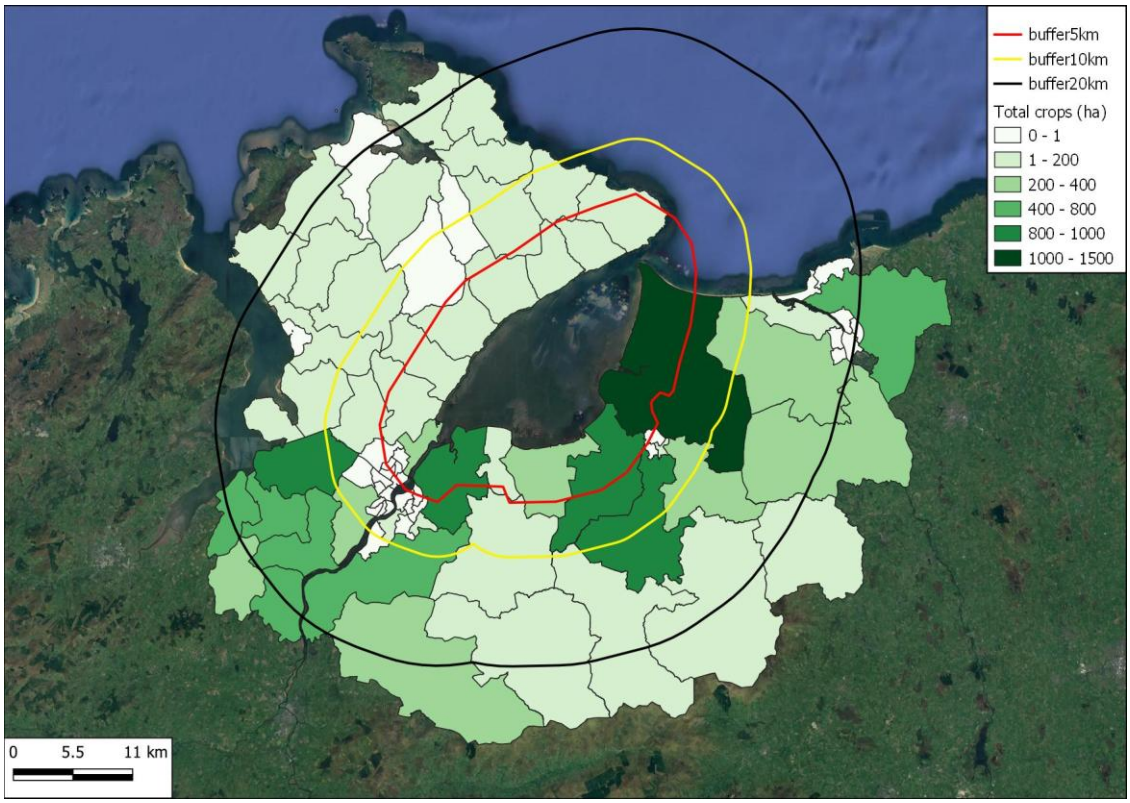

Figure 5-28: Total crops (ha) within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020).

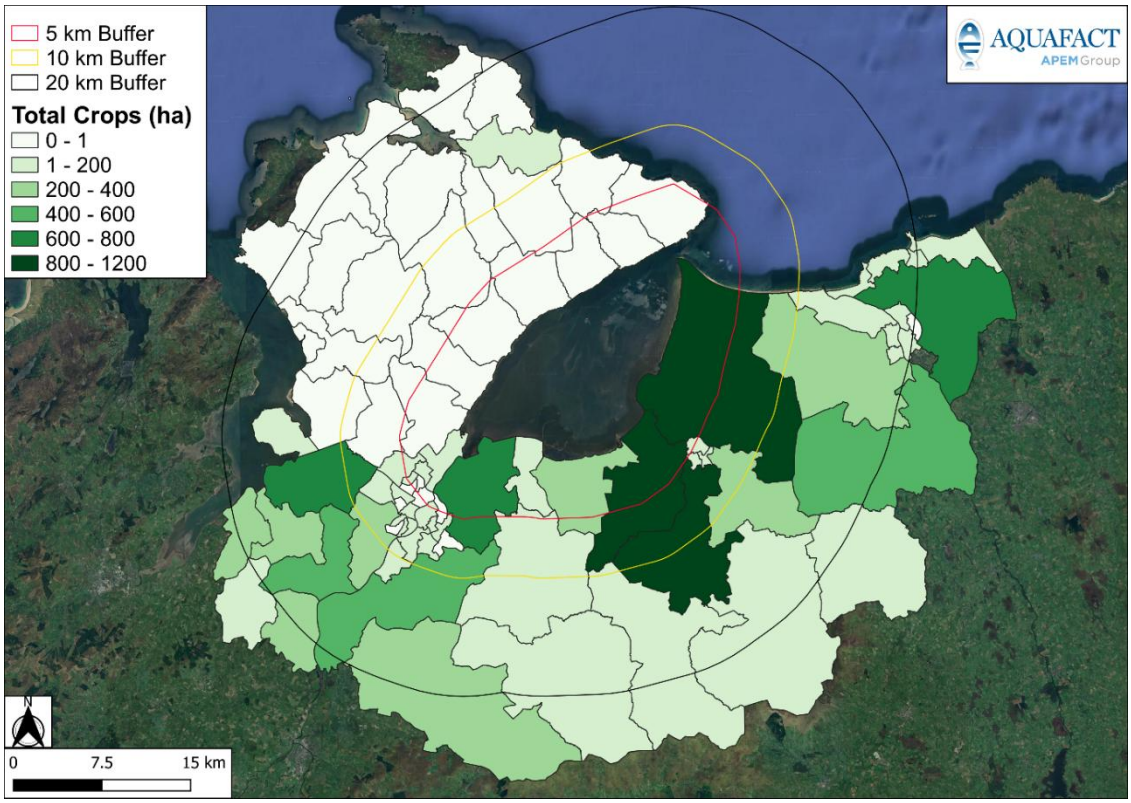

Figure 5-29: Total crops (ha) within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

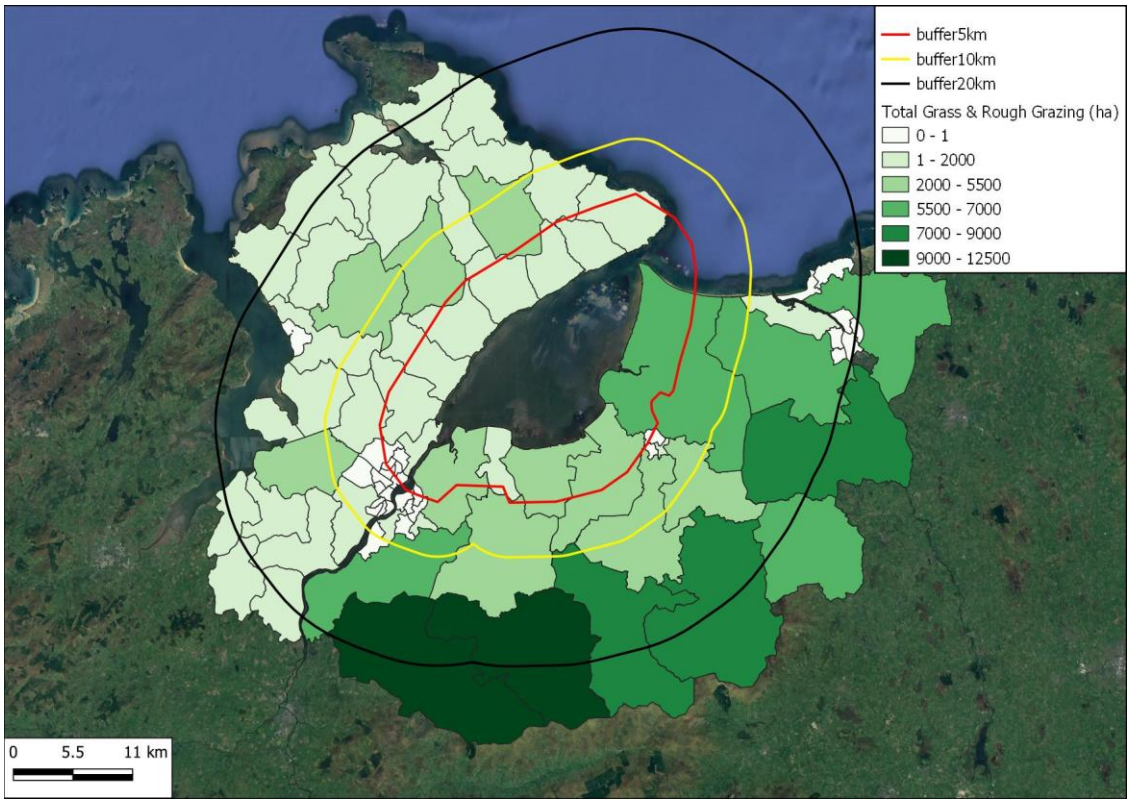

Figure 5-30: Total grasses within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020).

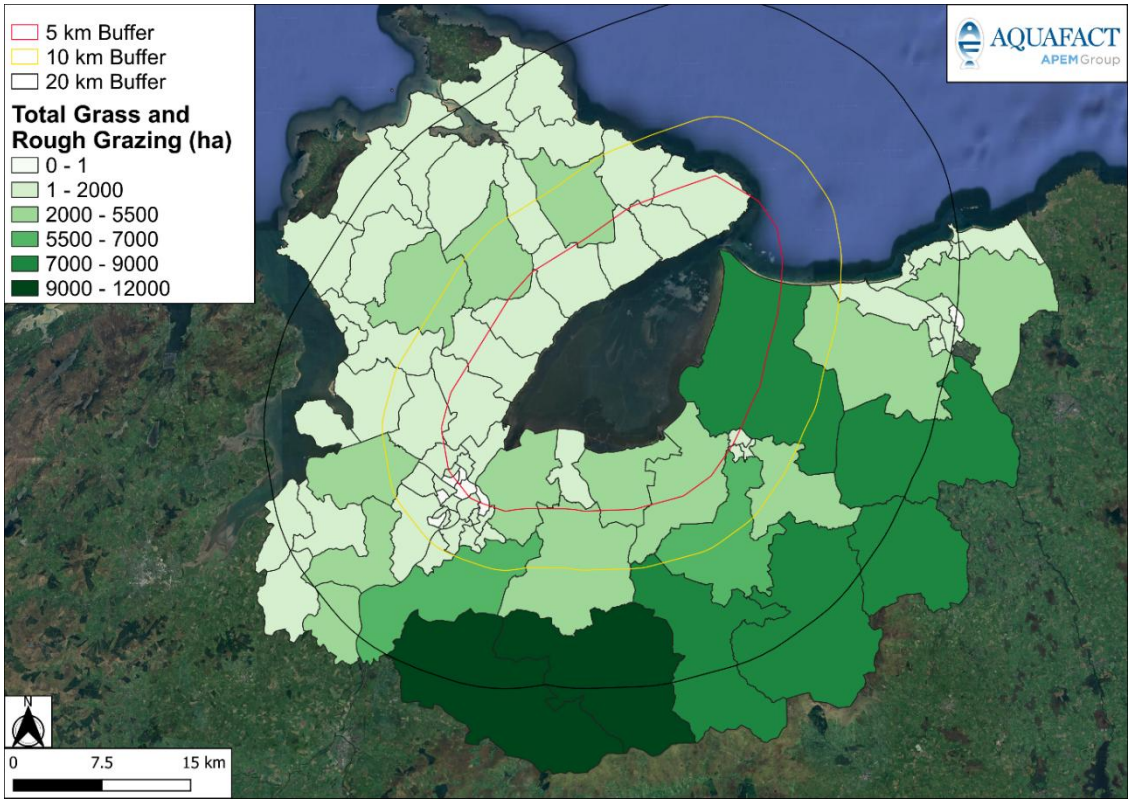

Figure 5-31: Total grasses within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

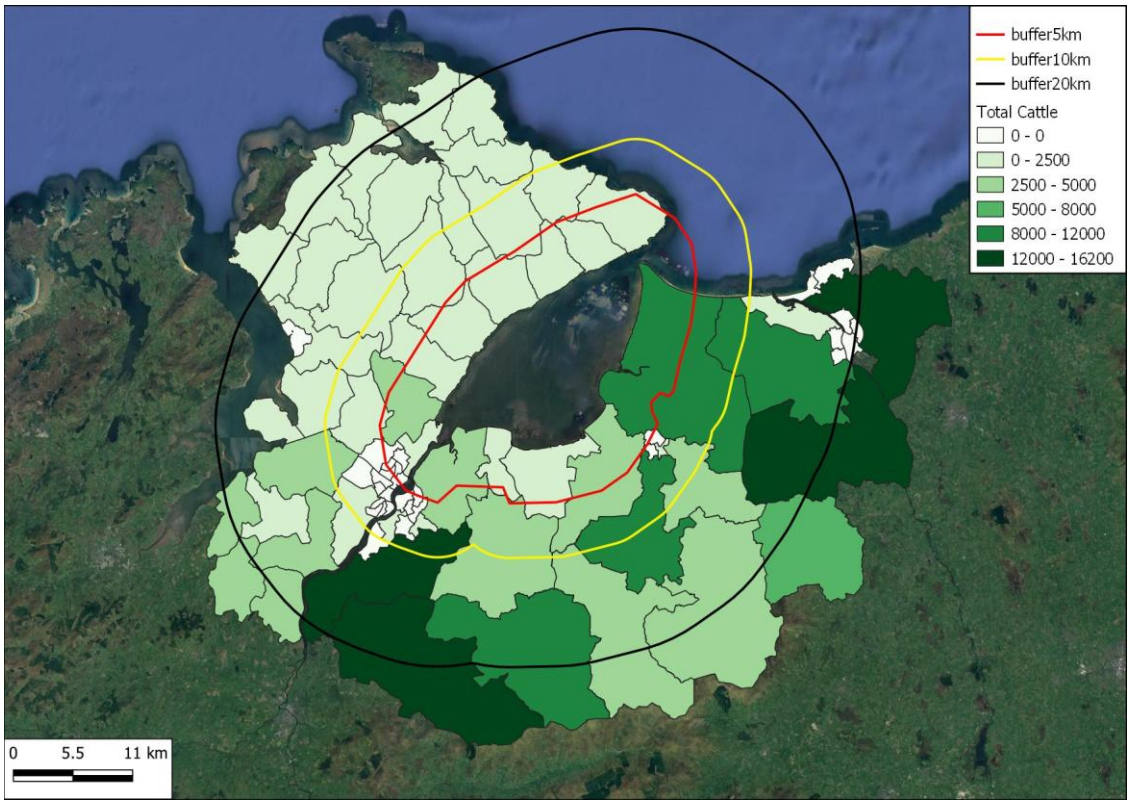

Figure 5-32: Cattle within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020

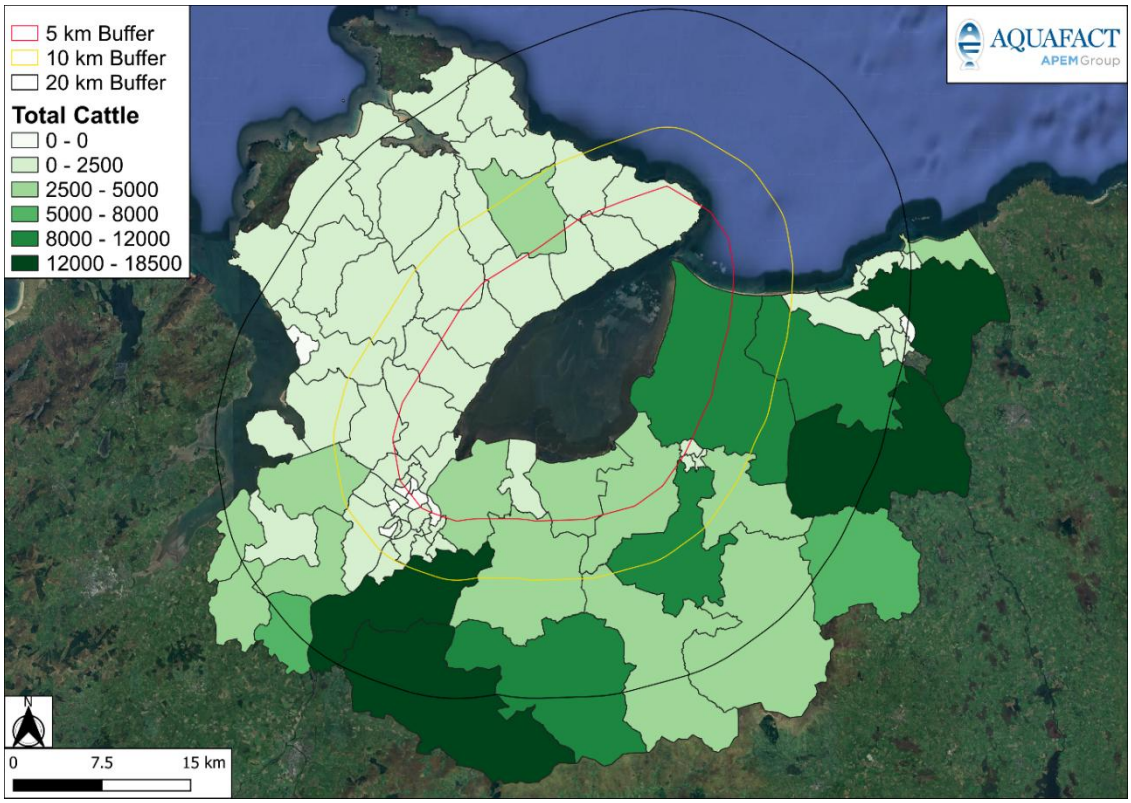

Figure 5-33: Cattle within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

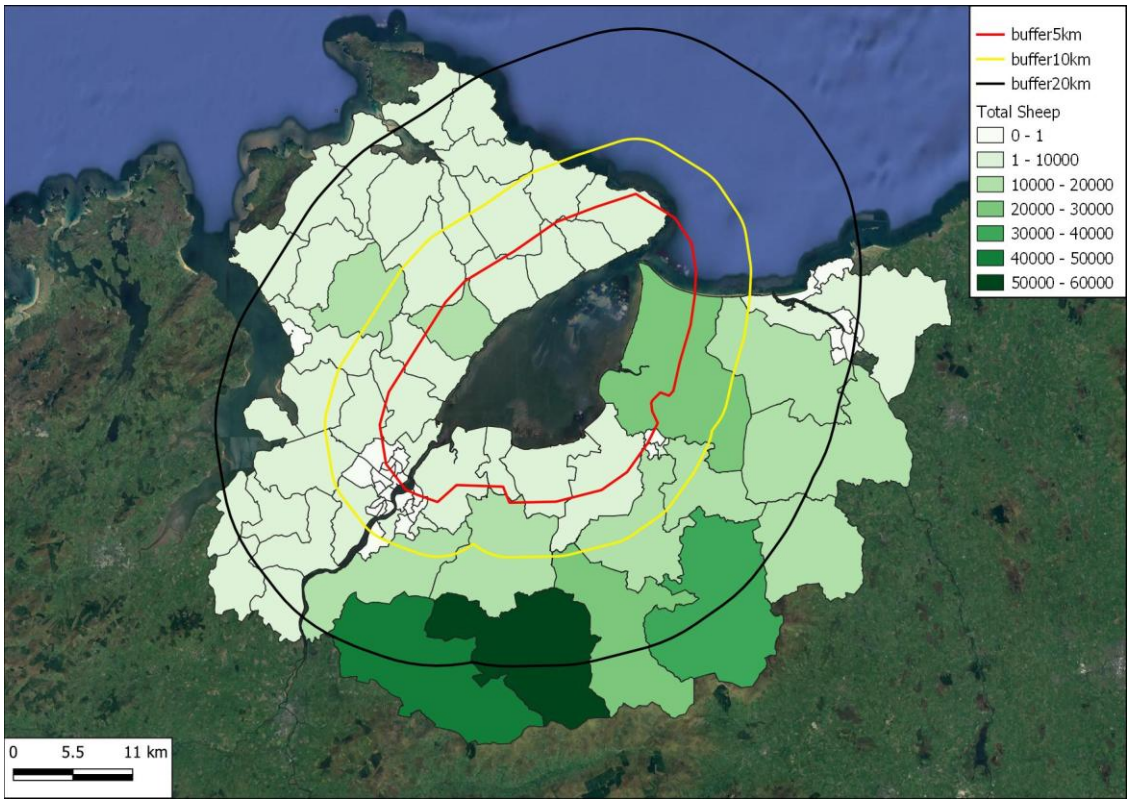

Figure 5-34: Sheep within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018; CSO AgriMap 2020).

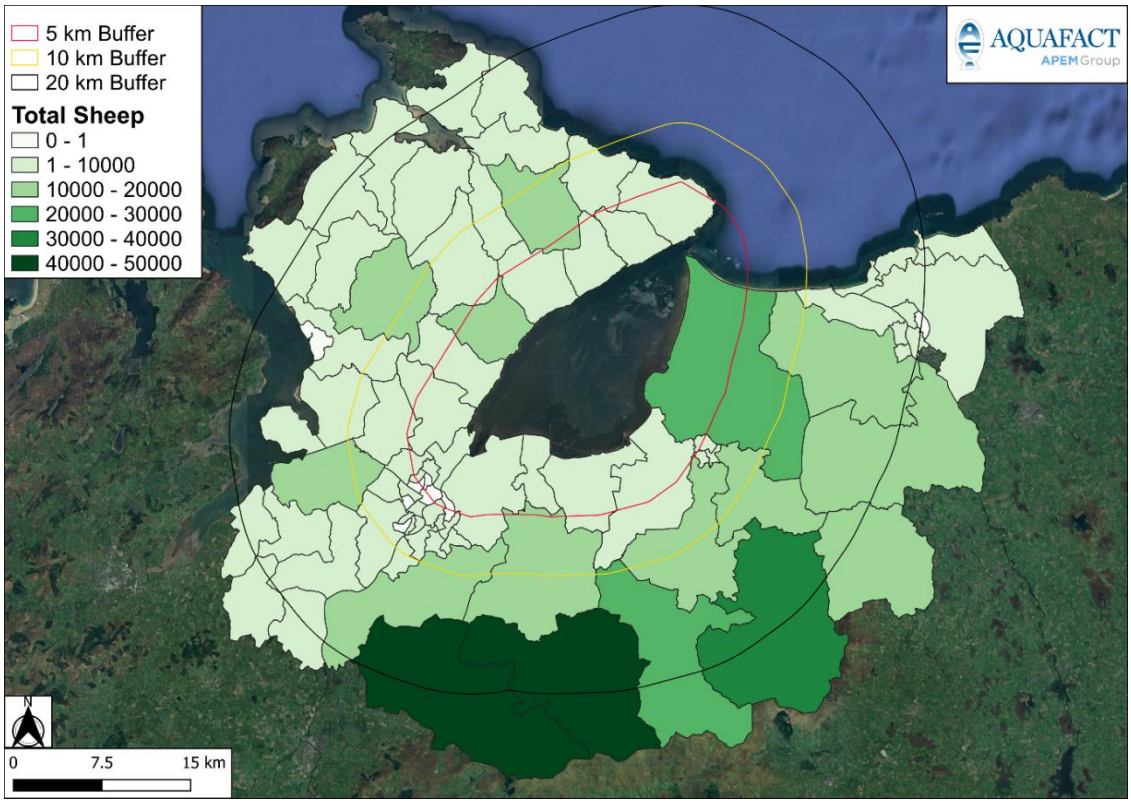

Figure 5-35: Sheep within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023; CSO AgriMap 2020).

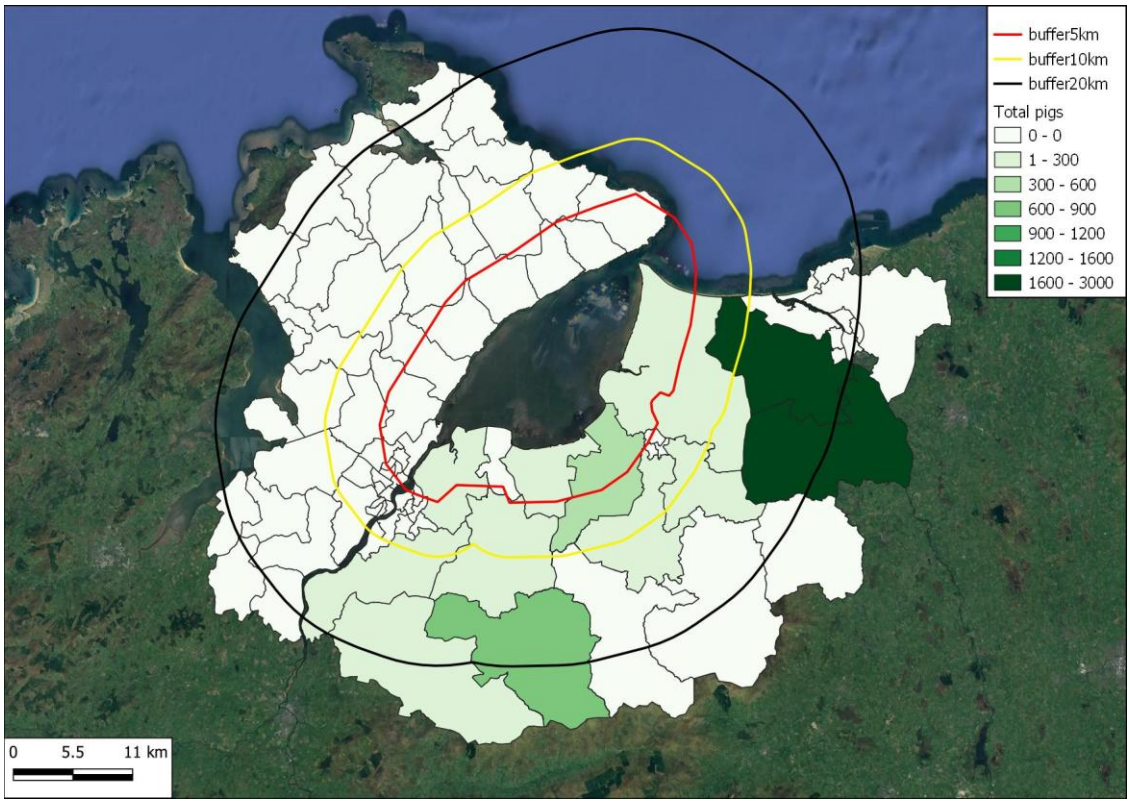

Figure 5-36: The number of pigs within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018). Note that there is no data on pig and poultry by Electoral Division in the Republic of Ireland.

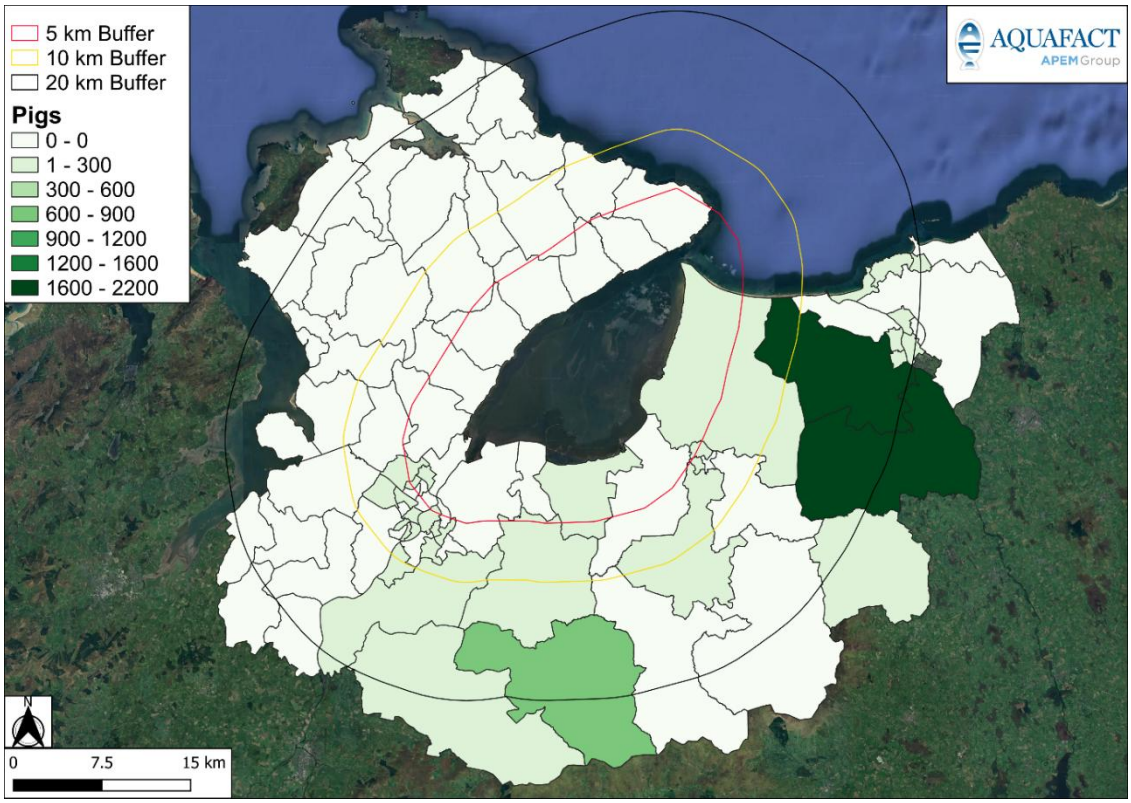

Figure 5-37: Pigs within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023). Note that there are no data on pig and poultry by Electoral Division in the Republic of Ireland.

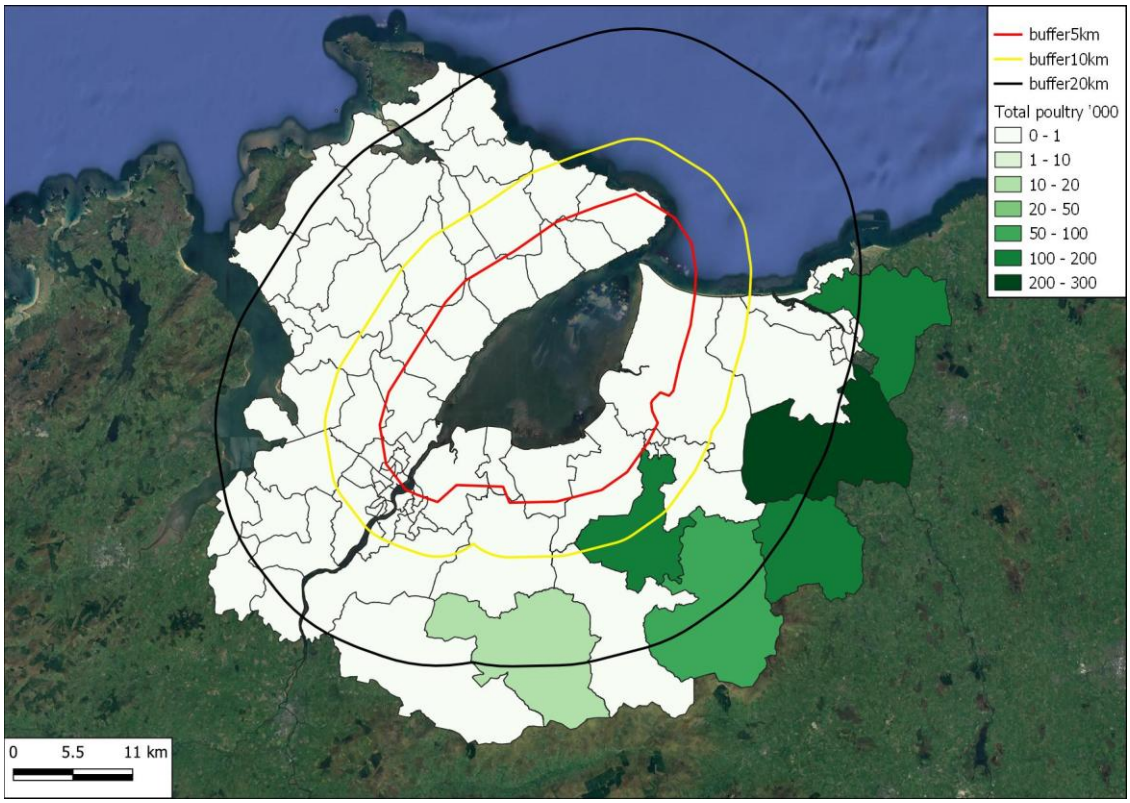

Figure 5-38: Poultry within Lough Foyle contributing catchment for 2018 (source: DAERA: NISRA Data Portal Farm census maps, 2018). Note that there are no data available on poultry by Electoral Division for the Republic of Ireland.

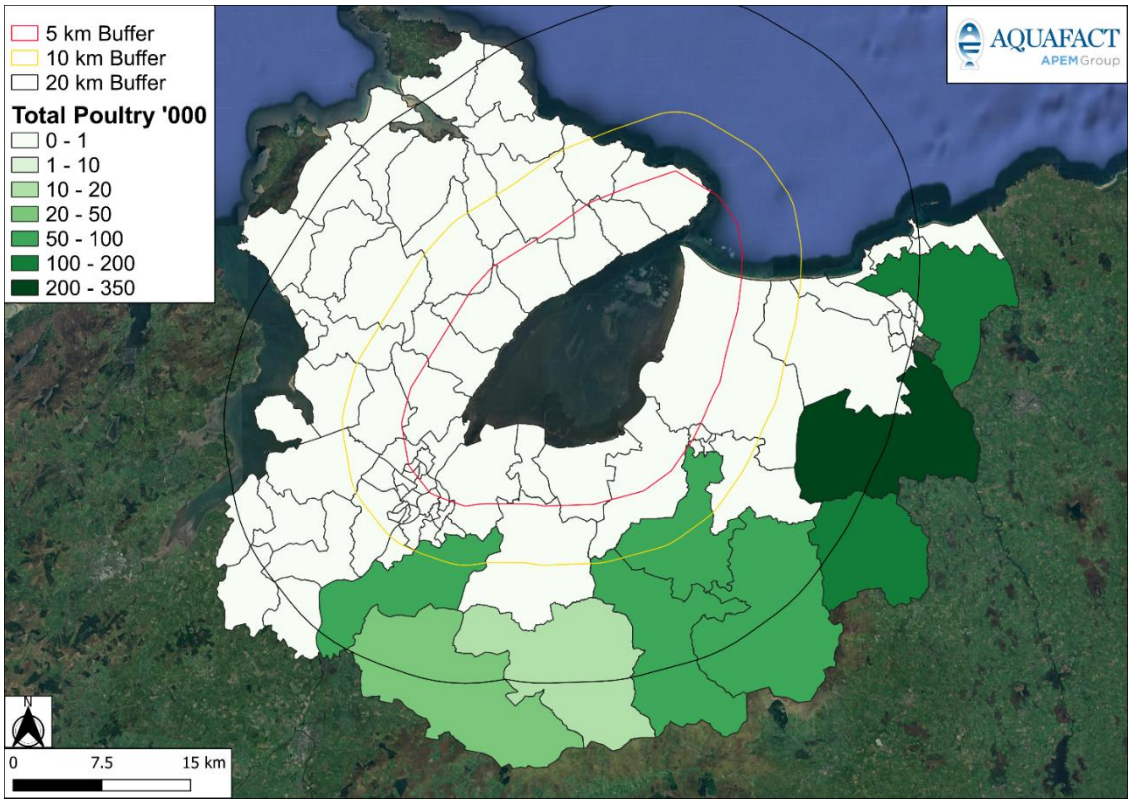

Figure 5-39: Poultry within Lough Foyle contributing catchment for 2023 (source: DAERA: NISRA Data Portal Farm census maps, 2023). Note that there are no data available on poultry by Electoral Division for the Republic of Ireland.

Most of the livestock in the contributing catchment are sheep (493,349), however cattle are also present in high numbers (192,742). Poultry have the highest numbers compared to other farmed animals (947,873); however, they are not considered livestock. Most of the agricultural land use in the area is total grass and rough grazing, however *c.* 10,000 ha are used for crops.

Sheep densities are variable throughout the EDs/Wards. The Ward Park (Derry and Strabane) had the highest numbers of sheep recorded (49,489) followed by Dunnamanagh Ward (40,077), and Dungiven Ward (34,750). There were more sheep within the eastern catchment of the lough (304,403) compared to the western areas (188,946). The highest number of cattle were in Aghadowey Ward (18,461), followed by Dundooan Ward (15,793) and Slievekirk Ward (14,252). There were more cattle in Northern Ireland (139,137) compared to Republic of Ireland (53,605). There were 5,217 pigs recorded in Northern Ireland with the highest density in Macosquin (2,136) and Aghadowey (1,996). There were 947,873 poultry recorded in Northern Ireland with the highest densities in Aghadowey

(338,970) and Dundooan (156,715). Poultry and pig abundance were not recorded in the Republic of Ireland.

Sheep numbers are expected to increase in spring following the birth of lambs and decrease in autumn as they are sent to market. Therefore, larger quantities of livestock droppings will be deposited during this period, though it may not impact the DSW until washed into the sea during and/or after periods of rainfall unless deposited directly on the shoreline.

A number of studies have reported strong correlations between intensive livestock farming areas and faecal indicator concentrations of microorganisms in streams and coastal waters due, especially during high flow conditions, both from point and non-point sources of contamination (*e.g.,* Crowther *et al*., 2002). **Table 5-10** shows the potential daily loading of *E. coli* from humans and animals. Sheep rank the worst based on the average number of *E. coli* per gram of faecal production, followed by pigs, cows, birds, humans, and poultry.

Table 5-10: Potential daily loading of *E. coli* (Jones and White, 1984).

Source	Faecal Production (g/day)	Average Number (*E. coli*/g)	Daily Load (*E. coli*)	Rank
Man	150	13 x 106	1.9 x 109	5
Cow	23600	0.23 x 106	5.4 x 109	3
Sheep	1130	16 x 106	18.1 x 109	1
Chicken	182	1.3 x 106	0.24 x 109	6
Pig	2700	3.3 x 106	8.9 x 109	2
Gull	15.3	131.2 x 106	2 x 109	4

5.1.6 Other Pollution Sources

5.1.6.1 Shipping

Operational waste from vessels, if not properly managed, can end up in the sea where the potential for contamination or pollution occurs. Wastes generated or landed in ports and harbours can be broadly divided into:

a) operational and domestic waste from ships and boats.
b) waste from commercial cargo activities.

c) wastes generated from maintenance activities and associated maritime industry activities.

MARPOL Annex IV defines sewage as “drainage from medical premises, toilets, urinals, spaces containing live animals, and other waste waters when mixed with sewage waste streams”. Although adopted in 1973, the Annex did not come into effect until September 2003, with subsequent amendments entered into force in August 2005. Annex IV requires ships to be equipped with either a sewage treatment plant, a sewage comminuting and disinfecting system, or a sewage holding tank. Within three miles of the shore, Annex IV requires that sewage discharges be treated by a certified Marine Sanitation Device (MSD) prior to discharge into the ocean. Sewage discharges made between three and 12 miles offshore must be treated by no less than maceration and chlorination, and sewage discharged greater than 12 miles from shore are unrestricted. Annex IV also established certain sewage reception facility standards and responsibilities for ports and contracting parties.

Ship sewage originates from water-borne human waste, wastewaters generated in preparing food, washing dishes, laundries, showers, toilets, and medical facilities. However, as waste enters the lough environment from many sources, it makes the identification of specific impacts from ship/boat waste very difficult. It is widely recognised that the majority of pollution entering the marine environment comes from land-based sources and atmospheric inputs from land based industrial activities, with only an estimated 12% originating from shipping activities (GESAMP [Joint Group of Experts on the Scientific Aspects of Marine environmental Pollution], 1990).

Piers, ports, harbours, and slips identified during the sanitary survey review are illustrated in **Figure 5-40**. Foyle Port is a commercial port and represents the largest freight port in the northwest (Marine Institute, 2020). It extends across Lough Foyle from Craigavon Bridge northward to Greencastle and Magilligan Point (Marine Institute, 2020). It encompasses a 400 m berth space with a large capacity for visitor’s to berth (Northern Ireland Marine Map Viewer). The tonnage of goods has increased by 6.8% from 1,760,000 tons in 2020 to 1,889,000 tons in 2022 (NISRA, 2022). A larger increase was observed between 2009 and 2020 of 8% from 1,619,000 tons to 1,760,000 tons (NISRA, 2022). Cargo passing through Foyle Port in 2022 included agricultural products (*e.g.,* grain, soya, tapioca), coal, ores,

other dry bulk, oil products, liquid bulk products, forestry products, other dry and liquid bulk products, other general cargo, and containers (NISRA, 2022). No live animals on the hoof have passed through the port in 2009 or since (NISRA, 2022).

There are two fishing ports in Lough Foyle: Greencastle commercial fishing harbour and Moville fishing harbour. However, Moville has received little maritime traffic as the majority of the fishing fleet has moved to Greencastle Harbour, excluding a few vessels that operate from Moville (eOceanic, Moville). Greencastle Harbour is situated inside the entrance to Lough Foyle and is the western terminal of the Lough Foyle ferry that travels across the mouth of the lough to Magilligan Point. Once a busy commercial fishing port, it has developed to include increased maritime leisure activities and vessels (eOceanic, Greencastle). Marine Traffic records automatic identification system (AIS) data from ships larger than 200 tons and amateur ships who link their receivers to the web and can be viewed on the website. Data from Marine Traffic on 25-06-24 was used to evaluate the ships on the lough, and found a variety of ships including pleasure craft, pusher tug vessels, tug vessels, cargo/containership, hopper dredgers, and sailing vessels at Foyle Port or in the lough. Greencastle Harbour also had a range of boats including high speed craft, suction dredger vessels, fishing vessels, pilot vessels, and a Ro-Ro/passenger ship (Marine Traffic). These ships ranged from 12 m to 212.5 m in length (Marine Traffic). It is important to note that this data was collected over one day and smaller vessels are not required to use AIS, implying that this potentially underrepresents vessel usage on the lough.

While data on sewage discharge levels from shipping activities in Lough Foyle are not available, it is possible that discharging may occur within the lough. The effect is likely to be the greatest in enclosed areas and shallow water with little or no tidal flow in the summer and autumn when temperatures are at their highest, coinciding with the peak of the boating season. However, it is also likely that these levels are very low compared with land-based discharges.

Figure 5-40: Piers, ports, harbours, and slips identified by the 2023 shoreline survey. Magilligan Ferry (pier) and Foyle Port/Marina were not identified during the shoreline survey. Piers/ports/slips/harbours were labelled where available from the desktop or shoreline survey.

5.1.6.2 Wildlife

Birds

It is important to assess the bird population in the Lough Foyle area as bird faeces are rich in faecal bacteria (Oshira & Fujioka, 1995) and have been shown to be a source of faecal contamination in the marine environment (Jones *et al*., 1978; Standridge *et al*., 1979; Levesque *et al*., 1993; Alderisio & DeLuca, 1999; Levesque *et al*., 2000; Ishii *et al*., 2007).

Lough Foyle is of high ornithological importance and overlaps with Lough Foyle SPA. The Lough Foyle SPA has two components; the Republic of Ireland Lough Foyle SPA (004087) comprises the western shore from Muff to north of Vances Point and the Northern Ireland Lough Foyle SPA (UK9020031) stretches along the southern and eastern shores of the

lough (**Figure 5-41**), supporting more than 20,000 internationally and nationally important wintering waterbirds (NWPS Lough Foyle SPA, DAERA Lough Foyle SPA). Lough Foyle SPA (UK9020031) covers the Rivers Foyle, Faughan, and Roe estuaries and overlaps extensive intertidal mudflats and sandflats (DAERA Lough Foyle SPA). The SPA (UK9020031) includes the entirety of the Lough Foyle ASSI's and Magilligan SAC (UK0016613). ASSI's are designated in the UK to protect areas of enhanced or excellent environmental conditions which represent wildlife or geology and contribute to the conservation of natural habitats and conditions. Lough Foyle SPA (UK9020031) is also completely congruent with Lough Foyle Ramsar site (UK12014), covering 2,204 ha and designated for its wetland properties, its rare, vulnerable or endangered species, and for its waterfowl (Lough Foyle Ramsar).

SPAs are designated for the conservation of Annex I birds and include all migratory birds and their habitats. There is a significant overlap of species between the Lough Foyle SPA and Ramsar site. Such as red-throated diver (*Gavia stellata*), great crested grebe (*Podiceps cristatus*), waterfowl including geese, swan, and duck species, oystercatcher (*Haematopus ostralegus*), curlew (*Numenius arquata*), and gull species.

Most wintering waterbirds utilising these conservation sites (004087 and UK9020031) occur along the eastern and southern shore (NWPS Lough Foyle SPA). Lough Foyle SPA (004087) regularly supports internationally important populations of whooper swan (*Cygnus cygnus*), light-bellied Brent goose (*Branta bernicla hrota*), and bar-tailed Godwit (*Limosa lapponica*), and a further 20 nationally important bird populations (NWPS Lough Foyle SPA). From 1991/92 to 1995/96, this area supported 5.6% of the international population of whooper swan, 18.7% of the international population of light-bellied Brent goose, and 1.9% of the international population of bar-tailed Godwit (Lough Foyle RAMSAR).

Nested within the coinciding Lough Foyle SPA (UK9020031) and the Lough Foyle Ramsar (UK12014) is the River Roe Estuary National Nature Reserve (**Figure 5-42**) designated due to exceptional habitat, biodiversity and geological characteristics, which provides an important food source for migrating bird species such as waders and waterfowl (Roe Estuary Nature Reserve, DAERA). There is overlap between areas of waterfowl importance within the nature reserve and mussel beds at Longfield Bank (see **Figure 3-2** for locations) (Roe Estuary Nature Reserve, DAERA).

The wide range of conservation objectives highlight that Lough Foyle is a highly significant ornithological region affording it various degrees and scopes of protection. Lough Foyle is routinely surveyed by the British Trust for Ornithology (BTO) (through the WeBS [Wetland Bird Survey] Project) and by Birdwatch Ireland (through the I-WeBS [Irish Wetland Bird Surveys] project). **Table 5-11** shows a five-year dataset used for the 2011 survey and the most recent five-year dataset. There has been a decrease in waterbirds in Lough Foyle since 2002-2007.

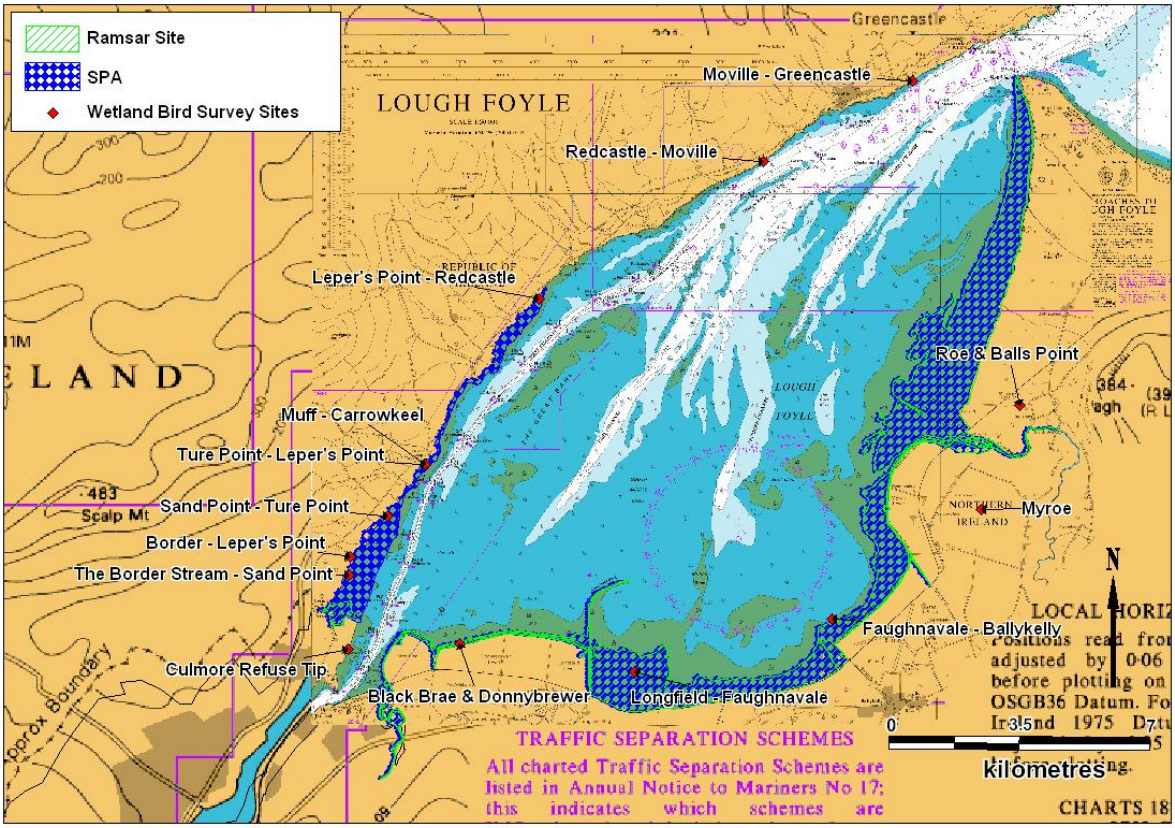

Figure 5-41: Special Protection Area (SPA), Ramsar sites and Wetland Bird Survey Sites in Lough Foyle 2010.

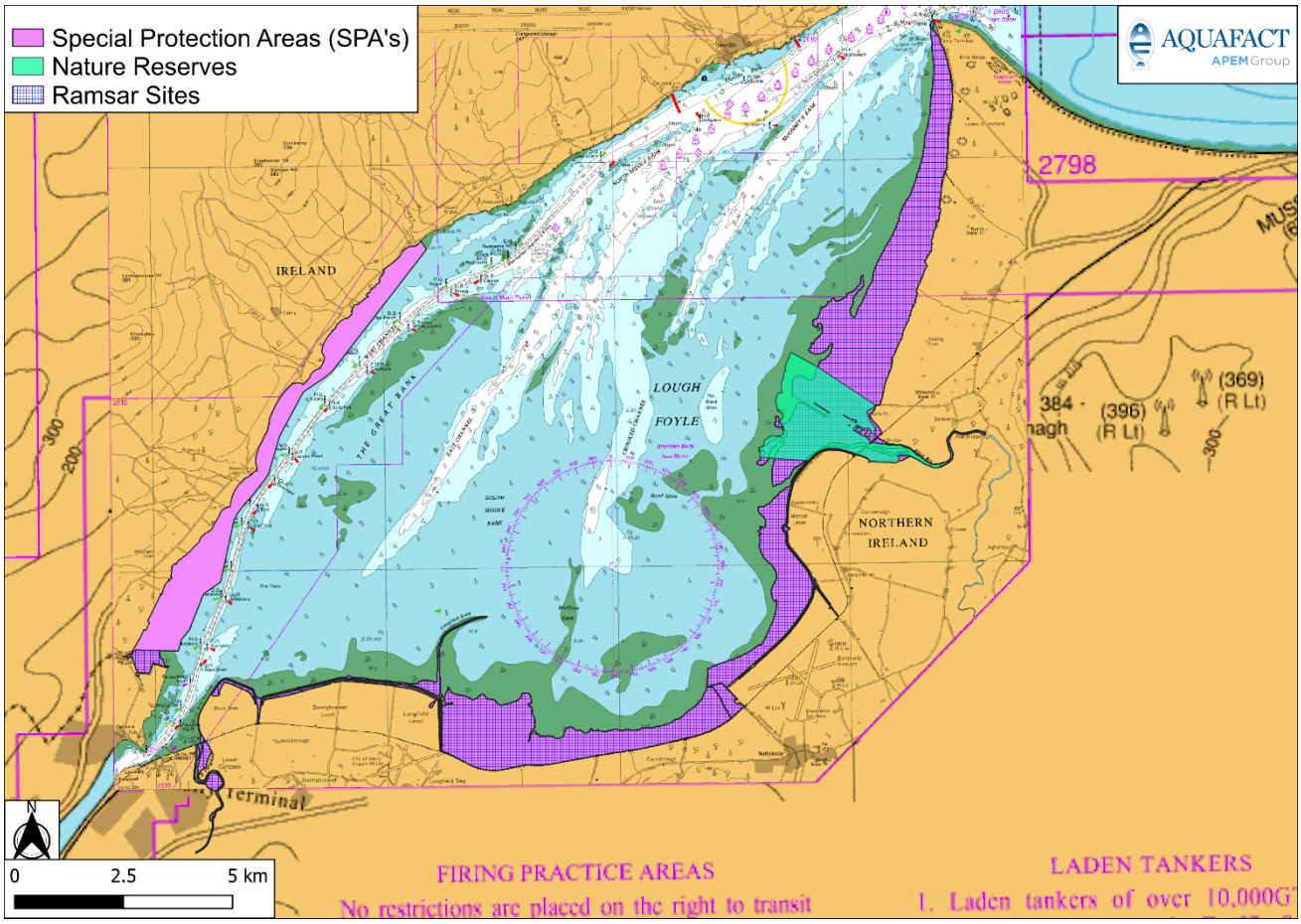

Figure 5-42: Special Protection Areas, nature reserves and Ramsar sites in Lough Foyle 2024 (source: Open Data Northern Ireland).

Table 5-11: Total number of water birds in Lough Foyle from 2002/03 to 2006/07 and 2012/12 to 2016/17 to 2019/20 and 2017/18 to 2021/22. (source: Frost *et al.*, 2020; Crowe *et al.*, 2011; British Trust for Ornithology Wetland Bird Survey report online).

Year	**2002/03**	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**5-year mean**
	34,154	37,292	33,076	38,324	34,850	35,539
Year	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**5-year mean**
	31,667	33,973	30,187	32,672	35,537	32,807
Year	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**5-year mean**
	32,005	36,477	29,991	26,665	27,565	30,541

Bird populations in the Lough Foyle area are typically higher in early winter and late spring due to migratory events and they are typically higher in mid-winter than spring and summer as the local birds tend to move off-site in the summer months to breed. Therefore, it is probable that the contribution made by wildfowl to pollution levels in Lough Foyle is higher in the winter months. However, it is likely that these levels are very low when compared to land-based discharges. Most wintering waterbirds utilising the cross-border Lough Foyle SPA (004087 and UK9020031) occur along the eastern and southern shore, indicating that this area will be a higher source of avian-related faecal material and, therefore, potential *E. coli*.

Aquatic Animals

Harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) have been recorded in Lough Foyle. There is no overlap of the lough with SACs designated for the protection of marine mammals. Harbour seals are present in the lough in low densities compared to other loughs and bays in Ireland and have been observed and recorded on the National Biodiversity Network Atlas for Northern Ireland (NBN Northern Ireland) and the National Biodiversity Data Centre biodiversity maps for the Republic of Ireland (NBDC). In 2013, the largest aggregation of harbour seals was observed at 39 individuals, and in 2018 18 individuals were recorded. The most recent record was from 2022 when two individuals were observed in the River Foyle near Strathfoyle (NBN Northern Ireland). The earliest record of harbour seals observed in the lough was in 1982 (NBDC).

Grey seals have been observed in the lough from 1982 to 2022, with an agglomeration of records around Magilligan Point (NBN Northern Ireland). In 2011 and 2012, there were individuals observed on Longfield Bank (**Figure 3-2**) near Lough Foyle View Point (NBN Northern Ireland). In 2017, one individual was observed in the River Foyle near Strathfoyle (NBN Northern Ireland). In 2011, 19 individuals were observed hauled out and resting on the western shore of Lough Foyle on Inishowen Head near Stroove (NBDC).

Common porpoise (*Phocoena phocoena*) has been observed in the lough from 1994 to 2023 (NBN Northern Ireland). The largest pod recorded in the lough was 12 individuals near Magilligan Point. In 2009 and 2015, individuals were recorded in the mouth of River Foyle, and in 2004, 2005 and 2013, two, three and one individual(s), respectively, were recorded upriver in the Foyle, around Derry/Londonderry town (NBN Northern Ireland). In 2018, an

individual was observed in the same area of River Foyle and notably, there is a high density of records around the seaward entrance to the lough and the area outside of this (NBDC). Citizen science and the ability of technology to capture biological data have led to increased ability to document biodiversity events, and in April 2020 a harbour seal was recorded *c.* seven km upriver in the Foyle (ORCA Ireland). Over the same period a pod of bottlenose dolphins (*Tursiops truncatus*) were also recorded, and in 2019, approximately eight individuals were observed in the same locality (ORCA Ireland). Bottlenose dolphins have been recorded in the lough from 2010 to 2022 (NBN Northern Ireland; NBDC). The largest pod observed was 27 individuals (NBDC) however records reveal most observations were of approximately 10-25 individuals (NBN Northern Ireland; NBDC). Common dolphin (*Delphinus delphis*) have been recorded through individual strandings in the lough from 2015 to 2018 (NBN Northern Ireland; NBDC). They have also been observed in the River Foyle near Derry/Londonderry town in 2020 (five individuals) and in 2018 (two individuals) (NBDC). Humpback whales (*Megaptera novaeangliae*) have been recorded in the lough with a stranding in 1907 (NBDC) and a live individual in 2004 (NBN Northern Ireland). A blue whale (*Balaenoptera musculus*) was stranded outside the lough across from The Tuns in 1907 (NBDC). White-beaked dolphin (*Lagenorhynchus albirostris*) has been recorded in the lough through strandings in 2005 and 2015 (NBDC). In 1981 a Risso's dolphin (*Grampus griseus*) was stranded outside the lough (NBDC). In 1987 a sperm whale (*Physeter macrocephalus*) was stranded (NBDC). A Minke whale (*Balaenoptera acutorostrata*) was stranded in the lough in 2015 on the southeastern shore and live animals have been recorded around the entrance and outside the lough (NBDC).

Basking sharks (*Cetorhinus maximus*) are protected by Irish and UK legislation, under Ireland's Wildlife Act (legally protected since 2022) and the Wildlife (Northern Ireland) Order 1985. They occur inside and around the lough observed as individuals or in groups (NBDC; NBN Northern Ireland).

5.2 Shoreline Survey

5.2.1 Shoreline Survey Report

The aim of the shoreline survey is to identify/confirm and mark all discharges, pollution sources, waterways, and marinas along the shoreline. As part of the survey, GPS (Global Positioning System) coordinates were recorded for all features and marked on a map. In

addition, all features were photographed digitally (where possible) and included in **Appendix A**. Notes were made of most of the features regarding the observation being made, on the numbers and types of farm animals visible from the shoreline, and on wild fowl/populations of wild animals with an estimate of their numbers.

A shoreline survey was carried out on the 17th, 18th, and 19th of July 2023. The entire shoreline was walked where practical, with the exception of west of map ID 246 (**Figure 5-43**) and after the Eglinton Embankment between map IDs 251 and 260 (**Figure 5-43**). **Figure 5-43** shows the GPS coordinates of 329 sites which were photographed over the three survey days (see **Appendix A** for shoreline survey images).

Figure 5-43 shows the locations of all features identified during the 2023 shoreline survey. Of the 329 features observed, there was an expanse of bamboo, two corn fields, an empty field, a watercourse leading to an airport, three regions of woodland, an area of fern, three shore habitats, a football pitch, a golf course, a shooting reserve, holiday homes, and a motor track. There were five drains, eight groundwater discharges, one gutter, one lagoon, one manhole, 127 pipes, one pipe wall, five pipes/drains, seven storm drains, one surface water flow, one swamp, one water course, one water pool, four water reservoirs adjacent to water courses, one well, three rivers, 74 streams, one stream/pond, and seven features with visible hydrocarbons. There were three areas with dumped silage wrap (two in large quantities) and an area of dumped grass. There were four occurrences of embankment features and three occurrences of stairs (two of which led to the shore from the embankment feature), three break water barriers, and six access routes (one field, two road, one access route, and two gates leading to the shore). There were three slips, two slips/piers, one slip/boat yard, and three large piers, namely Carrickarory Pier, Greencastle Harbour, and Moville Pier. Greencastle Harbour also contained a slip with in-wall drainage adjacent. In terms of wildlife, there were five sites with cows, seven sites with sheep, a site with rabbit burrows, and one feature observed was a grey heron and a grey seal next to each other near the shore. In terms of aquaculture, there were two oyster processing shacks, and 12 oyster trestles observed along the intertidal however, due to the subtidal nature of this feature it was not possible to estimate size and extent at the time of surveying. **Figure 5-44** to **Figure 5-68** show the locations of these features. **Table 5-12** details all observed features; the map ID number used is cross-referenced from **Figure 5-43** to **Figure 5-68**.

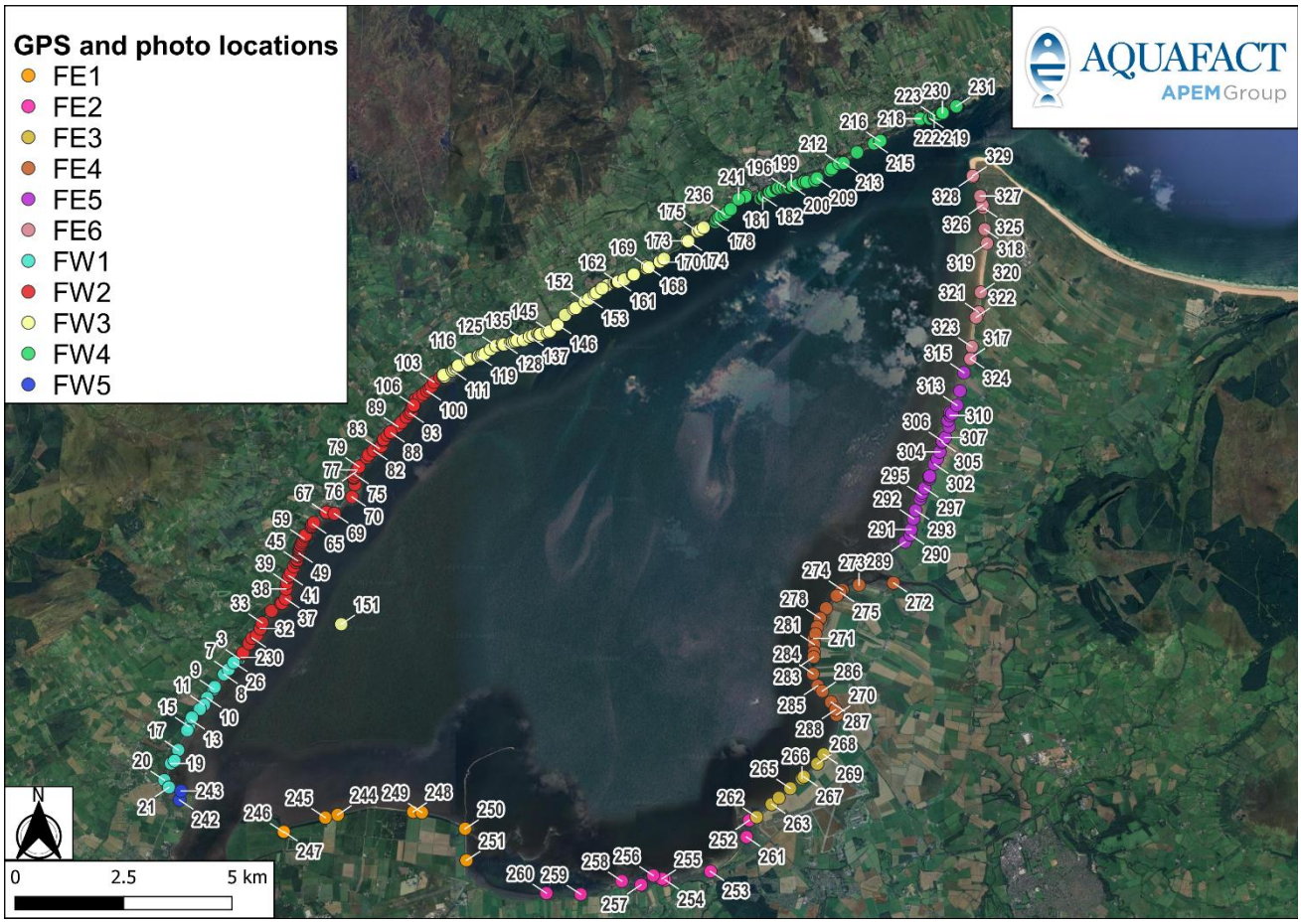

Figure 5-43: Location of GPS and photograph sites from the 2023 shoreline survey from Foyle East (FE) transects 1-6 and Foyle West (FW) transects 1-5 as defined by the 2023 shoreline survey (numbering cross-referenced to Table 5-12).

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Table 5-12: Features identified during the 2023 shoreline survey. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid. Refer to Figure 5-43 to Figure 5-68 for locations and Appendix A for photographs.

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
1	FW1-1	Oyster Cultivation Trestles	-	249306	427524	55.0926	-7.2285	FWT101A
2	FW1-2	Discharge Pipe	-	249265	427452	55.0919	-7.2292	FWT102 A-B
3	FW1-3	Discharge Pipe	No flow from pipe.	249230	427421	55.0917	-7.2297	FWT103 A-B
4	FW1-4	Groundwater Discharge	Visible hydrocarbons.	249224	427418	55.0916	-7.2298	FWT104 A-B
5	FW1-5	Sheep in Field	No visible discharge from field. Approximately 29 sheep.	249157	427382	55.0913	-7.2309	FWT105 A-B
6	FW1-6	Oyster Processing Shack	-	249133	427360	55.0911	-7.2312	FWT106
7	FW1-7	Stream	Dark copper colour. Visible algal growth.	248970	427154	55.0893	-7.2338	FWT107

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
8	FW1-8	Oyster Processing Shack	-	248880	427059	55.0884	-7.2353	FWT108 A-D
9	FW1-9	Stream	Clear. No odour.	248644	426713	55.0854	-7.2390	FWT109 A-B
10	FW1-10	Stream	Copper colour. No odour.	248497	426509	55.0835	-7.2414	FWT110 A-C
11	FW1-11	Stream	Copper colour. No odour.	248429	426351	55.0821	-7.2424	FWT111 A-C
12	FW1-12	Stream	Clear. No odour.	248333	426250	55.0812	-7.2440	FWT 112 A-B
13	FW1-13	Oyster Cultivation Trestles	-	248130	425998	55.0790	-7.2472	FWT113 A-B
14	FW1-14	Stream	Clear. No odour.	248116	425949	55.0785	-7.2474	FWT114 A-C
15	FW1-15	Bamboo	Extensive on shoreline (approximately 1 km).	248087	425847	55.0776	-7.2479	FWT115 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
16	FW1-16	Stream	Copper colour. No odour.	248047	425759	55.0768	-7.2485	FWT116 A-B
17	FW1-17	Stream	Copper. No odour.	247845	425303	55.0728	-7.2518	FWT117 A-C
18	FW1-18	Oyster Cultivation Trestles	Oyster cultivation trestles end for FWT101. Extensive along shoreline.	247736	425057	55.0706	-7.2535	FWT118 A-D
19	FW1-19	Stream	Dark copper.	247681	424994	55.0700	-7.2544	FWT119 A-C
20	FW1-20	Stream	Light brown.	247532	424609	55.0666	-7.2568	FWT120 A-D
21	FW1-21	Visible Hydrocarbons	Minimal.	247639	424441	55.0650	-7.2551	FWT 121 A-B
22	FWT122	Visible Hydrocarbons	-	247764	425055	55.0705	-7.2531	FWT122 A-D
23	FWT123	Visible Hydrocarbons	-	248152	426056	55.0795	-7.2468	FWT123 A-C
24	FWT124	Cows	3 visible.	248671	426765	55.0858	-7.2386	FWT124 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
25	FWT125	Cows	4 visible.	248985	427175	55.0895	-7.2336	FWT125 A-B
26	FWT126	Pipe	Dry.	249100	427332	55.0909	-7.2318	FWT126 A-B
27	FW2-1	Oyster Cultivation Trestles	Start of oyster trestles.	249305	427531	55.0926	-7.2285	FWT201 A-B
28	FW2-2	Grass Dump		249316	427556	55.0929	-7.2284	FWT202 A-B
29	FW2-3	Stream	No animals in adjacent fields, could host cattle.	249449	427774	55.0948	-7.2262	FWT203 A-B
30	FW2-4	Sheep and Site Entrance	Sheep in fields.	249521	427902	55.0959	-7.2251	FWT204 A-B
31	FW2-5	Stream	Sheep farms either side. Spreading machinery present in fields.	249626	427959	55.0964	-7.2234	FWT205 A
32	FWT2-6	Pipe x2	One old one new.	249710	428117	55.0979	-7.2221	FWT206 A-B
33	FWT2-7	Drainage Ditch	Fields empty. No flow just pooled.	249748	428251	55.0991	-7.2215	FWT 207 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
34	FWT2-8	Stream	Cattle in fields. Discoloured. Clear. No odour. Growth.	249960	428530	55.1015	-7.2181	FWT 208 A-C
35	FWT2-9	Stream	Cattle in fields. Discoloured. Clear. No odour.	250173	428706	55.1031	-7.2147	FWT 209 A-B
36	FWT2-10	Pipe	Plastic pipe in cement casing. No Flow. Pool of water collection present.	250204	428713	55.1032	-7.2142	FWT 210 A-C
37	FWT2-11	Slip	Site access.	250281	428815	55.1041	-7.2130	FWT 211 A-B
38	FWT2-12	Pipe	Flowing. Sheep fields above, roads then houses. Lines up with drainage ditch.	250289	429038	55.1061	-7.2129	FWT 212 A
39	FWT2-13	Pipe	Flowing. No ditch or stream in field above. Possible sump in middle of field.	250310	429174	55.1073	-7.2125	FWT 213 A-C
40	FWT2-14	Drainage Ditch		250345	429314	55.1085	-7.2119	FWT 214 A-B
41	FWT2-15	Road Access		250354	429342	55.1088	-7.2118	FWT 215 A
42	FWT2-16	Pipe	Large black pipe. Comparatively large flow. Stream running under road.	250396	429410	55.1094	-7.2111	FWT 216 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
43	FWT2-17	Pipe/Drain	Small flow. Red colouration on rocks. Under road.	250464	429557	55.1107	-7.2100	FWT 217 A
44	FWT2-18	Drain	Small flowing drain. Passes under vacant site and road.	250514	429654	55.1116	-7.2092	FWT 218 A-B
45	FWT2-19	Pipe	Black drain pipe from field. No flow.	250547	429690	55.1119	-7.2087	FWT 219 A
46	FWT2-20	Storm Drain	Very small flow.	250541	429715	55.1121	-7.2088	FWT 220 A
47	FWT2-21	Storm Drain	No flow.	250559	429784	55.1127	-7.2085	FWT 221 A
48	FWT2-22	Pipe	Concrete pipe under road. Flowing. Slight odour. Orange discolouration on rock. Sheen patches.	250570	429819	55.1131	-7.2083	FWT 222 A-B
49	FWT2-23	Storm Drain	Small flow.	250577	429863	55.1134	-7.2082	FWT 223 A
50	FWT2-24	Pipe	Little to no flow. Wall stained red/orange.	250582	429894	55.1137	-7.2081	FWT 224 A
51	FWT2-25	Pipe	No Flow. Orange staining.	250586	429930	55.1140	-7.2080	FWT 225 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
52	FWT2-26	Pipe	No Flow. Orange staining.	250590	429951	55.1142	-7.2080	FWT 226 A
53	FWT2-27	Pipe	Black pipe blue inside. No flow. Could hear water.	250598	429995	55.1146	-7.2078	FWT 227 A
54	FWT2-28	Pipe	Black pipe in block wall under road. Small flow. Stained wall brown. Some growth.	250599	430000	55.1147	-7.2078	FWT 228 A
55	FWT2-29	Pipe/Drain	No flow. Staining and growth.	250618	430046	55.1151	-7.2075	FWT 229 A
56	FWT2-30	Pipe/Drain	No flow. Staining and growth.	250623	430061	55.1152	-7.2074	FWT 230 A
57	FWT2-31	Pipe/Drain		250647	430111	55.1157	-7.2071	FWT 231 A
58	FWT2-32	Storm Drain	No flow.	250663	430148	55.1160	-7.2068	FWT 232 A
59	FWT2-33	Storm Drain	Dripping.	250687	430202	55.1165	-7.2064	FWT 233 A
60	FWT2-34	Storm Drain	No flow but growth and staining.	250713	430251	55.1169	-7.2060	FWT 234 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
61	FWT2-35	Stream	Flowing. Not clear. No odour or growth.	250724	430283	55.1172	-7.2058	FWT 235 A
62	FWT2-36	Pipe	Old dripping. Whitish grey colour. Smells like slurry. Houses above.	250856	430467	55.1188	-7.2037	FWT 236 A
63	FWT2-37	Pipe	New pipe, large black. Flow. Clear no odour.	250853	430475	55.1189	-7.2038	FWT 237 A
64	FWT2-38	Pipe	Old pipe no flow.	250872	430494	55.1191	-7.2035	FWT 238 A
65	FWT2-39	Pipe	Very small flow. Houses above. Hidden in weeds.	250882	430536	55.1195	-7.2033	FWT 239 A-B
66	FWT2-40	Pipe	Large pipe with tyre guard. No odour. Clear.	250913	430569	55.1198	-7.2028	FWT 240 A
67	FWT2-41	Pipe	Pipe with tyre guard. Small flow. No odour. Clear.	251185	430802	55.1218	-7.1985	FWT 241 A-B
68	FWT2-42	Stream	Very small. From ground. No clear source.	251199	430812	55.1219	-7.1983	FWT 242 A
69	FWT2-43	Stream	Quigley point fisherman's yard and caravan park on either side. Clear. No odour. Growth visible.	251384	430784	55.1216	-7.1954	FWT 243 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
70	FWT2-44	Stream	Red tinge. Between sheep farms. No odour.	251781	431173	55.1251	-7.1891	FWT 244 A
71	FWT2-45	Pipe	Leading to cattle farm drainage ditch.	251846	431461	55.1277	-7.1880	FWT 245 A
72	FWT2-46	Pipe/Drain	Partially covered/filled with sand. Small flow. Lots of sheen on water surface.	251813	431612	55.1290	-7.1885	FWT 246 A-B
73	FWT2-47	Pipe	Buried.	251815	431618	55.1291	-7.1885	FWT 247 A
74	FWT2-48	Discharge Pipe	Empty field. Cattle use.	251823	431635	55.1292	-7.1884	FWT 248 A
75	FWT2-49	Discharge Pipe	From sheep field. Sediment surrounding has anoxic smell and black colour.	251843	431690	55.1297	-7.1880	FWT 249 A-B
76	FWT2-50	Discharge Pipe and Sheep	Sheep. No visible drain in field.	251869	431753	55.1303	-7.1876	FWT 250 A-B
77	FWT2-51	Discharge Pipe and Sheep	Sheep. Clear.	251889	431794	55.1307	-7.1873	FWT 251 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
78	FWT2-52	Discharge Pipe and Sheep	Sheep. Clear.	251906	431827	55.1310	-7.1870	FWT 252 A
79	FWT2-53	Discharge Pipe and Sheep	Sheep. Clear. Small sheen around sediment.	251936	431868	55.1313	-7.1865	FWT 253 A-B
80	FWT2-54	Stream	Empty overgrown field.	252115	432087	55.1333	-7.1837	FWT 254 A-B
81	FWT2-55	Pipe	Small flow. Clear. Empty field above.	252153	432148	55.1338	-7.1831	FWT 255 A-B
82	FWT2-56	Pipe	Trickle. Clear. No odour.	252269	432247	55.1347	-7.1813	FWT 256 A
83	FWT2-57	Stream	No animals in adjacent fields.	252394	432292	55.1351	-7.1793	FWT 257 A-C
84	FWT2-58	Pipe	Trickle.	252447	432353	55.1356	-7.1784	FWT 258 A
85	FWT2-59	Pipe		252494	432478	55.1367	-7.1777	FWT 259 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
86	FWT2-60	Stream		252500	432505	55.1370	-7.1776	FWT 260 A
87	FWT2-61	Oyster Cultivation Trestles	End of oyster trestles.	252583	432605	55.1379	-7.1763	NO PHOTO
88	FWT2-62	Stream and Cattle	Cattle in adjacent field.	252665	432654	55.1383	-7.1750	FWT 262 A-B
89	FWT2-63	Slip/Pier		252823	432799	55.1396	-7.1725	FWT 263 A
90	FWT2-64	Stream	From farmyard.	252820	432813	55.1397	-7.1725	FWT 264 A
91	FWT2-65	Stream	Small, clear. Empty field.	252903	432900	55.1405	-7.1712	FWT 265 A-B
92	FWT2-66	Slip	Private at house.	253018	433028	55.1416	-7.1694	FWT 266 A-B
93	FWT2-67	Pipe	No flow.	253094	433111	55.1424	-7.1682	FWT 267 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
94	FWT2-68	Oyster Cultivation Trestles	Start of oyster trestles.	253125	433150	55.1427	-7.1677	NO PHOTO
95	FWT2-69	Pipe	Near cover. Very orange small flow.	253147	433258	55.1437	-7.1673	FWT 269 A
96	FWT2-70	Stream	Between fields. One side Croom site.	253188	433284	55.1439	-7.1666	FWT 270 A-B
97	FWT2-71	Pipe Wall	Pipe wall starts with small orange plastic pipes roughly every 1.5 meters. No flow.	253227	433430	55.1452	-7.1660	FWT 271 A-C
98	FWT2-72	Pipe	Flowing pipe on same wall.	253307	433492	55.1458	-7.1647	FWT 272 A
99	FWT2-73	Pipe Wall	Pipe wall ends.	253396	433555	55.1463	-7.1633	FWT 273 A-B
100	FWT2-74	Pipe	Black drain pipe. Under road from houses. Small clear flow.	253482	433629	55.1470	-7.1620	FWT 274 A
101	FWT2-75	Pipe	Smaller black drain pipe under road. No flow.	253538	433680	55.1474	-7.1611	FWT 275 A
102	FWT2-76	Discharge Pipe	Under road.	253584	433740	55.1480	-7.1604	FWT 276 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
103	FWT2-77	Storm Drain		253639	433834	55.1488	-7.1595	FWT 277 A
104	FWT2-78	Pipe	Black drain pipe beside garage. Flowing clear with some growth on pipe and in splash zone.	253782	433934	55.1497	-7.1572	FWT 278 A
105	FWT2-79	Stream		252650	432674	55.1385	-7.1752	FWT 279 A-C
106	FWT2-80	Stream		253175	433295	55.1440	-7.1669	FWT 280 A-C
107	FW3-1	Pipe	Dry.	253851	433958	55.1499	-7.1561	FWT 301 A-B
108	FW3-2	Oyster Cultivation Trestles	Underwater - couldn't estimate size.	253856	433960	55.1499	-7.1560	No picture
109	FW3-3	Sheep in field	17 sheep visible - no visible discharge.	253878	433965	55.1499	-7.1557	FWT 303 A
110	FW3-4	Stream	Fast flow. Brownish.	253859	434004	55.1503	-7.1560	FWT 304 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
111	FW3-5	Road Access	-	254064	434103	55.1512	-7.1528	FWT 305 A
112	FW3-6	Concrete Buried Pipe	No access to sample.	254098	434138	55.1515	-7.1522	FWT 306 A-B
113	FW3-7	Concrete Buried Pipe	No access to sample.	254145	434179	55.1518	-7.1515	FWT 307 A-C
114	FW3-8	Concrete Buried Pipe	No access to sample.	254170	434203	55.1520	-7.1511	FWT 308 A-C
115	FW3-9	Concrete Buried Pipe	No access to sample.	254197	434225	55.1522	-7.1506	FWT 309 A-C
116	FW3-10	Shore Access	-	254416	434351	55.1533	-7.1472	FWT 310 A
117	FW3-11	Discharge Pipe	Clear. Green algae.	254463	434370	55.1535	-7.1465	FWT 311 A-C
118	FW3-12	Discharge Pipe	Clogged with debris.	254469	434371	55.1535	-7.1464	FWT 312 A
119	FW3-13	Visible Hydrocarbons	-	254645	434440	55.1541	-7.1436	FWT 313 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
120	FW3-14	Stream	Clear. No odour.	254665	434457	55.1543	-7.1433	FWT 314 A-C
121	FW3-15	Stream	Clear. No odour (Checked photo for GPS).	254721	434468	55.1544	-7.1424	FWT 315 A
122	FW3-16	Discharge Pipe	Clear.	254755	434485	55.1545	-7.1418	FWT 316 A
123	FW3-17	Discharge Pipe	No flow.	254803	434505	55.1547	-7.1411	FWT 317 A
124	FW3-18	Slip/Boat Yard	Clear. No odour.	254934	434606	55.1556	-7.1390	FWT 318 A-B
125	FW3-19	Stream	-	255057	434689	55.1563	-7.1371	FWT 319 A-B
126	FW3-20	Field Access	-	255201	434721	55.1566	-7.1348	FWT 320 A
127	FW3-21	Stream	Clear/no odour.	255205	434732	55.1567	-7.1347	FWT 321 A-B
128	FW3-22	Sheep in field	10 sheep visible - no visible discharge.	255235	434718	55.1566	-7.1343	FWT 322 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
129	FW3-23	Discharge Pipe	No flow.	255392	434758	55.1569	-7.1318	FWT 323 A
130	FW3-24	Slip/Pier	-	255434	434751	55.1568	-7.1311	FWT 324 A-B
131	FW3-25	Surface Water Flow	Clear. Some green algae. No odour.	255437	434776	55.1571	-7.1311	FWT 325 A-B
132	FW3-26	Discharge Pipe	Clear.	255440	434782	55.1571	-7.1310	FWT 326 A
133	FW3-27	Visible Hydrocarbons	-	255490	434795	55.1572	-7.1303	FWT 327 A
134	FW3-28	Golf Course	Very close to shore.	255536	434816	55.1574	-7.1295	FWT 328 A
135	FW3-29	Stream	Brown algal growth.	255689	434828	55.1575	-7.1271	FWT 329 A-D
136	FW3-30	Holiday Homes	-	255893	434934	55.1584	-7.1239	FWT330 A
137	FW3-31	Stream	Grey. Strong odour.	255827	434909	55.1582	-7.1250	FWT331 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
138	FW3-32	Stream	Slow flow.	255910	434936	55.1584	-7.1236	FWT332 A
139	FW3-33	Pipe	Ground pipe. No flow.	256032	434923	55.1583	-7.1217	FWT 333 A
140	FW3-34	River	Dark brown.	256014	434981	55.1588	-7.1220	FWT 334 A-C
141	FW3-35	Discharge Pipe x2	No flow.	256053	434966	55.1587	-7.1214	FWT 335 A
142	FW3-36	Discharge Pipe	No flow.	256073	434965	55.1587	-7.1211	FWT 336 A
143	FW3-37i	Stream	Grey. Strong odour.	256249	435026	55.1592	-7.1183	FWT 337i A-C
144	FW3-37ii	Sheep In field	Approximately 40 sheep visible (Checked photo for GPS).	256238	435019	55.1591	-7.1185	FWT 337ii A
145	FW3-38	Oyster Cultivation Trestles	-	256290	435040	55.1593	-7.1177	FWT 338 A
146	FW3-39	Stream	Light red in colour.	256461	435191	55.1607	-7.1149	FWT 339 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
147	FW3-40	Grey Seal and Grey Herron	Appear undisturbed.	256462	435190	55.1607	-7.1149	FWT 340 A-B
148	FW3-41	Discharge Pipe	Clear.	256635	435414	55.1627	-7.1122	FWT 341 A
149	FW3-42	Discharge Pipe	Dry.	256833	435554	55.1639	-7.1090	FWT 342 A
150	FW3-43	Discharge Pipe	Dry.	256877	435576	55.1641	-7.1083	FWT 343 A
151	FW3-44	Stream	Clear.	251569	428241	55.0988	-7.1929	FWT 344 A-B
152	FW3-45	Stream	Clear (Checked photo for GPS).	257085	435735	55.1655	-7.1051	FWT 345 A-C
153	FW3-46	Oyster Cultivation Trestles	Oyster cultivation continued.	257179	435792	55.1660	-7.1036	FWT 346 A
154	FW3-47	Woodland	Uninterrupted approximately 1.5 km - Few visible discharges.	257305	435904	55.1670	-7.1016	FWT 347 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
155	FW3-48	Oyster Cultivation Trestles	Oyster cultivation trestles continued underwater. Hard to estimate size.	257347	435933	55.1672	-7.1009	FWT 348 A
156	FW3-49i	Oyster Cultivation Trestles	Oyster cultivation trestles continued underwater. Hard to estimate size.	257588	436106	55.1688	-7.0971	FWT 349i A
157	FW3-49ii	Road Access	Checked photo for GPS.	257478	436034	55.1681	-7.0988	FWT 349ii A
158	FW3-50	Stream	Large flow. Clear.	257765	436175	55.1694	-7.0943	FWT 350 A-C
159	FW3-51	Discharge Pipe	Dry.	257813	436182	55.1694	-7.0935	FWT 351 A
160	FW3-52	Discharge Pipe	Dry.	257826	436186	55.1694	-7.0933	FWT 352 A
161	FW3-53	Discharge Pipe x2	Dry.	257830	436190	55.1695	-7.0933	FWT 353 A
162	FW3-54	Discharge Pipe x3	Dry.	257842	436183	55.1694	-7.0931	FWT 354 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
163	FW3-55	Discharge Pipe x2	Dry.	257849	436197	55.1695	-7.0930	FWT 355 A-B
164	FW3-56	Oyster Cultivation Trestles	Oyster cultivation trestles continued underwater. Hard to estimate size.	257986	436247	55.1700	-7.0908	NO PHOTO
165	FW3-57	Woodland	Woodland continued.	258182	436361	55.1710	-7.0877	FWT 357 A-B
166	FW3-58	Stream	Clear.	258203	436366	55.1710	-7.0874	FWT 358 A-C
167	FW3-59	Stream	Clear.	258495	436515	55.1723	-7.0828	FWT 359 A-C
168	FW3-60	Ferns	Break in forest for ferns; large quantities of ferns.	258501	436556	55.1727	-7.0827	FWT 360 A-B
169	FW3-61	Stream	Clear.	258542	436535	55.1725	-7.0820	FWT 361 A-B
170	FW3-62	Stream	Clear.	258801	436654	55.1735	-7.0779	FWT 362 A-B
171	FW3-63	Stream	Clear.	258799	436670	55.1737	-7.0780	FWT 363 A-E

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
172	FW3-64	Woodland	Continued woodland. Minimal features.	258892	436734	55.1742	-7.0765	FWT 364 A
173	FW3-65	Stream	Grey. Strong odour.	259409	437156	55.1780	-7.0683	FWT 365 A-D
174	FW3-66	Stream	Clear (Checked photo for GPS).	259445	437146	55.1779	-7.0677	FWT 366 A-B
175	FW3-67	River	Clear (Checked photo for GPS).	259652	437378	55.1799	-7.0644	FWT 367 A-C
176	FW3-68	Pipe	Clear.	259716	437407	55.1802	-7.0634	FWT 368 A
177	FW3-69	Pipe	Clear.	259795	437465	55.1807	-7.0622	FWT 369 A
178	FW4-1	Pier and Shore	Transect restart at sandy/rocky shore by pier.	260058	437598	55.1819	-7.0580	FWT 401 A-C
179	FW4-2	Discharge Pipe	Very little flow.	260067	437644	55.1823	-7.0579	FWT 402 A-C
180	FWT4-3	Moville Pier		261095	438147	55.1867	-7.0416	FWT 403 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
181	FWT4-4	Slip	Transect restart at slip north of Moville pier.	261148	438163	55.1868	-7.0408	FWT 404 A-B
182	FWT4-5	Groundwater discharge	Little flow. Clear. No colour. No odour.	261153	438187	55.1870	-7.0407	FWT 405 A
183	FWT4-6	Discharge Pipe	No flow.	261160	438196	55.1871	-7.0406	FWT 406 A-C
184	FWT4-7	Discharge Pipe	No flow.	261166	438205	55.1872	-7.0405	FWT 407 A-B
185	FWT4-8	Discharge Pipe	Clear. No colour. No odour.	261168	438206	55.1872	-7.0405	FWT 408 A-B
186	FWT 4-9	Groundwater Discharge	Transect restart at groundwater discharge with very little flow.	261245	438255	55.1876	-7.0392	FWT 409 A-C
187	FWT 4-10	Groundwater Discharge	Clear. No colour. No odour.	261250	438274	55.1878	-7.0392	FWT 410 A-B
188	FWT 4-11	Groundwater Discharge	Clear. No colour. No odour.	261280	438295	55.1880	-7.0387	FWT 411 A-B
189	FWT 4-12	Discharge Pipe	Little flow. Clear. No colour. No odour.	261301	438300	55.1880	-7.0384	FWT 412 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
190	FWT 4-13	Visible Hydrocarbons	Possible hydrocarbons in water. Pipe nearby.	261308	438299	55.1880	-7.0382	FWT 413 A
191	FWT 4-14	Shore	Transect restart at large rocks/boulder shore with gravelly sand and macroalgae present.	261364	438326	55.1882	-7.0374	FWT 414 A
192	FWT 4-15	Discharge Pipe	Steady flow and clear. No colour. No odour.	261465	438389	55.1888	-7.0358	FWT 415 A-D
193	FWT 4-16	Well	Steady flow and clear. No colour. No odour.	261471	438397	55.1889	-7.0357	FWT 416 A-B
194	FWT 4-17	Discharge Pipe	Large flow and clear. No colour. No odour.	261499	438394	55.1888	-7.0352	FWT 417 A-B
195	FWT 4-18	Embankment Feature	Transect continue. Embankment walk with boulders/rocky shore.	261575	438408	55.1889	-7.0340	FWT 418 A-B
196	FWT 4-19	Discharge Pipe	Little flow and clear. Slight discolouration. Hydrocarbons. No odour.	261660	438419	55.1890	-7.0327	FWT 419 A-B
197	FWT 4-20	Visible Hydrocarbons		261720	438403	55.1889	-7.0318	FWT 420 A-C
198	FWT 4-21	Discharge Pipe	No flow.	261748	438414	55.1890	-7.0313	FWT 421 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
199	FWT 4-22	Discharge Pipe	No flow.	261799	438448	55.1893	-7.0305	FWT 422 A-C
200	FWT 4-23	Groundwater Discharge	Medium flow and clear. Slight discolouration. Hydrocarbons. No odour.	261800	438451	55.1893	-7.0305	FWT 423 A-C
201	FWT 4-24	Discharge Pipe	No flow.	261824	438456	55.1893	-7.0301	FWT 424 A-B
202	FWT 4-25	Groundwater Discharge	Little flow and clear. No colour. No odour.	261832	438455	55.1893	-7.0300	FWT 425 A-B
203	FWT 4-26	Discharge Pipe	Medium flow and clear. No colour. No odour.	261931	438468	55.1894	-7.0284	FWT 426 A-C
204	FWT 4-27	Discharge Pipe	No flow.	261952	438482	55.1896	-7.0281	FWT 427 A-B
205	FWT 4-28	Discharge Pipe	No flow.	262066	438546	55.1901	-7.0263	FWT 428 A-B
206	FWT 4-29	Discharge Pipe	Large flow and clear. Light yellow/brown colour. No odour.	262097	438550	55.1902	-7.0258	FWT 429 A-B
207	FWT 4-30	Discharge Pipe X2	No flow.	262150	438545	55.1901	-7.0250	FWT 430 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
208	FWT 4-31	Discharge Pipe	Large flow and clear. No colour. No odour.	262342	438579	55.1904	-7.0220	FWT 431 A-B
209	FWT 4-32	Discharge Pipe	No flow.	262386	438633	55.1909	-7.0213	FWT 432 A-C
210	FWT 4-33	Embankment Feature	Transect continue - embankment walk with sandy/rocky shore + mixed accessibility.	262688	438818	55.1925	-7.0165	FWT 433 A-C
211	FWT 4-34	Discharge Pipe	No flow.	262730	438859	55.1929	-7.0158	FWT 434 A-B
212	FWT 4-35	Discharge Pipe	Little flow and clear. No colour. No odour. Hydrocarbons + groundwater discharge nearby.	262887	438980	55.1939	-7.0133	FWT 435 A-D
213	FWT 4-36	Stream	Large flow and clear. Slight discolouration. No odour.	262990	438992	55.1940	-7.0117	FWT 436 A-C
214	FWT 4-37	Discharge Pipe	No flow.	263296	439239	55.1962	-7.0068	FWT 437 A-B
215	FWT 4-38	Stream	Little flow and clear. No colour. No odour.	263686	439448	55.1980	-7.0006	FWT 438 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
216	FWT 4-39	Stream	Little flow and clear. No colour. No odour.	263822	439505	55.1985	-6.9985	FWT 439 A-B
217	FWT 4-40	Stream	Little flow and clear. No colour. No odour.	263827	439511	55.1986	-6.9984	FWT 440 A-C
218	FWT 4-41	Greencastle Harbour	POI.	264738	440031	55.2031	-6.9840	FWT 441 A-E
219	FWT 4-42	In Wall Drainage and Slip	Approximately 40. Desktop Review identified slip in associated photo - most likely part of Greencastle harbour.	264957	440039	55.2032	-6.9806	FWT 442 A-D
220	FWT 4-43	Discharge Pipe x6	Clear.	265042	440080	55.2035	-6.9792	FWT 443 A-D
221	FWT 4-44	Discharge Pipe	Grey. Odour.	265046	440089	55.2036	-6.9792	FWT 444 A-C
222	FWT 4-45	Discharge Pipe	Dry.	265058	440103	55.2037	-6.9790	FWT 445 A
223	FWT 4-46	Discharge Pipe x2	Dry.	265070	440108	55.2038	-6.9788	FWT 446 A-E
224	FWT 4-47	Groundwater Discharge	Brown. Odour.	265109	440117	55.2038	-6.9782	FWT 447 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
225	FWT 4-48	Discharge Pipe	Copper. Sheen. GPS Taken on 18/07/23 Sample taken on 20/07/23	265110	440119	55.2039	-6.9781	FWT 448 A-F
226	FWT 4-49	Discharge Pipe	-	265144	440132	55.2040	-6.9776	FWT 449 A-B
227	FWT 4-50	Pipe	Buried.	265201	440178	55.2044	-6.9767	FWT 450 A-B
228	FWT 4-51	Gutter	Dry.	265228	440179	55.2044	-6.9763	FWT 451 A
229	FWT 4-52	Discharge Pipe	-	265262	440190	55.2045	-6.9757	FWT 452 A-C
230	FWT 4-53	Discharge Pipe	Grey. Odour.	265249	440171	55.2043	-6.9760	FWT 453 A-C
231	FWT 4-54	Carrickarory Pier	Start of pier.	265564	440329	55.2057	-6.9710	FWT 454 A-C
232	FWT 4-55	Drain	Dry.	260086	437663	55.1824	-7.0576	FWT 455 A-B
233	FWT 4-56	Discharge Pipe x2	Dry.	260121	437700	55.1828	-7.0570	FWT 456 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
234	FWT 4-57	Drain	Dry.	260142	437713	55.1829	-7.0567	FWT 457 A-B
235	FWT 4-58	Discharge Pipe	Grey. Odour.	260187	437745	55.1832	-7.0560	FWT 458 A-B
236	FWT4-59	Stream	Brown.	260278	437772	55.1834	-7.0545	FWT4-59 A-C
237	FWT4-60	Pipe x6	Dry.	260324	437819	55.1838	-7.0538	FWT4-60 A-B
238	FWT4-61	Stream	Clear.	260412	437895	55.1845	-7.0524	FWT4-61 A
239	FWT4-62	Bredagh River Stream	Large volume. Brackish. Brown Colour. Adjacent to beach/shore.	260769	438221	55.1874	-7.0467	FWT4-62 A-C
240	FWT4-63	Football Pitch	-	260747	438187	55.1871	-7.0471	FWT4-63 A-B
241	FWT4-64	Stream	Clear.	260588	438127	55.1865	-7.0496	FWT4-64 A-D
242	FWT 5-01	Lagoon	No visible discharge.	247887	424155	55.0624	-7.2513	FWT 501 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
243	FWT 5-02	Discharge Pipe	Brown sludge dried out. Unable to sample.	247922	424362	55.0643	-7.2507	FWT 502 A-D
244	FET1-1	Water Reservoir	Beside water course. No unauthorised access. Steel grid and ladder around. Screen ID:027-002/014/015. Field side of embankment.	251539	423853	55.0594	-7.1942	FET1-1 A
245	FET1-2	Water Reservoir	Beside water course. No unauthorised access. Steel grid and ladder around. Field side of embankment.	251253	423786	55.0588	-7.1987	FET1-2 A-C
246	FET1-3	Water Course	Water course entrance to Lough Foyle. Reddy/brown colour scum on top. No odour.	250303	423430	55.0557	-7.2136	FET1-3 A-C
247	FET1-4	Pipe x2	Two brown pipes from private land across water course.	250301	423448	55.0559	-7.2137	FET1-4 A
248	FET1-5	Water Reservoir	Beside water course. No unauthorised access. Steel grid and ladder around. Screen ID:027-004/018. Field side of embankment. On sea side large cement block. Looks like reservoir.	253279	423941	55.0600	-7.1670	FET1-5 A-D

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
249	FET1-6	Pipe	No flow. Green growth in pipe and flow zone.	253479	423930	55.0599	-7.1638	FET1-6 A
250	FET1-7	Water Reservoir	Beside water course. No unauthorised access. Steel grid and ladder around. Screen ID:027-002/019. Field side of embankment	254482	423567	55.0565	-7.1482	FET1-7 A
251	FET1-8	Walkway and Water Course	End of walkway and water course leading to airport.	254520	422838	55.0499	-7.1478	FET1-8 A
252	FE2-1	Stream	Stream/large water course. Dark reddish. No odour.	261032	423846	55.0582	-7.0457	FET 201 A-B
253	FE2-2	Stream	Under railway bridge. Cloudy. Lots of sediment. Dark.	260152	422655	55.0476	-7.0597	FET 202 A-C
254	FE2-3	Swampy Area	Lots of sheen. On sediment nearby.	259104	422448	55.0459	-7.0761	FET 203 A-C
255	FE2-4	Stream and Pond	Stream from large pond/pool leading to sea.	259037	422471	55.0461	-7.0772	FET 204 A-C
256	FE2-5	Stream	Reddish colour. Slightly cloudy. Some growth. No odour.	258832	422544	55.0468	-7.0804	FET 205 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
257	FE2-6	Pipe	Large pipe flowing into sea. Dark water from pipe mixing.	258555	422327	55.0449	-7.0847	FET 206 A-B
258	FE2-7	Stream	Clear. No red colour or odour.	258111	422405	55.0456	-7.0917	FET 207 A-B
259	FE2-8	Pipe	Pipe discharging to sea. No odour. Clear. Some growth.	257166	422089	55.0429	-7.1065	FET 208 A-B
260	FE2-9	Stream	Stream, rushes. Lots of growth.	256373	422105	55.0431	-7.1189	FET 209 A-B
261	FE2-10	Stream	Unable to sample. Channel across mudflats and in shooting reserve.	260972	423460	55.0548	-7.0467	FET 210 A-C
262	FET 3-01	Embankment Feature	Start of embankment feature. No visible discharge.	261199	423922	55.0589	-7.0430	FET 301 A-B
263	FET 3-02	Break Water Barrier	Start of break water barrier that continues for approximately 1km.	261542	424224	55.0616	-7.0376	FET 302 A-B
264	FET 3-03	Discharge Pipe	Dry. Unable to sample.	261707	424373	55.0629	-7.0350	FET 303 A-B
265	FET 3-04	Embankment Feature	Embankment feature continued. No visible discharge.	261966	424595	55.0648	-7.0309	FET 304 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
266	FET 3-05	Stairs	Stairs on embankment to shore.	262233	424828	55.0669	-7.0267	FET 305 A-B
267	FET 3-06	Break Water Barrier	End of break water barrier.	262275	424865	55.0672	-7.0260	FET 306 A-B
268	FET 3-07	Break Water Barrier	Break water barrier.	262581	425169	55.0699	-7.0212	FET 307 A-B
269	FET 3-08	Stairs	Stairs on embankment to shore.	262722	425388	55.0719	-7.0189	FET 308 A
270	FE4-1	Pipe	No flow.	263007	426299	55.0800	-7.0142	FET 401 A
271	FE4-2	Stairs	Access from rock armour.	262458	428055	55.0959	-7.0224	FET 402 A-B
272	FET4-3	River Roe	Dark red colour.	264278	429356	55.1073	-6.9937	FET4-3 A-B
273	FET4-4	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	263482	429299	55.1069	-7.0061	FET4-4 A
274	FET4-5	Manhole	Water is written on it. Same location as old survey point.	263104	429177	55.1059	-7.0121	FET4-5 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
275	FET4-6	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	263055	429121	55.1054	-7.0129	FET4-6 A
276	FET4-7	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262974	429041	55.1047	-7.0142	FET4-7 A
277	FET4-8	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262733	428749	55.1021	-7.0180	FET4-8 A
278	FET4-9	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262597	428519	55.1000	-7.0202	FET4-9 A
279	FET4-10	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262531	428316	55.0982	-7.0212	FET4-10 A
280	FET4-11	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262497	428156	55.0968	-7.0218	FET4-11 A

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
281	FET4-12	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262473	427913	55.0946	-7.0222	FET4-12 A
282	FET4-13	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262467	427730	55.0929	-7.0224	FET4-13 A
283	FET4-14	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262462	427625	55.0920	-7.0225	FET4-14 A
284	FET4-15	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262453	427239	55.0885	-7.0227	FET4-15 A-B
285	FET4-16	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262566	426966	55.0861	-7.0210	FET4-16 A-B
286	FET4-17	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262672	426842	55.0849	-7.0194	FET4-17 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
287	FET4-18	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262877	426594	55.0827	-7.0162	FET4-18 A-B
288	FET4-19	Field Drain Pipe	Into a field water course on the other side of the embankment; not into Lough Foyle.	262985	426421	55.0811	-7.0146	FET4-19 A-B
289	FET 5-01	Shooting Reserve	Access restricted on shooting reserve.	264530	430303	55.1158	-6.9895	FET 501 A-B
290	FET 5-02	Rabbit Holes	-	264649	430468	55.1172	-6.9876	FET 502 A-B
291	FET 5-03	Shore	Sandy/rocky shore.	264663	430591	55.1184	-6.9873	FET 503 A
292	FET 5-04	Stream	Clear. No odour. Dark algae growth.	264717	430840	55.1206	-6.9864	FET 504 A-D
293	FET 5-05	Empty Fields	Grass.	264761	431033	55.1223	-6.9857	FET 505 A-B
294	FET 5-06	Corn Field	No visible discharges.	264864	431302	55.1247	-6.9840	FET 506 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
295	FET 5-07	Stream	Clear. No odour.	264887	431384	55.1254	-6.9836	FET 507 A-C
296	FET 5-08	Gate Access to Shore	-	264910	431439	55.1259	-6.9833	FET 508 A-B
297	FET 5-09	Stream	Clear. No odour.	264964	431550	55.1269	-6.9824	FET 509 A-C
298	FET 5-10	Sheep In Field	3 sheep visible.	265068	431764	55.1288	-6.9807	FET 510 A
299	FET 5-11	Dumped Silage Wrap	Dumped in large quantity.	265061	431809	55.1292	-6.9808	FET 511 A-C
300	FET 5-12	Stream	Clear. No odour. Extensive vegetation. Close to cows in field.	265075	431821	55.1293	-6.9806	FET 512 A-C
301	FET 5-13	Cows	10 cows visible in field.	265078	431826	55.1294	-6.9806	FET 513 A-B
302	FET 5-14	Sheep In Field	8 sheep visible.	265179	432104	55.1319	-6.9789	FET 514 A-D
303	FET 5-15	Motor Track	Close to shore.	265245	432230	55.1330	-6.9778	FET5-15 A-B

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
304	FET 5-16	Stream	Clear. No odour.	265300	432386	55.1344	-6.9769	FET5-16 A-C
305	FET 5-17	Shore Access	Overgrown vegetation restricting the access.	265350	432605	55.1363	-6.9761	FET5- 17 A-B
306	FET 5-18	Dumped Silage Wrap	Dumped in large quantity.	265361	432630	55.1366	-6.9759	FET5-18 A-B
307	FET 5-19	Discharge Pipe	Dry. Clogged.	265420	432717	55.1373	-6.9750	FET5-19 A-C
308	FET 5-20	Stream	Clear. No odour.	265503	432971	55.1396	-6.9736	FET5-20 A-C
309	FET 5-21	Gate Access to Shore	-	265477	433112	55.1409	-6.9740	FET5-21 A-B
310	FET 5-22	Dumped Silage Wrap	-	265530	433225	55.1419	-6.9731	FET5-22 A-B
311	FET 5-23	Pipe	Broken. Dry. No visible discharge. Possibly pipe to pump seawater to land.	265529	433296	55.1425	-6.9731	FET5-23 A-E
312	FET 5-24	Stream	Clear. No odour. Dark algal growth.	265569	433269	55.1423	-6.9725	FET5-24 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
313	FET 5-25	Cows	10 cows visible in field.	265681	433460	55.1440	-6.9707	FET5-25 A-B
314	FET 5-26	Stream	Clear. No odour.	265743	433793	55.1470	-6.9697	FET5-26 A-C
315	FET 5-27	Cows	30 cows visible in field.	265828	434215	55.1507	-6.9682	FET5-27 A-C
316	FET 5-28	Stream	Clear. No odour.	265976	434534	55.1536	-6.9658	FET5-28 A-D
317	FET 5-29	Corn Field	No visible discharges.	265991	434565	55.1539	-6.9656	FET5-29 A-C
318	FE6-1	Pipe	From dunes - no flow.	266256	437514	55.1803	-6.9608	FET 601 A-B
319	FE6-2	Stream	Clear. No odour. Growth visible. Military shooting grounds above.	266316	437194	55.1774	-6.9599	FET 602 A-B
320	FE6-3	Water Pool	Lots of rock debris and softer sediment.	266189	436065	55.1673	-6.9622	FET 603 A-C
321	FE6-4	Stream	Cloudy. Dark. No odour. Growth visible. Dumped rubbish and scrap.	266149	435607	55.1632	-6.9629	FET 604 A-C

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude	Photo ID
322	FE6-5	Access Route		266090	435490	55.1622	-6.9638	FET 605 A-C
323	FE6-6	Stream	Between dunes and fields. Clear. No odour. Some growth. Lots of litter, plastic and metal.	266003	434811	55.1561	-6.9654	FET 606 A-B
324	FE6-7	Stream	Between agricultural land. Clear. Growth visible. Litter. No odour.	265972	434533	55.1536	-6.9659	FET 607 A-C
325	FE6-8	Pipe	Plastic black. Out of dune. No flow.	266216	438010	55.1848	-6.9613	FET 608 A-B
326	FE6-9	Pipe	Concrete pipe in rock armour. No flow but evidence of previous flow.	266195	438074	55.1854	-6.9616	FET 609 A-B
327	FE6-10	Pipe	Plastic white. Out of Dunes. No flow.	266144	438278	55.1872	-6.9623	FET 610 A-B
328	FE6-11	Pipe	In concrete under ferry terminal. No flow.	265961	438711	55.1911	-6.9651	FET 611 A-B
329	FE6-12	Pipe	Under point bar. Trickle clear. Scummy green/white growth.	265966	438741	55.1914	-6.9650	FET 612 A-C

Figure 5-44: GPS and photo locations for features 1 – 10 and 24 – 31 from the Foyle West (FW) 1 transect and Foyle West (FW) 2 transect (see Figure 5-43 for FW1 and FW2 features).

Figure 5-45: GPS and photo locations for features 11-17 and 23 from the Foyle West (FW) 1 transect (see Figure 5-43 for FW1 features).

Figure 5-46: GPS and photo locations for features 18-22 and 242 to 243 from the Foyle West (FW) 1 and Foyle West (FW) 5 transect (see Figure 5-43 for FW1 and FW5 features).

Figure 5-47: GPS and photo locations for features 32-42 and 151 from the Foyle West (FW) 2 transect and Foyle West (FW) 3 transect (see Figure 5-43 for FW2 and FW3 features).

Figure 5-48: GPS and photo locations for features 43-69 from the Foyle West (FW) 2 transect(see Figure 5-43 for FW2 features).

Figure 5-49: GPS and photo locations for features 70-82 from the Foyle West (FW) 2 transect(see Figure 5-43 for FW2 features).

Figure 5-50: GPS and photo locations for features 83-100 and 105-106 from the Foyle West (FW) 2 transect (see Figure 5-43 for FW2 features).

Figure 5-51: GPS and photo locations for features 101-104 and 107-125 from the Foyle West (FW) 2 transect and Foyle West (FW) 3 transect (see Figure 5-43 for FW2 and FW3 features).

Figure 5-52: GPS and photo locations for features 126-150 from the Foyle West (FW) 3 transect (see Figure 5-43 for FW3 features).

Figure 5-53: GPS and photo locations for features 152-159 and 161-169 from the Foyle West (FW) 3 transect (see Figure 5-43 for FW3 features).

Figure 5-54: GPS and photo locations for features 170-177 from the Foyle West (FW) 3 transect (see Figure 5-43 for FW3 features).

Figure 5-55: GPS and photo locations for features 178-198 and 232-241 from the Foyle West (FW) 4 transect (see Figure 5-43 for FW4 features).

Figure 5-56: GPS and photo locations for features 199-214 from the Foyle West (FW) 4 transect (see Figure 5-43 for FW4 features).

Figure 5-57: GPS and photo locations for features 215-222 and 224-231 from the Foyle West (FW) 4 transect (see Figure 5-43 for FW4 features).

Figure 5-58: GPS and photo locations for features 244-251 from the Foyle East (FE) 1 transect (see Figure 5-43 for FE1 features).

Figure 5-59: GPS and photo locations for features 253-260 from the Foyle East (FE) 2 transect (see Figure 5-43 for FE2 features).

Figure 5-60: GPS and photo locations for features 252 and 261-269 from the Foyle East (FE) 2 transect and Foyle East (FE) 3 transect (see Figure 5-43 for FE2 and FE3 features).

Figure 5-61: GPS and photo locations for features 270, and 284-288 from the Foyle East (FE) 4 transect (see Figure 5-43 for FE4 features).

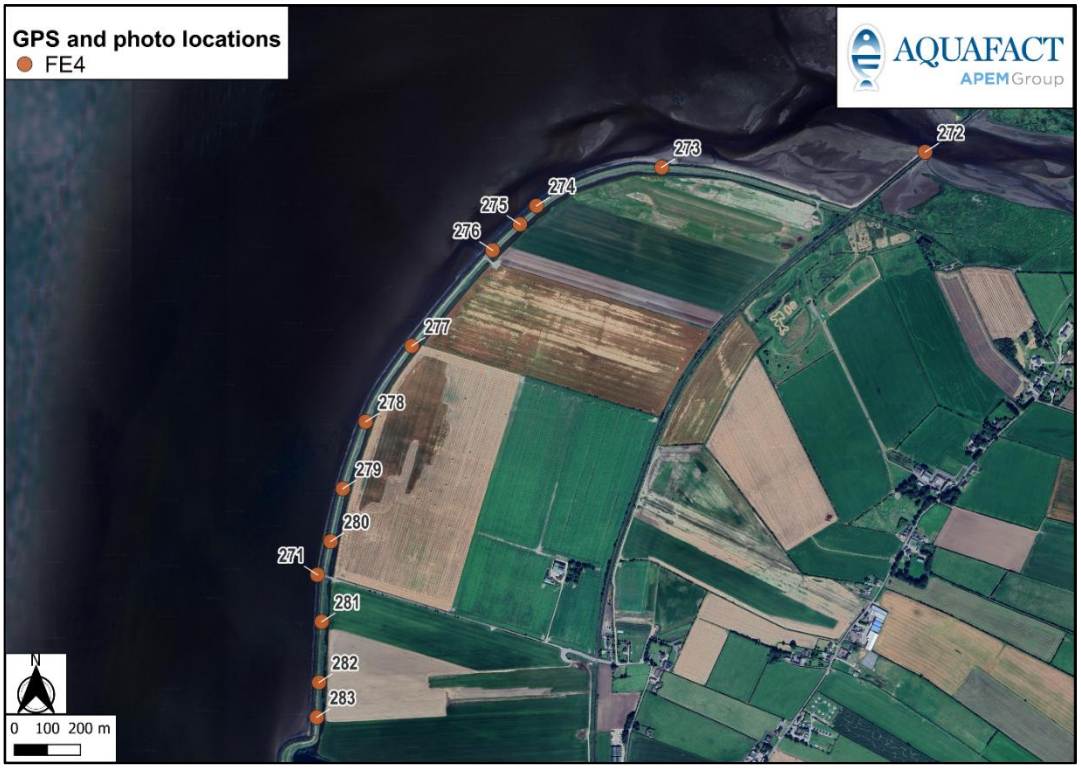

Figure 5-62: GPS and photo locations for features 271-283 from the Foyle East (FE) 4 transect (see Figure 5-43 for FE4 features).

Figure 5-63: GPS and photo locations for features 289-297 from the Foyle East (FE) 5 transect (see Figure 5-43 for FE5 features).

Figure 5-64:GPS and photo locations for features 298-308 from the Foyle East (FE) 5 transect (see Figure 5-43 for FE5 features).

Figure 5-65:GPS and photo locations for features 309-317 and 324 from the Foyle East (FE) 5 transect and Foyle East (FE) 6 transect (see Figure 5-43 for FE5 and FE6 features).

Figure 5-66: GPS and photo locations for features 318-320 from the Foyle East (FE) 6 transect (see Figure 5-43 for FE6 features).

Figure 5-67: GPS and photo locations for features 321-323 from the Foyle East (FE) 6 transect (see Figure 5-43 for FE6 features).

Figure 5-68: GPS and photo locations for features 325-329 from the Foyle East (FE) 6 transect (see Figure 5-43 for FE6 features).

5.2.2 Location of Sources

Figure 5-69 shows all rivers/streams that discharge into Lough Foyle. **Figure 5-70** shows all discharges into Lough Foyle contributing catchment and **Table 5-13** provides cross-referenced details for industrial discharges, drains, pipes, rivers, and stream discharges observed during the 2023 shoreline survey.

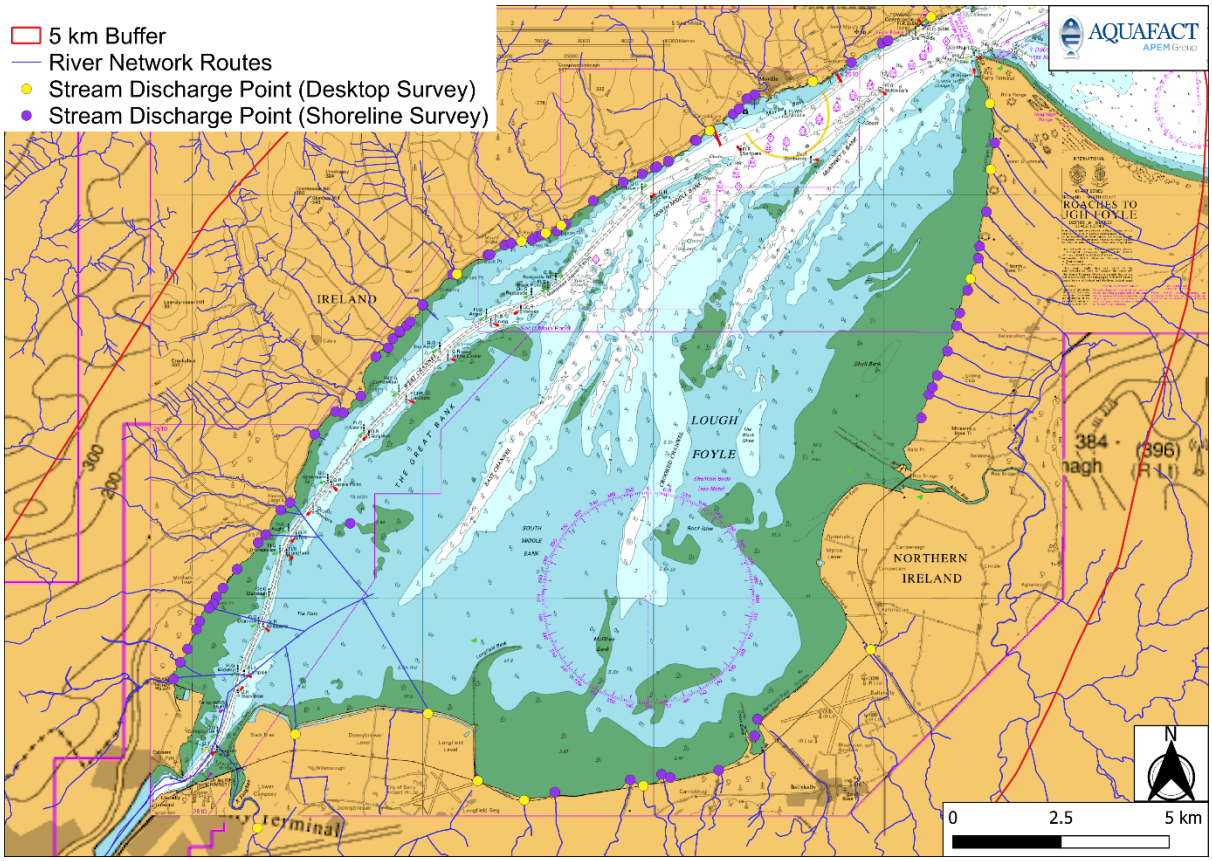

Figure 5-69: Locations of river/stream discharge points into Lough Foyle. Stream/river discharge points identified during the 2023 shoreline survey are pink and the remaining stream/river discharge points (green) were identified through the desktop survey (source: EPA Geoportal and DAERA).

The majority of rivers/streams according to the EPA Geoportal and DAERA were identified during the shoreline survey. Along the southern coast of Lough Foyle, there were areas that were not surveyed as access was limited. Several streams were identified using EPA Geoportal by the desktop survey in this area (**Figure 5-69**).

Table 5-13: Discharges identified by the 2023 shoreline survey discharging into Lough Foyle. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
1	FW1-2	Discharge Pipe		249265	427452	55.0919	-7.2292
2	FW1-3	Discharge Pipe	No flow from pipe.	249230	427421	55.0917	-7.2297
3	FW1-4	Groundwater Discharge	Visible hydrocarbons.	249224	427418	55.0916	-7.2298
4	FW1-7	Stream	Dark copper colour. Visible algal growth.	248970	427154	55.0893	-7.2338
5	FW1-9	Stream	Clear. No odour.	248644	426713	55.0854	-7.2390
6	FW1-10	Stream	Copper colour. No odour.	248497	426509	55.0835	-7.2414
7	FW1-11	Stream	Copper colour. No odour.	248429	426351	55.0821	-7.2424
8	FW1-12	Stream	Clear. No odour.	248333	426250	55.0812	-7.2440
9	FW1-14	Stream	Clear. No odour.	248116	425949	55.0785	-7.2474
10	FW1-16	Stream	Copper colour. No odour.	248047	425759	55.0768	-7.2485
11	FW1-17	Stream	Copper. No odour.	247845	425303	55.0728	-7.2518
12	FW1-19	Stream	Dark copper.	247681	424994	55.0700	-7.2544
13	FW1-20	Stream	Light brown.	247532	424609	55.0666	-7.2568
14	FWT126	Pipe	Dry.	249100	427332	55.0909	-7.2318

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
15	FW2-3	Stream	No animals in adjacent fields, could host cattle.	249449	427774	55.0948	-7.2262
16	FW2-5	Stream	Sheep farms either side. Spreading machinery present in fields.	249626	427959	55.0964	-7.2234
17	FWT2-6	Pipe x2	One old one new.	249710	428117	55.0979	-7.2221
18	FWT2-7	Drainage Ditch	Fields empty. No flow just pooled.	249748	428251	55.0991	-7.2215
19	FWT2-8	Stream	Cattle in fields. Discoloured. Clear. No odour. Growth.	249960	428530	55.1015	-7.2181
20	FWT2-9	Stream	Cattle in fields. Discoloured. Clear. No odour.	250173	428706	55.1031	-7.2147
21	FWT2-10	Pipe	Plastic pipe in cement casing. No Flow. Pool of water collection present.	250204	428713	55.1032	-7.2142
22	FWT2-12	Pipe	Flowing. Sheep fields above, roads then houses. Lines up with drainage ditch.	250289	429038	55.1061	-7.2129
23	FWT2-13	Pipe	Flowing. No ditch or stream in field above. Possible sump in middle of field.	250310	429174	55.1073	-7.2125
24	FWT2-14	Drainage Ditch		250345	429314	55.1085	-7.2119
25	FWT2-16	Pipe	Large black pipe. Comparatively large flow. Stream running under road.	250396	429410	55.1094	-7.2111

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
26	FWT2-17	Pipe/Drain	Small flow. Red colouration on rocks. Under road.	250464	429557	55.1107	-7.2100
27	FWT2-18	Drain	Small flowing drain. Passes under vacant site and road.	250514	429654	55.1116	-7.2092
28	FWT2-19	Pipe	Black drain pipe from field. No flow.	250547	429690	55.1119	-7.2087
29	FWT2-20	Storm Drain	Very small flow.	250541	429715	55.1121	-7.2088
30	FWT2-21	Storm Drain	No flow.	250559	429784	55.1127	-7.2085
31	FWT2-22	Pipe	Concrete pipe under road. Flowing. Slight odour. Orange discolouration on rock. Sheen patches.	250570	429819	55.1131	-7.2083
32	FWT2-23	Storm Drain	Small flow.	250577	429863	55.1134	-7.2082
33	FWT2-24	Pipe	Little to no flow. Wall stained red/orange.	250581	429894	55.1137	-7.2081
34	FWT2-25	Pipe	No Flow. Orange staining.	250586	429930	55.1140	-7.2080

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
35	FWT2-26	Pipe	No Flow. Orange staining.	250590	429951	55.1142	-7.2080
36	FWT2-27	Pipe	Black pipe blue inside. No flow. Could hear water.	250598	429995	55.1146	-7.2078
37	FWT2-28	Pipe	Black pipe in block wall under road. Small flow. Stained wall brown. Some growth.	250599	430000	55.1147	-7.2078
38	FWT2-29	Pipe/Drain	No flow. Staining and growth.	250618	430046	55.1151	-7.2075
39	FWT2-30	Pipe/Drain	No flow. Staining and growth.	250623	430061	55.1152	-7.2074
40	FWT2-31	Pipe/Drain		250647	430111	55.1157	-7.2071
41	FWT2-32	Storm Drain	No flow.	250663	430148	55.1160	-7.2068
42	FWT2-33	Storm Drain	Dripping.	250687	430202	55.1165	-7.2064
43	FWT2-34	Storm Drain	No flow but growth and staining.	250713	430251	55.1169	-7.2060

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
44	FWT2-35	Stream	Flowing. Not clear. No odour or growth.	250724	430283	55.1172	-7.2058
45	FWT2-36	Pipe	Old dripping. Whitish grey colour. Smells like slurry. Houses above.	250856	430467	55.1188	-7.2037
46	FWT2-37	Pipe	New pipe, large black. Flow. Clear no odour.	250853	430475	55.1189	-7.2038
47	FWT2-38	Pipe	Old pipe no flow.	250872	430494	55.1191	-7.2035
48	FWT2-39	Pipe	Very small flow. Houses above. Hidden in weeds.	250882	430536	55.1195	-7.2033
49	FWT2-40	Pipe	Large pipe with tyre guard. No odour. Clear.	250913	430569	55.1198	-7.2028
50	FWT2-41	Pipe	Pipe with tyre guard. Small flow. No odour. Clear.	251185	430802	55.1218	-7.1985
51	FWT2-42	Stream	Very small. From ground. No clear source.	251199	430812	55.1219	-7.1983
52	FWT2-43	Stream	Quigley point fisherman's yard and caravan park on either side. Clear. No odour. Growth.	251384	430784	55.1216	-7.1954

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
53	FWT2-44	Stream	Red tinge. Between sheep farms. No odour.	251781	431173	55.1251	-7.1891
54	FWT2-45	Pipe	Leading to cattle farm drainage ditch.	251846	431461	55.1277	-7.1880
55	FWT2-46	Pipe/Drain	Partially covered/filled with sand. Small flow. Lots of sheen on water surface.	251813	431612	55.1290	-7.1885
56	FWT2-47	Pipe	Buried.	251815	431618	55.1291	-7.1885
57	FWT2-48	Discharge Pipe	Empty field. Cattle use.	251822	431635	55.1292	-7.1884
58	FWT2-49	Discharge Pipe	From sheep field. Sediment surrounding has anoxic smell and black colour.	251843	431690	55.1297	-7.1880
59	FWT2-50	Discharge Pipe and Sheep	Sheep. No visible drain in field.	251869	431753	55.1303	-7.1876
60	FWT2-51	Discharge Pipe and Sheep	Sheep. Clear.	251889	431794	55.1307	-7.1873

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
61	FWT2-52	Discharge Pipe and Sheep	Sheep. Clear.	251906	431827	55.1310	-7.1870
62	FWT2-53	Discharge Pipe and Sheep	Sheep. Clear. Small sheen around sediment.	251936	431868	55.1313	-7.1865
63	FWT2-54	Stream	Empty overgrown field.	252115	432087	55.1333	-7.1837
64	FWT2-55	Pipe	Small flow. Clear. Empty field above.	252153	432148	55.1338	-7.1831
65	FWT2-56	Pipe	Trickle. Clear. No odour.	252269	432247	55.1347	-7.1813
66	FWT2-57	Stream	No animals in adjacent fields.	252394	432292	55.1351	-7.1793
67	FWT2-58	Pipe	Trickle.	252447	432353	55.1356	-7.1784
68	FWT2-59	Pipe		252494	432478	55.1367	-7.1777

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
69	FWT2-60	Stream		252500	432505	55.1370	-7.1776
70	FWT2-62	Stream and Cattle	Cattle in adjacent field.	252665	432654	55.1383	-7.1750
71	FWT2-64	Stream	From farmyard.	252820	432813	55.1397	-7.1725
72	FWT2-65	Stream	Small, clear. Empty field.	252903	432900	55.1405	-7.1712
73	FWT2-67	Pipe	No flow.	253094	433111	55.1424	-7.1682
74	FWT2-69	Pipe	Near cover. Very orange small flow.	253147	433258	55.1437	-7.1673
75	FWT2-70	Stream	Between fields. One side Croom site.	253188	433284	55.1439	-7.1666
76	FWT2-71	Pipe Wall	Pipe wall starts with small orange plastic pipes roughly every 1.5 meters. No flow.	253227	433430	55.1452	-7.1660
77	FWT2-72	Pipe	Flowing pipe on same wall.	253307	433492	55.1458	-7.1647

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
78	FWT2-73	Pipe Wall	Pipe wall ends.	253395	433555	55.1463	-7.1633
79	FWT2-74	Pipe	Black drain pipe. Under road from houses. Small clear flow.	253482	433629	55.1470	-7.1620
80	FWT2-75	Pipe	Smaller black drain pipe under road. No flow.	253538	433680	55.1474	-7.1611
81	FWT2-76	Discharge Pipe	Under road.	253584	433740	55.1480	-7.1604
82	FWT2-77	Storm Drain		253639	433834	55.1488	-7.1595
83	FWT2-78	Pipe	Black drain pipe beside garage. Flowing clear with some growth on pipe and in splash zone.	253782	433934	55.1497	-7.1572
84	FWT2-79	Stream		252650	432674	55.1385	-7.1752
85	FWT2-80	Stream		253175	433295	55.1440	-7.1669
86	FW3-1	Pipe	Dry.	253851	433958	55.1499	-7.1561
87	FW3-4	Stream	Fast flow. Brownish.	253858	434004	55.1503	-7.1560

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
88	FW3-6	Concrete Buried Pipe	No access to sample.	254098	434138	55.1515	-7.1522
89	FW3-7	Concrete Buried Pipe	No access to sample.	254145	434179	55.1518	-7.1515
90	FW3-8	Concrete Buried Pipe	No access to sample.	254170	434203	55.1520	-7.1511
91	FW3-9	Concrete Buried Pipe	No access to sample.	254197	434225	55.1522	-7.1506
92	FW3-11	Discharge Pipe	Clear. Green algae.	254463	434370	55.1535	-7.1465
93	FW3-12	Discharge Pipe	Clogged with debris.	254469	434371	55.1535	-7.1464
94	FW3-14	Stream	Clear. No odour.	254665	434457	55.1543	-7.1433
95	FW3-15	Stream	Clear. No odour (Checked photo for GPS).	254721	434468	55.1544	-7.1424
96	FW3-16	Discharge Pipe	Clear.	254755	434485	55.1545	-7.1418
97	FW3-17	Discharge Pipe	No flow.	254803	434505	55.1547	-7.1411
98	FW3-19	Stream	-	255057	434689	55.1563	-7.1371

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
99	FW3-21	Stream	Clear/no odour.	255205	434732	55.1567	-7.1347
100	FW3-23	Discharge Pipe	No flow.	255392	434758	55.1569	-7.1318
101	FW3-25	Surface Water Flow	Clear. Some green algae. No odour.	255437	434776	55.1571	-7.1311
102	FW3-26	Discharge Pipe	Clear.	255440	434782	55.1571	-7.1310
103	FW3-29	Stream	Brown algal growth.	255689	434828	55.1575	-7.1271
104	FW3-31	Stream	Grey. Strong odour.	255827	434909	55.1582	-7.1250
105	FW3-32	Stream	Slow flow.	255910	434936	55.1584	-7.1236
106	FW3-33	Pipe	Ground pipe. No flow.	256032	434923	55.1583	-7.1217
107	FW3-34	River	Dark brown.	256014	434981	55.1588	-7.1220
108	FW3-35	Discharge Pipe x2	No flow.	256053	434966	55.1587	-7.1214
109	FW3-36	Discharge Pipe	No flow.	256073	434965	55.1587	-7.1211
110	FW3-37i	Stream	Grey. Strong odour.	256249	435026	55.1592	-7.1183
111	FW3-39	Stream	Light red in colour.	256461	435191	55.1607	-7.1149

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
112	FW3-41	Discharge Pipe	Clear.	256635	435414	55.1627	-7.1122
113	FW3-42	Discharge Pipe	Dry.	256833	435554	55.1639	-7.1090
114	FW3-43	Discharge Pipe	Dry.	256877	435576	55.1641	-7.1083
115	FW3-44	Stream	Clear.	251569	428241	55.0988	-7.1929
116	FW3-45	Stream	Clear (Checked photo for GPS).	257085	435735	55.1655	-7.1051
117	FW3-50	Stream	Large flow. Clear.	257765	436175	55.1694	-7.0943
118	FW3-51	Discharge Pipe	Dry.	257813	436182	55.1694	-7.0935
119	FW3-52	Discharge Pipe	Dry.	257826	436186	55.1694	-7.0933
120	FW3-53	Discharge Pipe x2	Dry.	257830	436190	55.1695	-7.0933
121	FW3-54	Discharge Pipe x3	Dry.	257842	436183	55.1694	-7.0931
122	FW3-55	Discharge Pipe x2	Dry.	257849	436197	55.1695	-7.0930

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
123	FW3-58	Stream	Clear.	258203	436366	55.1710	-7.0874
124	FW3-59	Stream	Clear.	258495	436515	55.1723	-7.0828
125	FW3-61	Stream	Clear.	258542	436535	55.1725	-7.0820
126	FW3-62	Stream	Clear.	258801	436654	55.1735	-7.0779
127	FW3-63	Stream	Clear.	258799	436670	55.1737	-7.0780
128	FW3-65	Stream	Grey. Strong odour.	259409	437156	55.1780	-7.0683
129	FW3-66	Stream	Clear (Checked photo for GPS).	259445	437146	55.1779	-7.0677
130	FW3-67	River	Clear (Checked photo for GPS).	259652	437378	55.1799	-7.0644
131	FW3-68	Pipe	Clear.	259716	437406	55.1802	-7.0634
132	FW3-69	Pipe	Clear.	259795	437465	55.1807	-7.0622
133	FW4-2	Discharge Pipe	Very little flow.	260067	437644	55.1823	-7.0579
134	FWT4-5	Groundwater discharge	Little flow. Clear. No colour. No odour.	261153	438187	55.1870	-7.0407
135	FWT4-6	Discharge Pipe	No flow.	261160	438196	55.1871	-7.0406
136	FWT4-7	Discharge Pipe	No flow.	261166	438205	55.1872	-7.0405

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
137	FWT4-8	Discharge Pipe	Clear. No colour. No odour.	261168	438206	55.1872	-7.0405
138	FWT 4-9	Groundwater Discharge	Transect restart at groundwater discharge with very little flow.	261245	438255	55.1876	-7.0392
139	FWT 4-10	Groundwater Discharge	Clear. No colour. No odour.	261250	438274	55.1878	-7.0392
140	FWT 4-11	Groundwater Discharge	Clear. No colour. No odour.	261280	438295	55.1880	-7.0387
141	FWT 4-12	Discharge Pipe	Little flow. Clear. No colour. No odour.	261301	438300	55.1880	-7.0384
142	FWT 4-15	Discharge Pipe	Steady flow and clear. No colour. No odour.	261465	438389	55.1888	-7.0358
143	FWT 4-16	Well	Steady flow and clear. No colour. No odour.	261471	438397	55.1889	-7.0357
144	FWT 4-17	Discharge Pipe	Large flow and clear. No colour. No odour.	261499	438394	55.1888	-7.0352
145	FWT 4-19	Discharge Pipe	Little flow and clear. Slight discolouration. Hydrocarbons. No odour.	261660	438419	55.1890	-7.0327

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
146	FWT 4-21	Discharge Pipe	No flow.	261748	438414	55.1890	-7.0313
147	FWT 4-22	Discharge Pipe	No flow.	261799	438449	55.1893	-7.0305
148	FWT 4-23	Groundwater Discharge	Medium flow and clear. Slight discolouration. Hydrocarbons. No odour.	261800	438451	55.1893	-7.0305
149	FWT 4-24	Discharge Pipe	No flow.	261824	438456	55.1893	-7.0301
150	FWT 4-25	Groundwater Discharge	Little flow and clear. No colour. No odour.	261832	438455	55.1893	-7.0300
151	FWT 4-26	Discharge Pipe	Medium flow and clear. No colour. No odour.	261931	438468	55.1894	-7.0284
152	FWT 4-27	Discharge Pipe	No flow.	261952	438482	55.1896	-7.0281
153	FWT 4-28	Discharge Pipe	No flow.	262066	438546	55.1901	-7.0263
154	FWT 4-29	Discharge Pipe	Large flow and clear. Light yellow/brown colour. No odour.	262097	438550	55.1902	-7.0258

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
155	FWT 4-30	Discharge Pipe X2	No flow.	262150	438545	55.1901	-7.0250
156	FWT 4-31	Discharge Pipe	Large flow and clear. No colour. No odour.	262342	438579	55.1904	-7.0220
157	FWT 4-32	Discharge Pipe	No flow.	262386	438633	55.1909	-7.0213
158	FWT 4-34	Discharge Pipe	No flow.	262730	438859	55.1929	-7.0158
159	FWT 4-35	Discharge Pipe	Little flow and clear. No colour. No odour. Hydrocarbons & groundwater discharge nearby.	262887	438980	55.1939	-7.0133
160	FWT 4-36	Stream	Large flow and clear. Slight discolouration. No odour.	262990	438992	55.1940	-7.0117
161	FWT 4-37	Discharge Pipe	No flow.	263296	439239	55.1962	-7.0068
162	FWT 4-38	Stream	Little flow and clear. No colour. No odour.	263686	439448	55.1980	-7.0006
163	FWT 4-39	Stream	Little flow and clear. No colour. No odour.	263822	439505	55.1985	-6.9985

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
164	FWT 4-40	Stream	Little flow and clear. No colour. No odour.	263827	439510	55.1986	-6.9984
165	FWT 4-42	In Wall Drainage and Slip	Approximately 40. AM NOTE: picture includes a slip - most likely part of Greencastle harbour	264957	440039	55.2032	-6.9806
166	FWT 4-43	Discharge Pipe x6	Clear.	265041	440080	55.2035	-6.9792
167	FWT 4-44	Discharge Pipe	Grey. Odour.	265046	440089	55.2036	-6.9792
168	FWT 4-45	Discharge Pipe	Dry.	265058	440103	55.2037	-6.9790
169	FWT 4-46	Discharge Pipe x2	Dry.	265070	440108	55.2038	-6.9788
170	FWT 4-47	Groundwater Discharge	Brown. Odour.	265109	440117	55.2038	-6.9782
171	FWT 4-48	Discharge Pipe	Copper. Sheen. GPS Taken on 18/07/23 Sample taken on 20/07/23	265110	440119	55.2039	-6.9781
172	FWT 4-49	Discharge Pipe	-	265144	440132	55.2040	-6.9776

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
173	FWT 4-50	Pipe	Buried.	265201	440178	55.2044	-6.9767
174	FWT 4-51	Gutter	Dry.	265228	440179	55.2044	-6.9763
175	FWT 4-52	Discharge Pipe	-	265262	440191	55.2045	-6.9757
176	FWT 4-53	Discharge Pipe	Grey. Odour.	265249	440171	55.2043	-6.9760
177	FWT 4-55	Drain	Dry.	260086	437663	55.1824	-7.0576
178	FWT 4-56	Discharge Pipe x2	Dry.	260121	437700	55.1828	-7.0570
179	FWT 4-57	Drain	Dry.	260142	437713	55.1829	-7.0567
180	FWT 4-58	Discharge Pipe	Grey. Odour.	260187	437745	55.1832	-7.0560
181	FWT4-59	Stream	Brown.	260278	437772	55.1834	-7.0545

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
182	FWT4-60	Pipe x6	Dry.	260324	437819	55.1838	-7.0538
183	FWT4-61	Stream	Clear.	260412	437895	55.1845	-7.0524
184	FWT4-62	Bredagh River Stream	Large volume. Brackish. Brown Colour. Adjacent to beach/shore.	260769	438221	55.1874	-7.0467
185	FWT4-64	Stream	Clear.	260588	438127	55.1865	-7.0496
186	FWT 5-01	Lagoon	No visible discharge.	247887	424155	55.0624	-7.2513
187	FWT 5-02	Discharge Pipe	Brown sludge dried out. Unable to sample.	247922	424362	55.0643	-7.2507
188	FET1-3	Water Course	Water course entrance to Lough Foyle. Reddy/brown colour scum on top. No odour.	250303	423430	55.0557	-7.2136
189	FET1-4	Pipe x2	Two brown pipes from private land across water course.	250301	423448	55.0559	-7.2137
190	FET1-6	Pipe	No flow. Green growth in pipe and flow zone.	253479	423930	55.0599	-7.1638

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
191	FET1-8	Walkway and Water Course	End of walkway and water course leading to airport.	254520	422838	55.0499	-7.1478
192	FE2-1	Stream	Stream/large water course. Dark reddish. No odour.	261032	423846	55.0582	-7.0457
193	FE2-2	Stream	Under railway bridge. Cloudy. Lots of sediment. Dark.	260152	422655	55.0476	-7.0597
194	FE2-4	Stream and Pond	Stream from large pond/pool leading to sea.	259037	422471	55.0461	-7.0772
195	FE2-5	Stream	Reddish colour. Slightly cloudy. Some growth. No odour.	258832	422544	55.0468	-7.0804
196	FE2-6	Pipe	Large pipe flowing into sea. Dark water from pipe mixing.	258555	422327	55.0449	-7.0847
197	FE2-7	Stream	Clear. No red colour or odour.	258111	422405	55.0456	-7.0917
198	FE2-8	Pipe	Pipe discharging to sea. No odour. Clear. Some growth.	257166	422089	55.0429	-7.1065
199	FE2-9	Stream	Stream, rushes. Lots of growth.	256373	422105	55.0431	-7.1189
200	FE2-10	Stream	Unable to sample. Channel across mudflats and in shooting reserve.	260972	423460	55.0548	-7.0467
201	FET 3-03	Discharge Pipe	Dry. Unable to sample.	261707	424373	55.0629	-7.0350

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
202	FE4-1	Pipe	No flow.	263007	426299	55.0800	-7.0142
203	FET4-3	River Roe	Dark red colour.	264278	429356	55.1073	-6.9937
204	FET4-4	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	263482	429299	55.1069	-7.0061
205	FET4-5	Manhole	Water is written on it. Same location as old survey point.	263105	429177	55.1059	-7.0121
206	FET4-6	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	263055	429121	55.1054	-7.0129
207	FET4-7	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262974	429041	55.1047	-7.0142
208	FET4-8	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262733	428749	55.1021	-7.0180
209	FET4-9	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262597	428519	55.1000	-7.0202
210	FET4-10	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262531	428316	55.0982	-7.0212
211	FET4-11	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262497	428156	55.0968	-7.0218

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
212	FET4-12	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262473	427913	55.0946	-7.0222
213	FET4-13	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262467	427730	55.0929	-7.0224
214	FET4-14	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262462	427625	55.0920	-7.0225
215	FET4-15	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262453	427239	55.0885	-7.0227
216	FET4-16	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262566	426966	55.0861	-7.0210
217	FET4-17	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262672	426842	55.0849	-7.0194
218	FET4-18	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262877	426594	55.0827	-7.0162
219	FET4-19	Field Drain Pipe	Into field water course other side of embankment. Not into Foyle.	262985	426421	55.0811	-7.0146
220	FET 5-04	Stream	Clear. No odour. Dark algae growth.	264717	430840	55.1206	-6.9864

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
221	FET 5-07	Stream	Clear. No odour.	264887	431384	55.1254	-6.9836
222	FET 5-09	Stream	Clear. No odour.	264964	431550	55.1269	-6.9824
223	FET 5-12	Stream	Clear. No odour. Extensive vegetation. Close to cows in field.	265075	431821	55.1293	-6.9806
224	FET 5-16	Stream	Clear. No odour.	265300	432386	55.1344	-6.9769
225	FET 5-19	Discharge Pipe	Dry. Clogged.	265420	432717	55.1373	-6.9750
226	FET 5-20	Stream	Clear. No odour.	265503	432971	55.1396	-6.9736
227	FET 5-23	Pipe	Broken. Dry. No visible discharge. Possibly pipe to pump seawater to land.	265529	433296	55.1425	-6.9731
228	FET 5-24	Stream	Clear. No odour. Dark algal growth.	265569	433269	55.1423	-6.9725
229	FET 5-26	Stream	Clear. No odour.	265742	433793	55.1470	-6.9697

Map ID	Feature Name	Feature	Comment	Easting	Northing	Latitude	Longitude
230	FET 5-28	Stream	Clear. No odour.	265976	434535	55.1536	-6.9658
231	FE6-1	Pipe	From dunes - no flow.	266256	437514	55.1803	-6.9608
232	FE6-2	Stream	Clear. No odour. Growth. Military shooting grounds above.	266316	437194	55.1774	-6.9599
233	FE6-3	Water Pool	Lots of rock debris and softer sediment.	266188	436065	55.1673	-6.9622
234	FE6-4	Stream	Cloudy. Dark. No odour. Growth. Dumped rubbish and scrap.	266149	435607	55.1632	-6.9629
235	FE6-6	Stream	Between dunes and fields. Clear. No odour. Some growth. Lots of litter, plastic and metal.	266003	434811	55.1561	-6.9654
236	FE6-7	Stream	Between agricultural land. Clear. Growth. Litter. No odour.	265972	434533	55.1536	-6.9659
237	FE6-8	Pipe	Plastic black. Out of dune. No flow.	266216	438010	55.1848	-6.9613
238	FE6-9	Pipe	Concrete pipe in rock armour. No flow but evidence of previous flow.	266195	438074	55.1854	-6.9616
239	FE6-10	Pipe	Plastic white. Out of Dunes. No flow.	266144	438278	55.1872	-6.9623
240	FE6-11	Pipe	In concrete under ferry terminal. No flow.	265961	438711	55.1911	-6.9651
241	FE6-12	Pipe	Under point bar. Trickle clear. Scummy green/white growth.	265966	438741	55.1914	-6.9650

Figure 5-70: Location of all discharges into Lough Foyle. Foyle East (FE) transects 1-6 and Foyle West (FW) transects 1-5 as defined by the 2023 shoreline survey (see Figure 5-43 for FW and FE features).

Of the 329 features identified by the 2023 shoreline survey, 241 were discharges. **Figure 5-70** shows all discharges into Lough Foyle contributing catchment and **Table 5-13** provides cross-referenced details for industrial discharges, drains, pipes, rivers, and stream discharges. These were five drains, eight groundwater discharges, one gutter, one wall of drainage pipes, one lagoon, one manhole, 127 pipes, the beginning and end of a pipe wall, three rivers, seven storm drains, 74 streams, one stream/pond, one surface water flow, one water course, one water pool, and one well.

6. Shellfish and Water Sampling

6.1 Historical Data

6.1.1 Shellfish Water Quality

DAERA Water Management Unit monitors a number of shellfish growing waters around the Northern Irish coastline as part of the European Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU, and 2014/101/EU, and transposed in Northern Ireland through the Water Environmental (WFD) Regulations (NI) 2017. Within the River Basin Management Plan Structure, existing shellfish waters have now become WFD designated areas, and it has been proposed to carry out reviews triennially. In the Republic of Ireland, shellfish waters are monitored by the Department of the Environment, Heritage, and Local Government under the Shellfish Waters Directive Regulations 2006 (SI No 268 of 2006) (as amended).

6.1.2 Shellfish Flesh Quality

In accordance with Regulation (EU) 2017/625 and its subsequent Implementing Regulation (EU) 2019/627, the Food Standards Agency of Northern Ireland, as the competent authority, is required to establish the location and fix the boundaries of shellfish production areas.

Shellfish production areas must be monitored for levels of *E. coli* in live bivalve molluscs. According to the sample results, the area is classified as being one of three categories **A**, **B** or **C**, according to thresholds set out in Annex II of Implementing Regulation 2019/627. These classifications determine whether the product can be placed directly on the market or must undergo post-harvest treatment. An **A** classification allows for the product to be placed directly on the market, whereas a **B** or **C** classification requires the product to go through a process of depuration, heat treatment or relaying before it can be placed on the market; **Table 6-1** summarises the classification system.

The FSA and the SFPA both monitor shellfish flesh in Lough Foyle for microbiological contamination on a monthly basis and these results are reviewed annually to determine the classification awarded (**Table 6-2**). The FSA currently sample shellfish flesh in Production Area 3 and 4 for classification purposes. The SFPA currently sample shellfish flesh in Production Area 1 and 2 for classification purposes. The species currently monitored in the lough include mussels, native oysters, and Pacific oysters from within the classified areas

shown in **Figure 6-8**; the RMPs O3 and O4 are no longer monitored, and mussels are used to represent oysters in these fisheries from the M3 and M4 monitoring points. Lough Foyle has historically maintained a B classification. Lough Foyle currently contains two classified production areas under FSA NI's jurisdiction; production areas 3 and 4, and two classified production areas under SFPA's jurisdiction; production area 1 (Pacific oyster) and production area 2 (mussels), all of which are Class B status. Classification applies to the defined production areas and not the lough as a whole.

The seasonal variations of *E. coli* in mussels, native oysters, and Pacific oysters are illustrated in **Figure 6-9** to **Figure 6-15**. For mussels (sites M1-M4), the highest variation in *E. coli* and the highest values were recorded in autumn and winter, with a decreased *E. coli* range recorded in spring and summer. For Pacific oysters and native oysters (sites PO1, O1, and O2), autumn had the highest recorded levels of *E. coli*, and the most significant seasonal variation also occurred in autumn. This pattern may be correlated to increased levels of rainfall in autumn, which is likely to carry higher loadings of contamination accumulated at land-based inputs compared with the generally drier periods of spring and summer.

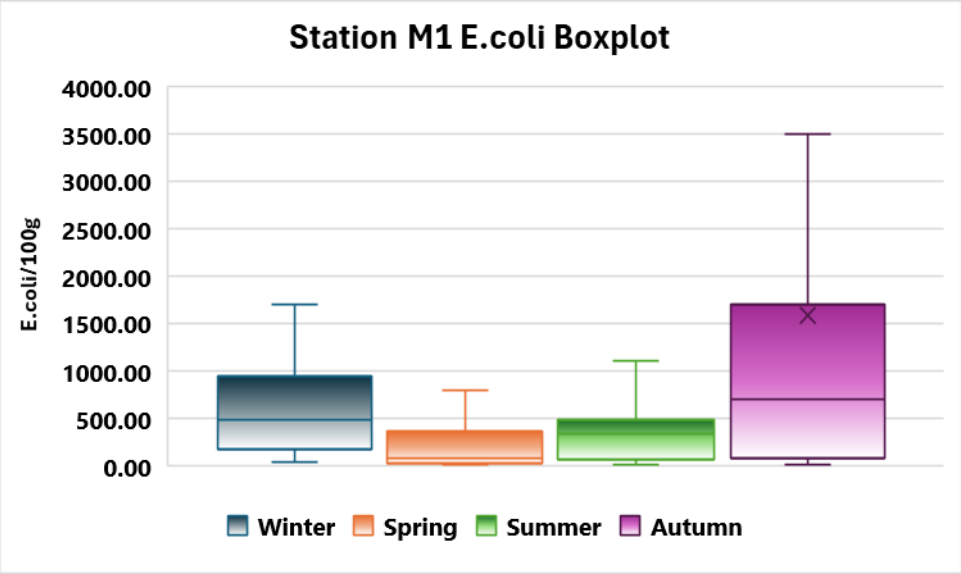

Figure 6-1: Seasonal variation of *Escherichia coli* in mussel flesh (*E. coli*/ 100 g) from the M1 monitoring point (2011- 2022). See Figure 6-8 for the location of the monitoring point.

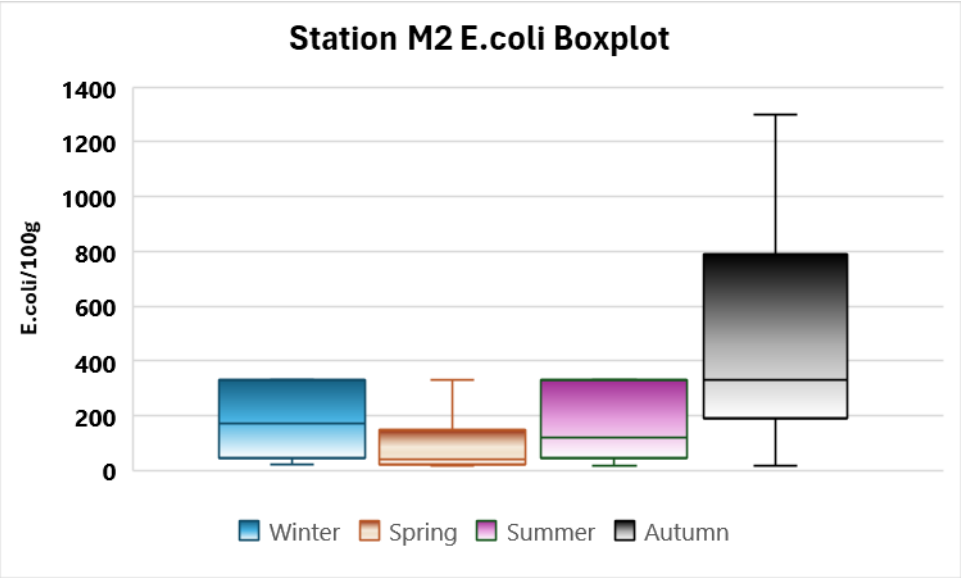

Figure 6-2: Seasonal variation of *Escherichia coli* in mussel flesh (*E. coli*/ 100 g) from the M2 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

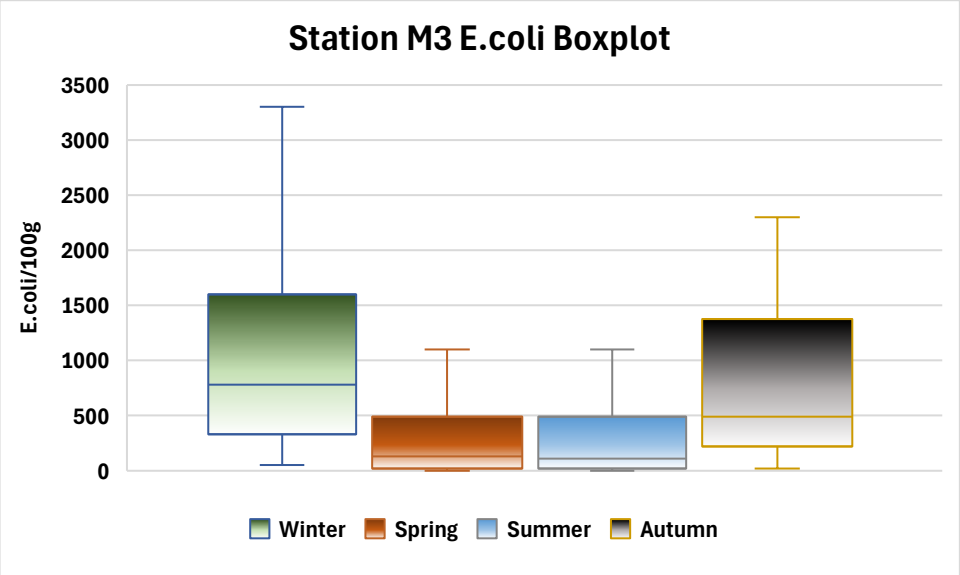

Figure 6-3: Seasonal variation of *Escherichia coli* in mussel flesh (*E. coli*/ 100 g) from the M3 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

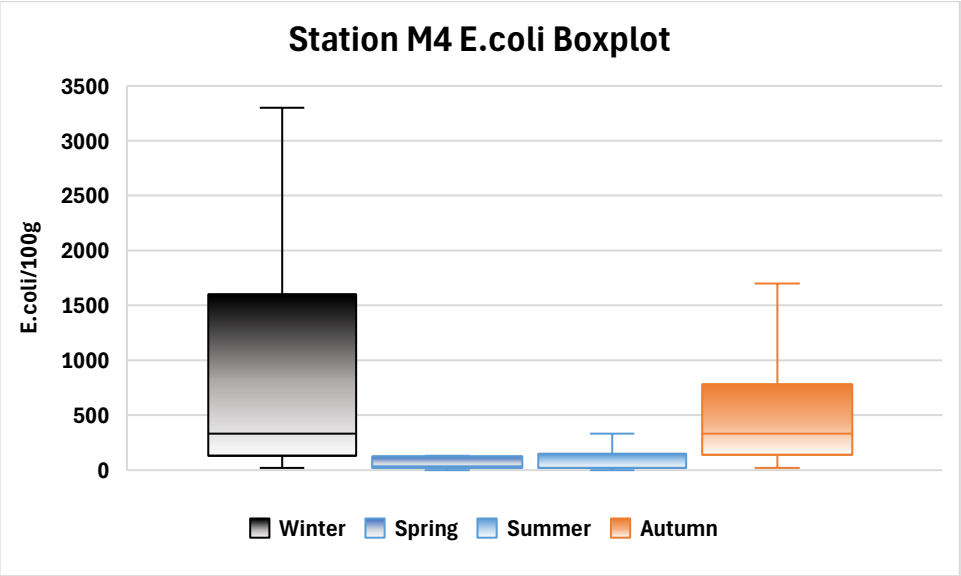

Figure 6-4: Seasonal variation of *Escherichia coli* in mussel flesh (*E. coli*/ 100 g) from the M4 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

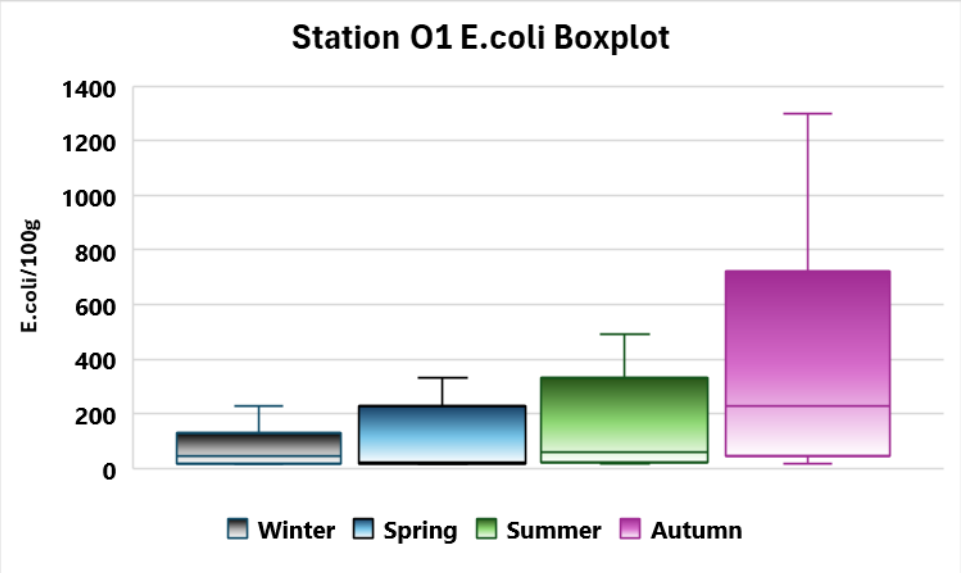

Figure 6-5: Seasonal variation of *Escherichia coli* in native oyster flesh (*E. coli*/ 100 g) from the O1 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

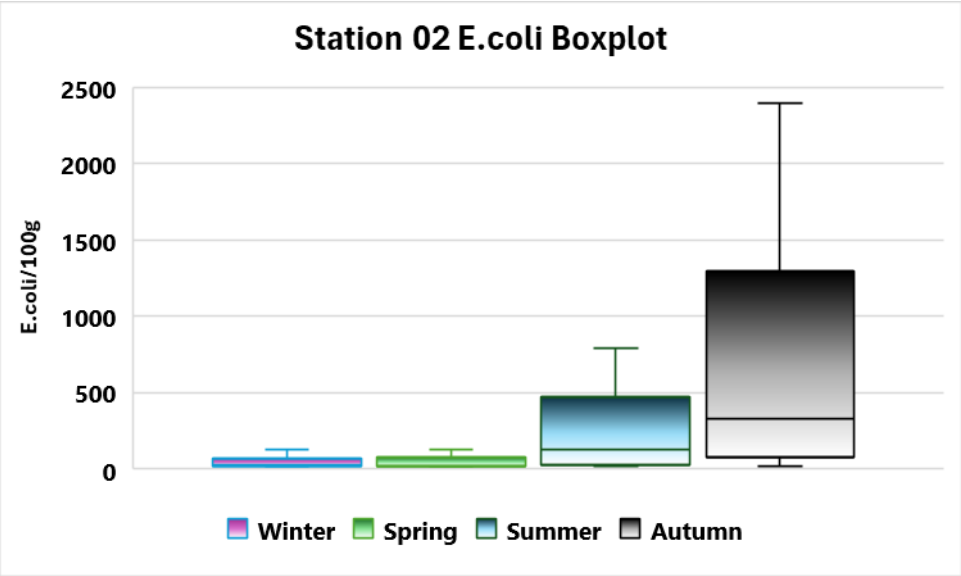

Figure 6-6: Seasonal variation of *Escherichia coli* in native oyster flesh (*E. coli*/ 100 g) from the O2 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

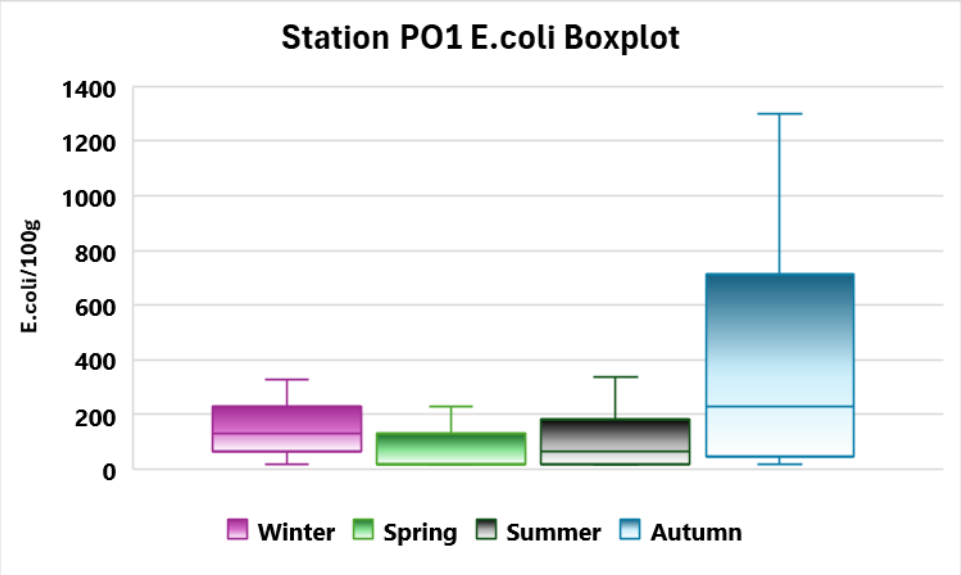

Figure 6-7: Seasonal variation of *Escherichia coli* in Pacific oyster flesh (*E. coli*/ 100 g) from the PO1 monitoring point (2011-2024). See Figure 6-8 for the location of the monitoring point.

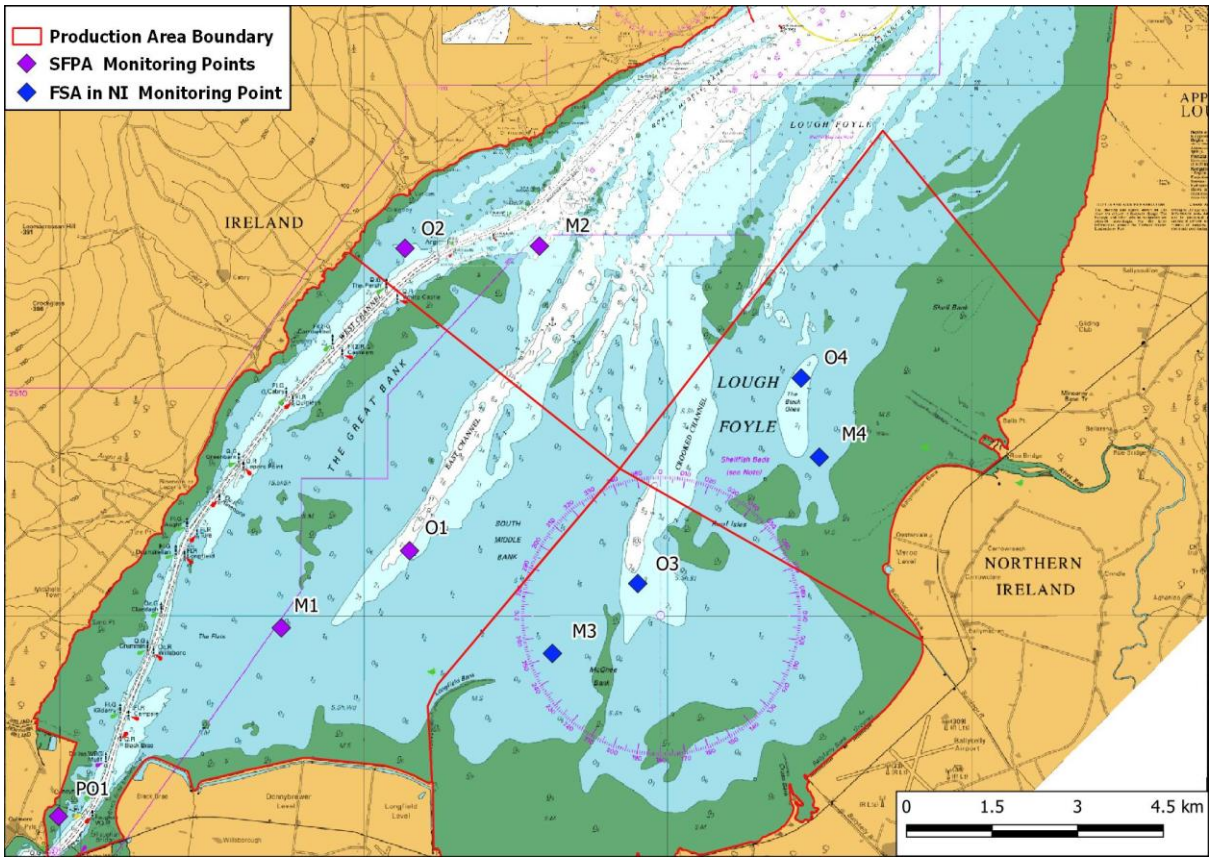

Figure 6-8: Locations of FSA and SFPA shellfish monitoring points for classification purposes from the 2022 sanitary survey.

Table 6-1: Classification system for shellfish harvesting areas.

Classification	Permitted Levels	Outcome
A	80% of sample results ≤ 230 *E. coli*/100 g, no results exceeding 700 *E. coli*/100 g.	Molluscs can be harvested for direct human consumption provided the end product standard is met.
B	90% of sample results must be less than or equal to 4,600 *E. coli*/100 g with none exceeding 46,000 *E. coli*/100 g.	Molluscs can go for human consumption after: • purification in an approved establishment, or • relaying in a classified Class A relaying area, or an *E. coli* approved heat treatment process.
C	Less than 46,000 *E. coli*/100 g flesh.	Molluscs must be subject to relaying for a period of at least two months or cooked by an approved method.

Table 6-2: Current and historical classification of shellfish beds in Lough Foyle (2014-2024).

Bed Name	Species	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
M1	Mussels	B	B	B	B	B	B*	B*	B*	B	B	B*
M2	Mussels	B	B	B	B	B	B*	B*	B*	B	B	B
M3	Mussels	B	B	B	B	B	B	B	B	B	B	B
M4	Mussels	B	B	B	B	B	B	B	B	B	B	B
O1	Native oysters	B	B	B	B	B	B	B	B	B	B	B
O2	Native oysters	B	B	B	B	B	B	B	B	B	B	B
O3	Native oysters	B	B	B	B	B	B	B	B**	B**	B**	B**
O4	Native oysters	B	B	B	B	B	B	B	B**	B**	B**	B**
PO1-Muff	Pacific oysters	B	B	B	B	B	B	B	B	B	B	B

*Dormant fishery. Contact SFPA if re-activating.

**indicates that *E. coli* levels in mussels are used as a proxy for that in oysters.

Figure 6-9 to **Figure 6-15** show the *E. coli* results for mussels, native oysters, and Pacific oysters for all monitoring points (M1-M4, O1-O2, and PO1 (Muff)) from 2011 to 2024; data are missing from M1 after 2022 as the site became inactive. These monthly *E. coli* data for each site regulated by the FSA in Northern Ireland is available online (Northern Ireland Microbiological Results) and data from the SPFA in the Republic of Ireland is available on request.

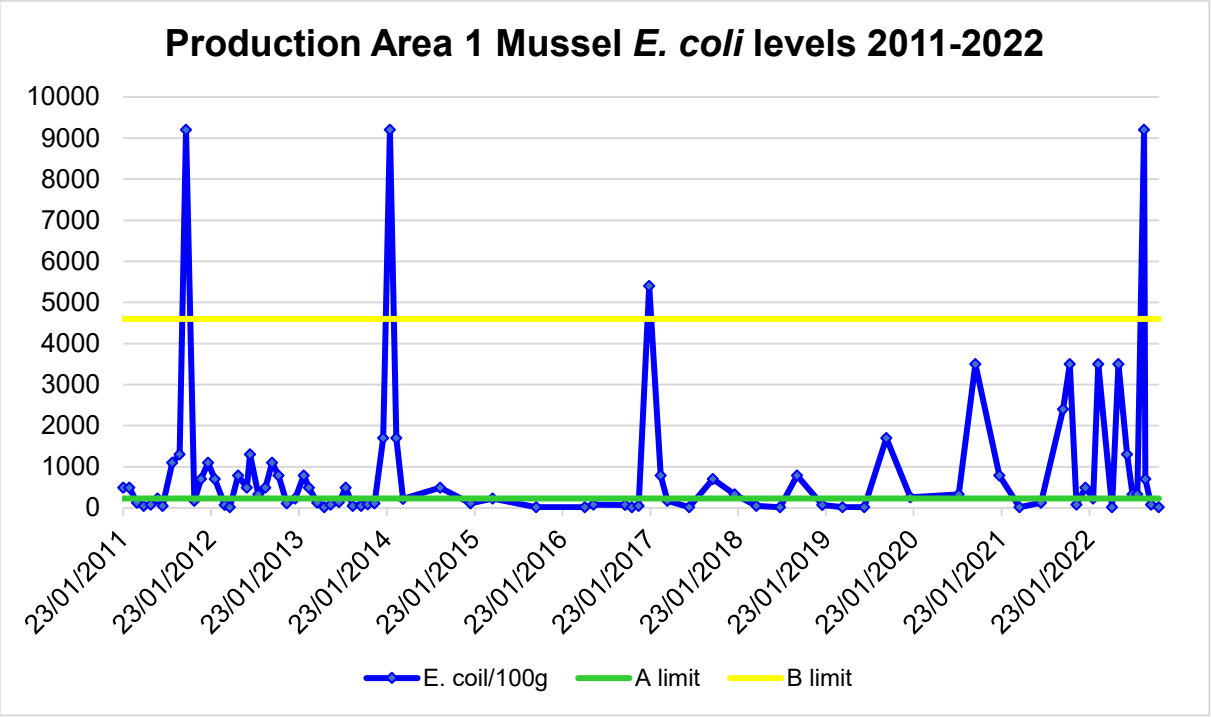

Figure 6-9: *Escherichia coli* levels from mussels at M1 from 2011 to July 2022 (source: SFPA).

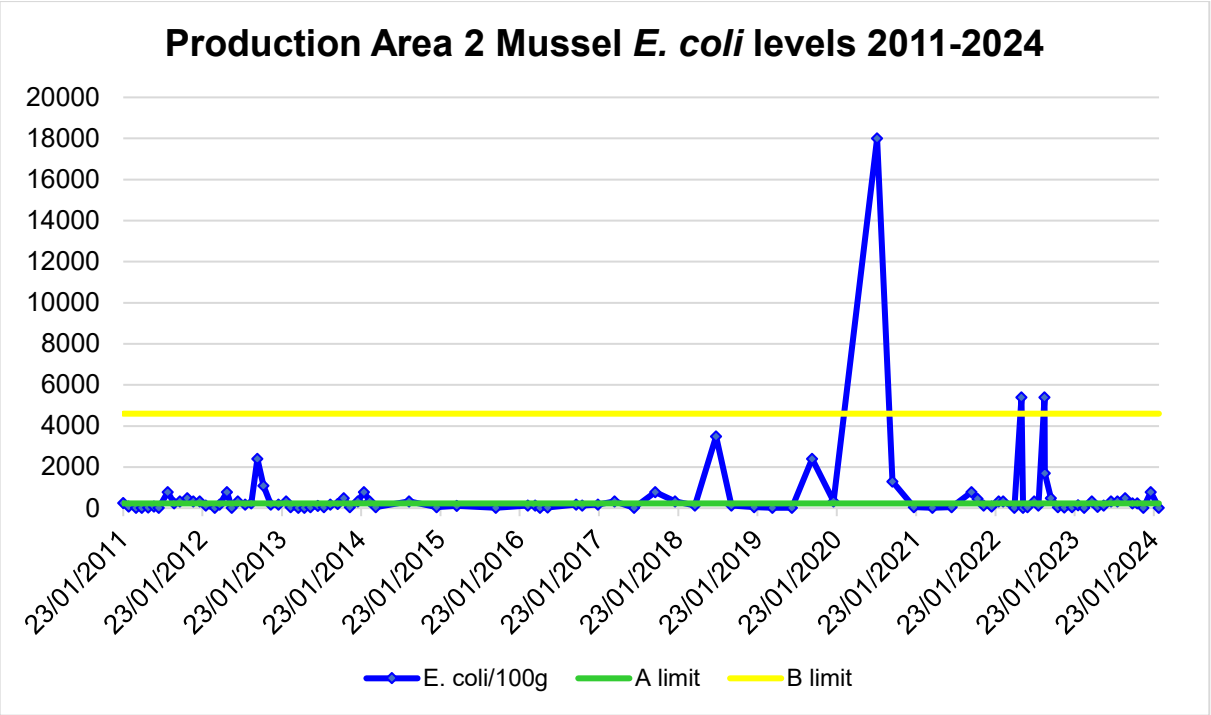

Figure 6-10: *Escherichia coli* levels from mussels at M2 from 2011 to February 2024 (source: SFPA).

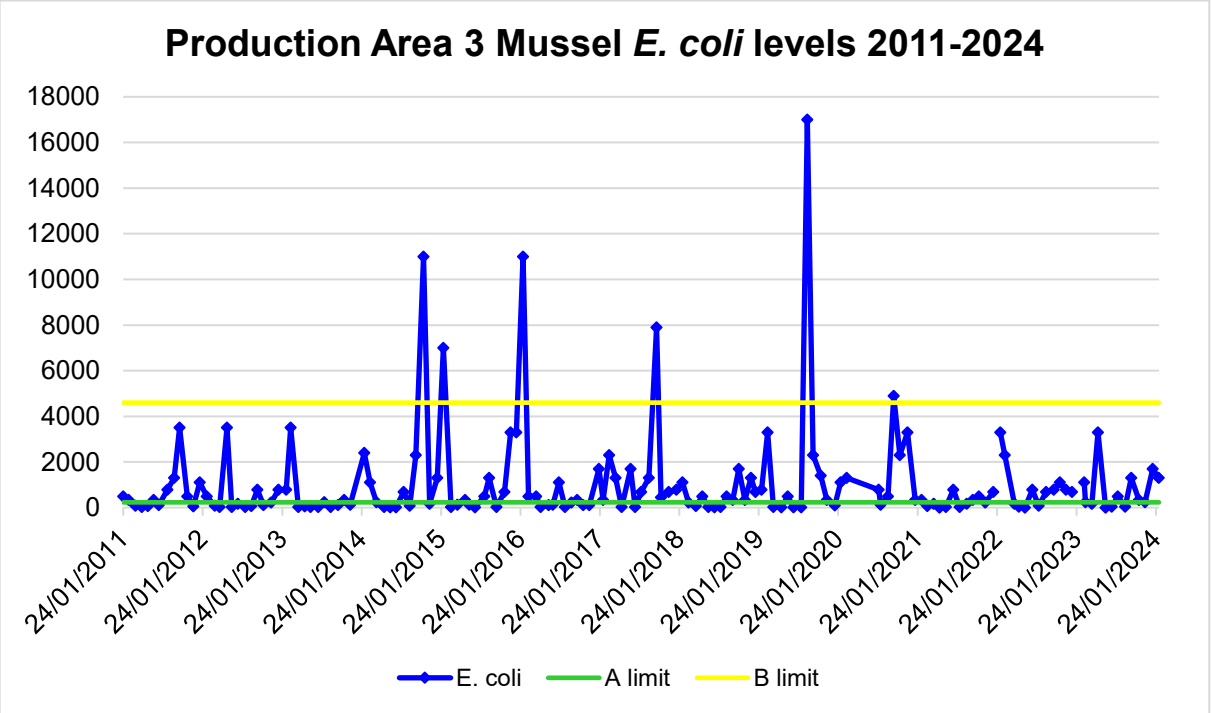

Figure 6-11: *Escherichia coli* levels from mussels at M3 from 2011 to February 2024. Mussels represent oysters in the fishery (source: FSA).

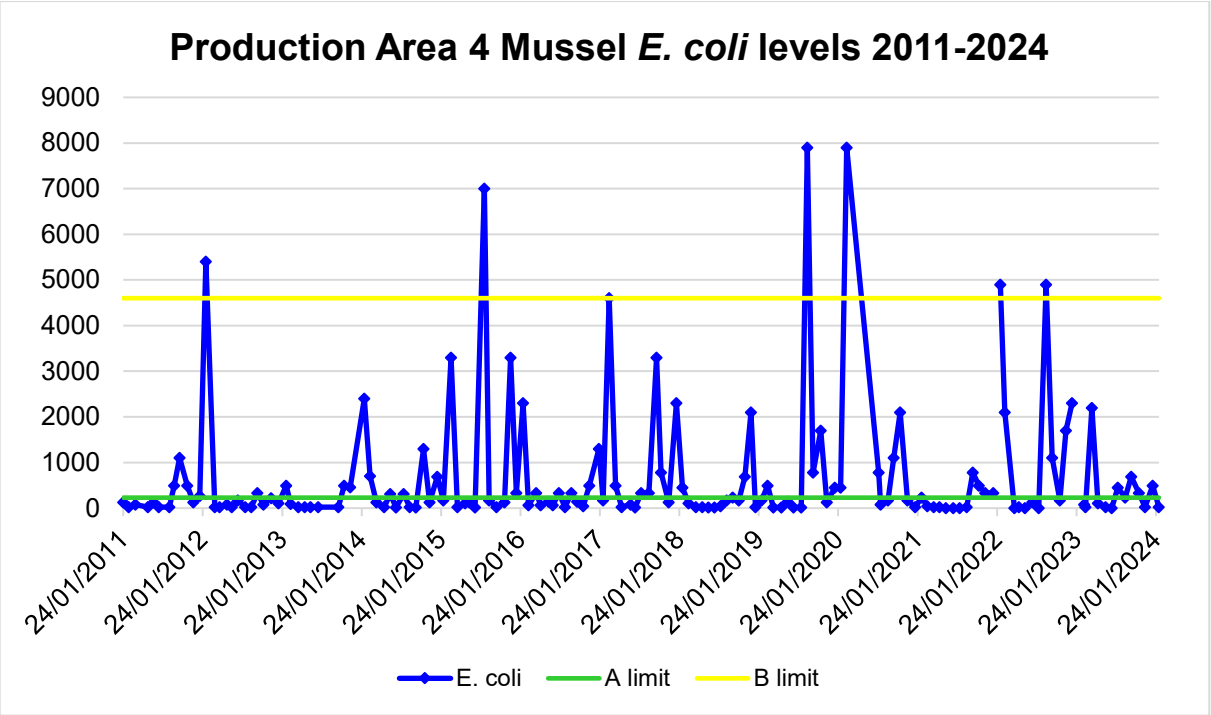

Figure 6-12: *Escherichia coli* levels from mussels at M4 from 2011 to February 2024. Mussels represent oysters in the fishery (source: FSA).

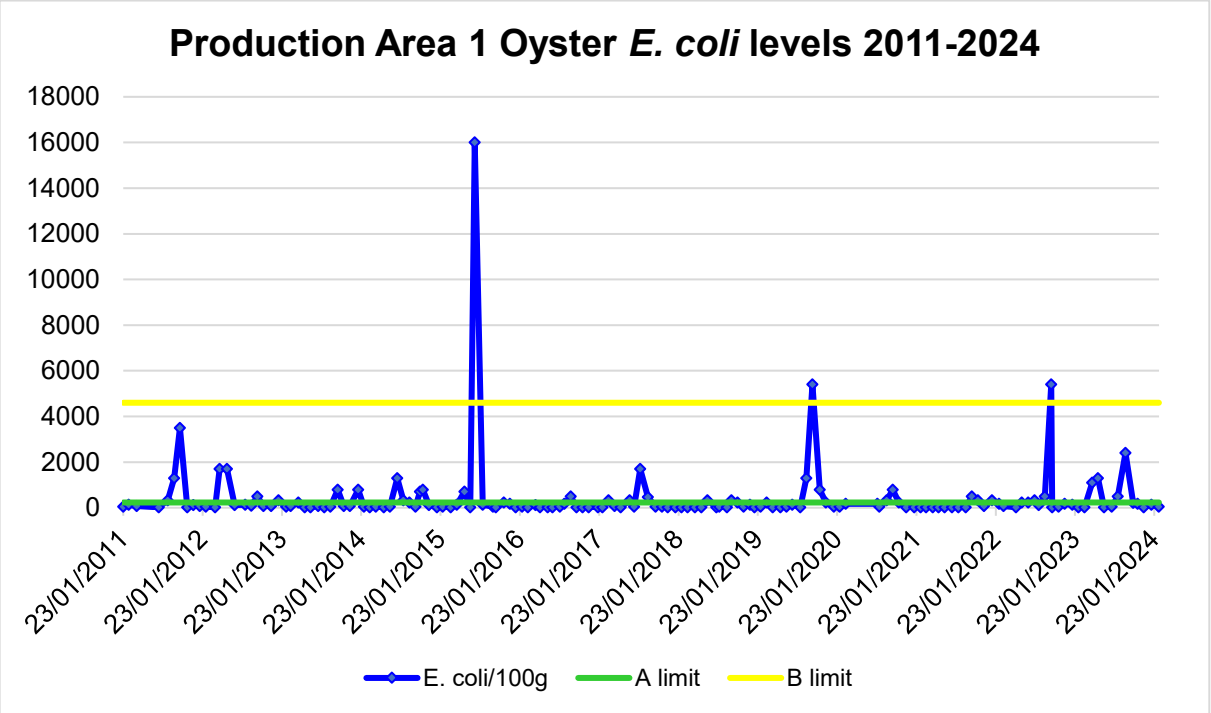

Figure 6-13: *Escherichia coli* levels from native oysters (*Ostrea edulis*) at O1 from 2011 to February 2024 (source: SFPA).

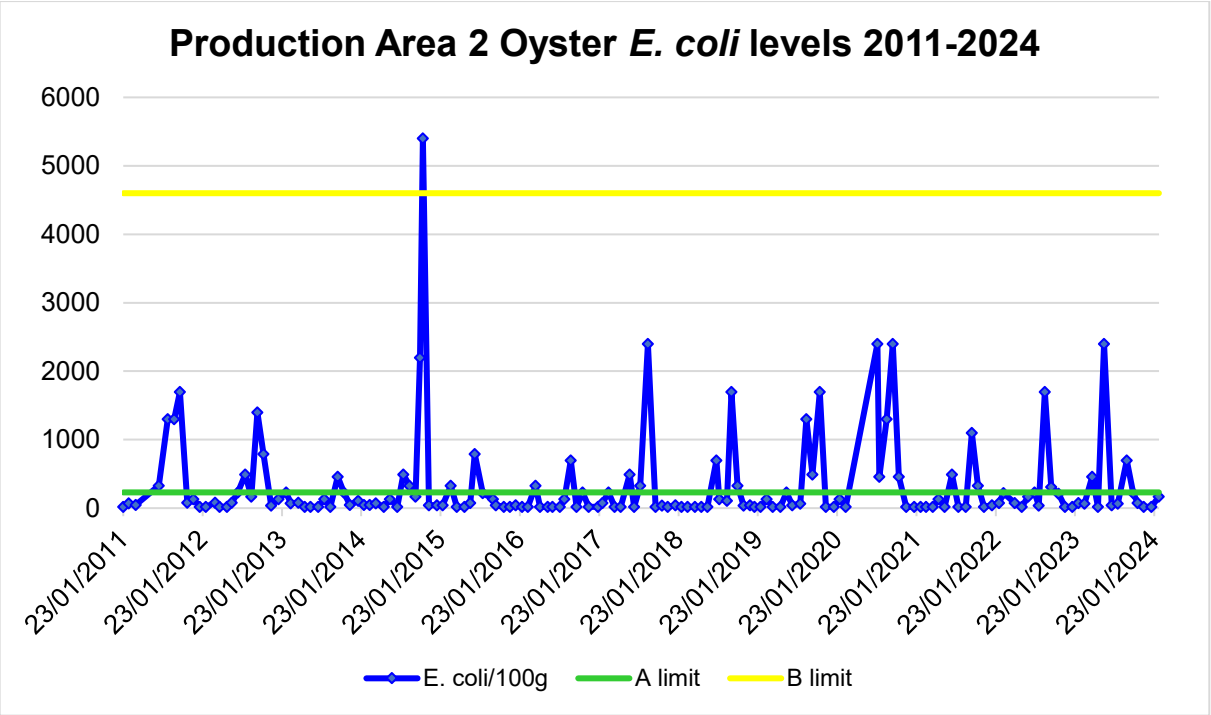

Figure 6-14: *Escherichia coli* levels from native oysters (*Ostrea* edulis) at O2 from 2011 to February 2024 (source: SFPA).

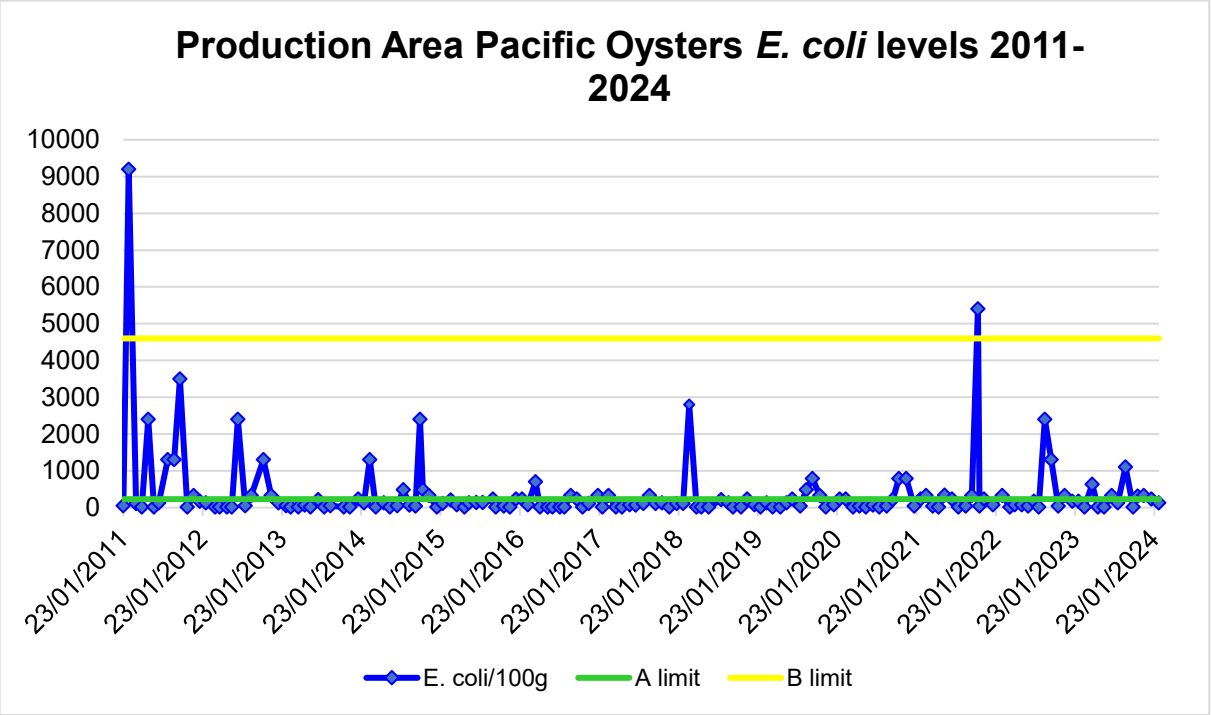

Figure 6-15: *Escherichia coli* levels from Pacific oysters (*Magallana gigas*) at PO1 from 2011 to February 2024 (source: SFPA).

Table 6-3 shows the summary statistics for historical *E. coli* data in Lough Foyle over the period 2011-2024 from the seven Representative Monitoring Points (RMPs) (**Figure 6-8**). M2, M3, and O1 had the largest range and the highest maximum Most Probable Number (MPN) *E. coli*/100 g (≤16000). O2 and M4 had the smallest ranges with maximum MPN/100 g ≥ 7900. Median and geometric mean values were standard between O1 and O2 with very little differences between the two native oyster monitoring sites. Within mussel monitoring sites, M3 (297 MPN/100 g) and M1 (251.8 MPN/100 g) had the highest geometric mean values, respectively, and M2 (150.7 MPN/100 g) had the lowest; the lowest geometric mean value overall was observed at O2 (89.2 MPN/100 g) for native oysters.

Table 6-3: Summary statistics of historical *Escherichia coli* data monitored from shellfish beds in Lough Foyle (FSA and SFPA).

Site	Species	Date of first sample	Date of last sample	Min *E. coli* (MPN/100 g)	Max *E. coli* (MPN/100 g)	Median *E. coli* (MPN/100 g)	Geometric Mean *E. coli* (MPN/100 g)
M1	Mussels	23/01/2011	07/11/2022	18	9200	245	251.8
M2	Mussels	23/01/2011	15/02/2024	18	18000	170	150.7
M3	Mussels	24/01/2011	06/02/2024	18	17000	330	297
M4	Mussels	24/01/2011	06/02/2024	18	7900	170	165.7
O1	Native oysters	23/01/2011	13/02/2024	18	16000	70	90.4
O2	Native oysters	23/01/2011	13/02/2024	18	5400	70	89.2
PO1	Pacific oysters	23/01/2011	13/02/2024	18	9200	110	101.3

Table 6-5 shows the variation of the annual geometric means of *E. coli* for the shellfish monitoring points in Lough Foyle (**Figure 6-8**). **Figure 6-16** shows the trend in geometric mean from 2011 to 2023 for six monitoring sites (M2-M4, O1-O2, PO1) and 2011 to 2022 for M1. The geometric mean for M1 could only be calculated for 2011 to 2013 and 2021 to 2022, and for M2 for 2011 to 2013 and 2016, and 2021 to 2023, as less than six results were available for the other years and would have given a skewed result. Sampling has continued into 2024 for all sites excluding M1, however these results have not been included as less than six results were available.

The range of geometric means for each monitoring point are as follows: for M1, 128.2 - 421.9 MPN/100 g; for M2, 80.3-220.7 MPN/100 g; for M3, 127.8-855.6 MPN/100 g; for M4, 71.5-621.1 MPN/100 g; for O1, 34.1-163.8 MPN/100 g; for O2, 46.5-225.1 MPN/100 g; for PO1, 39-281.4 MPN/100 g. **Table 6-4** shows M3 and M4 had the greatest range of geometric means and O1 and M2 had the lowest range, indicating that these areas experience more stability in *E. coli* abundances, whereas the M3 and M4 may experience low or high *E. coli* abundance.

The overall trend for *E. coli* contamination at the sites being monitored suggests that mussels and oysters in Lough Foyle typically fall within Class B limits, indicating a moderate level of contamination that necessitates treatment before the shellfish can be consumed. However, it is important to consider some of the higher counts and to carefully monitor their production and movement from those locations. The geometric mean values at many monitoring points have remained relatively stable over time, with some fluctuations likely attributable to environmental factors such as rainfall, water currents, and land-based pollution sources.

For example, sites such as M3 and M4 show higher ranges of geometric *E. coli* mean levels, which may indicate greater variability in contamination due to factors such as freshwater input or proximity to population centres. In contrast, sites O1 and O2 displayed much smaller ranges in *E. coli* levels, suggesting potentially more stable impacts at these sites and/or the nature of native oysters in concentrating *E. coli*.

The variation in geometric means across the sites can help inform management decisions. For instance, sites with higher variability, such as M3 and M4, may require more frequent monitoring or targeted mitigation efforts to reduce contamination.

Table 6-4: Range in geometric means at each representative monitoring point.

Site	Species	Lowest Geometric Mean	Highest Geometric Mean	Difference
M1	Mussels	128.2	421.9	293.7
M2	Mussels	80.3	220.7	140.4
M3	Mussels	127.8	855.6	727.8
M4	Mussels	71.5	621.1	549.6
O1	Native oyster	34.1	163.8	129.7
O2	Native oyster	46.5	225.1	178.6
PO1	Pacific oyster	39	281.4	242.4

Table 6-5: Variation of annual geometric means of *Escherichia coli* from shellfish monitoring points (Figure 6-8) in Lough Foyle.

Site	Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
M1	Mussels	338.3	377.5	128.2	-	-	-	-	-	-	-	332.3	421.9	-
M2	Mussels	114.7	220.7	89.7	-	-	80.3	-	-	-	-	109.5	206.6	128.8
M3	Mussels	249.4	159.7	127.8	282.4	299.9	273.6	607.2	231	332.6	855.6	164.4	539.4	346.1
M4	Mussels	97.3	92	71.5	141.6	228.6	166.3	299	137.7	133.9	571.4	84	621.1	184
O1	Native oyster	146	151	76.1	137.1	106.6	38.7	79.3	46.2	121.2	110.9	34.1	163.8	136.8
O2	Native oyster	206.8	98.8	71.7	146.8	66	46.5	69	70.5	88.5	225.1	52	111.7	104.6
PO1	Pacific oyster	281.4	117.7	39	163.3	66	69.1	75.6	76.4	88.3	95.3	130.7	127.2	123.6

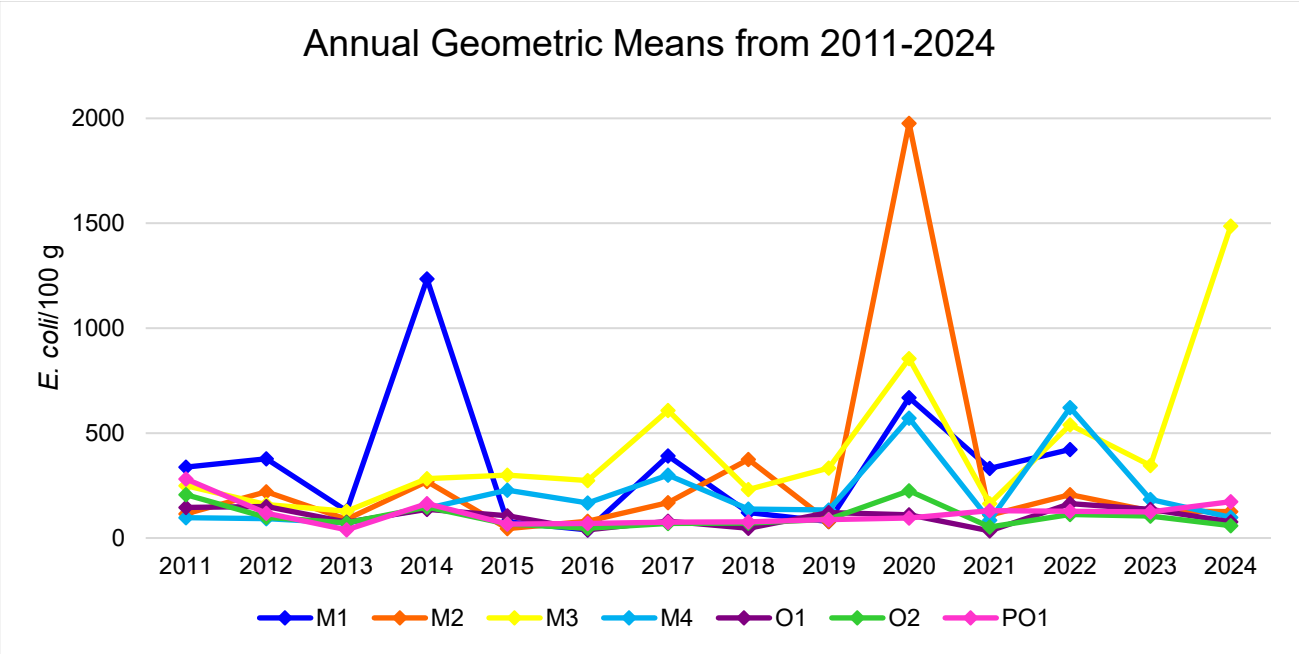

Figure 6-16: Trend in geometric mean of *Escherichia coli* levels from 2011 to 2024 for seven monitoring points in Lough Foyle (Figure 6-8).

6.2 Current Data

6.2.1 Sampling Sites and Methodology

Fifty-three water samples were taken along the coastline of Lough Foyle contributing catchment during the bacteriological survey. The locations of these sites can be seen in **Figure 6-17** and **Table 6-6** shows the sample station coordinates. All water samples were collected in sterile plastic water bottles. These samples were stored in a cool box until delivered to the laboratory for analysis (within 24 hours of collection).

Table 6-6: Water sample results and coordinates from the Lough Foyle bacteriological survey; cfu represents colony forming units. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid.

Map ID	Feature	*E. coli* (cfu/100 ml)	Easting	Northing	Latitude	Longitude
1	Stream	63	248970	427154	55.0893	-7.2338
2	Stream	60	248497	426510	55.0835	-7.2414
3	Stream	830	247845	425303	55.0728	-7.2518

Map ID	Feature	*E. coli* (cfu/100 ml)	Easting	Northing	Latitude	Longitude
4	Discharge Pipe	37	249262	427456	55.0920	-7.2292
5	Stream	1305	249449	427774	55.0948	-7.2262
6	Stream	1265	249625	427959	55.0964	-7.2234
7	Stream	6500	249961	428530	55.1015	-7.2181
8	Stream	350	250174	428706	55.1031	-7.2147
9	Pipe	2100	250290	429038	55.1061	-7.2129
10	Pipe	3700	250397	429409	55.1094	-7.2111
11	Pipe	42500	250571	429819	55.1131	-7.2083
12	Stream	860	250724	430283	55.1172	-7.2058
13	Pipe	1383	250854	430475	55.1189	-7.2038
14	Pipe	475000	250856	430467	55.1188	-7.2037
15	Stream	1550	251384	430784	55.1216	-7.1954
16	Stream	580	251781	431174	55.1251	-7.1891
17	Stream	2350	252650	432674	55.1385	-7.1752
18	Stream	1000	253175	433295	55.1440	-7.1669
19	Discharge Pipe	7	254462	434370	55.1535	-7.1465
20	Stream	63	255689	434828	55.1575	-7.1271
21	Stream	$2x10^6$	255827	434910	55.1582	-7.1250
22	Stream	20000	256249	435026	55.1592	-7.1183
23	Stream	1500	258799	436671	55.1737	-7.0780
24	Stream	3350	259410	437156	55.1780	-7.0683
25	Discharge Pipe	1	261168	438206	55.1872	-7.0405
26	Discharge Pipe	375	261301	438300	55.1880	-7.0384
27	Discharge Pipe	$2 x10^6$	261500	438394	55.1888	-7.0352
28	Discharge Pipe	91	261660	438418	55.1890	-7.0327

Map ID	Feature	*E. coli* (cfu/100 ml)	Easting	Northing	Latitude	Longitude
29	Groundwater Discharge	13	261800	438450	55.1893	-7.0305
30	Discharge Pipe	630	262097	438549	55.1902	-7.0258
31	Discharge Pipe	160000	265047	440090	55.2036	-6.9792
32	Groundwater Discharge	795	265109	440117	55.2038	-6.9782
33	Discharge Pipe	455	265249	440172	55.2043	-6.9760
34	Discharge Pipe	4 x10^6	260188	437745	55.1832	-7.0560
35	Discharge Pipe	8	265110	440120	55.2039	-6.9781
36	Stream	4550	260575	438099	55.1863	-7.0498
37	Water Course	580	250304	423430	55.0557	-7.2136
38	Stream	1050	261032	423846	55.0582	-7.0457
39	Stream	2500	260152	422655	55.0476	-7.0597
40	Stream	565	258833	422544	55.0468	-7.0804
41	Pipe	145	258555	422327	55.0449	-7.0847
42	Stream	1150	258110	422406	55.0456	-7.0917
43	Pipe	11275	257165	422089	55.0429	-7.1065
44	Stream	1125	256373	422105	55.0431	-7.1189
45	River Roe	953	264278	429356	55.1073	-6.9937
46	Stream	170	264718	430841	55.1206	-6.9864
47	Stream	960	265075	431821	55.1293	-6.9806
48	Stream	1150	265569	433269	55.1423	-6.9725
49	Stream	99	266316	437194	55.1774	-6.9599
50	Stream	11500	266149	435607	55.1632	-6.9629
51	Stream	445	266003	434811	55.1561	-6.9654

Map ID	Feature	*E. coli* (cfu/100 ml)	Easting	Northing	Latitude	Longitude
52	Stream	470	265972	434534	55.1536	-6.9659
53	Pipe	1150	265966	438741	55.1914	-6.9650

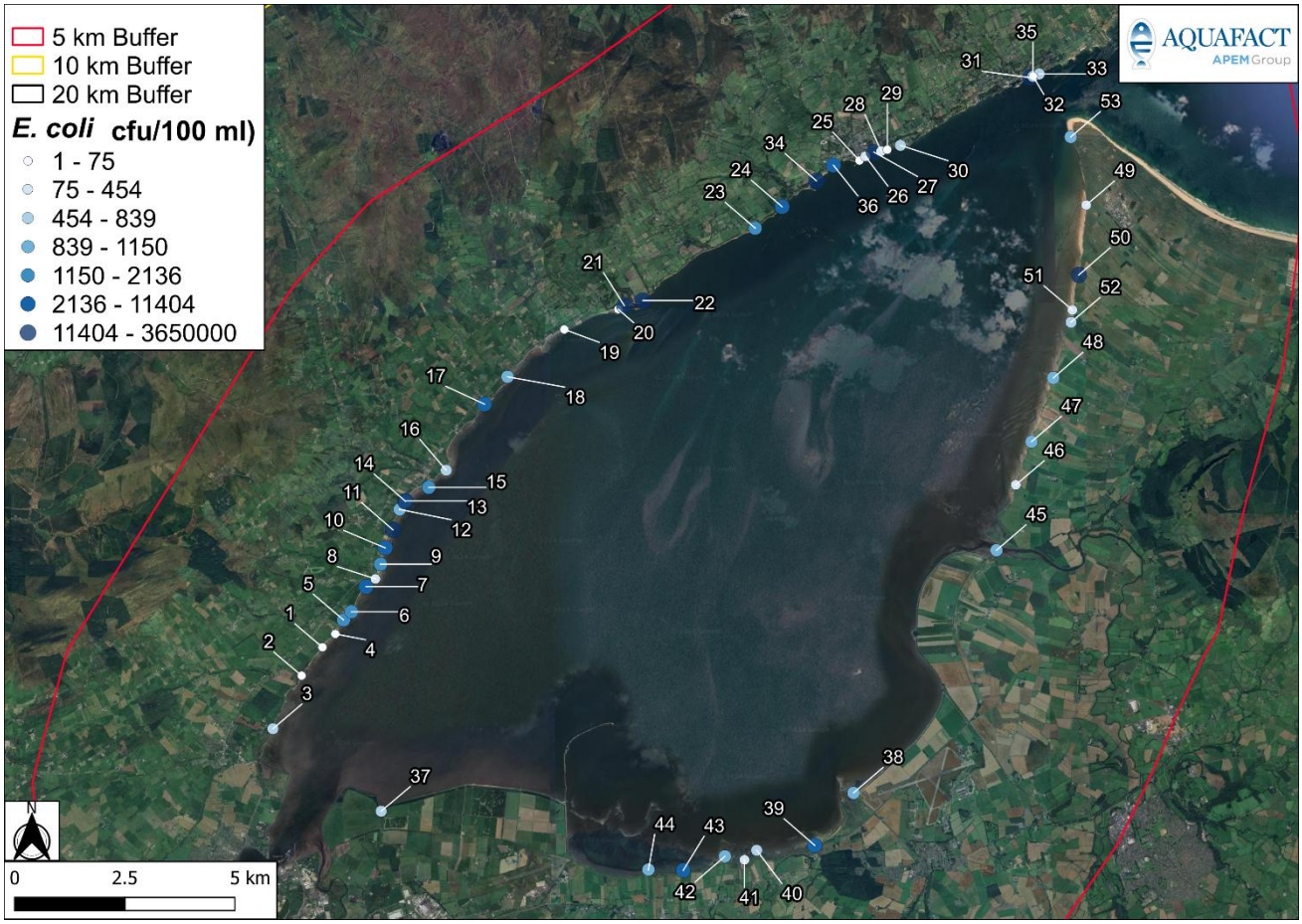

Figure 6-17: Location and magnitude of *Escherichia coli* (*E. coli*) results from the water samples taken during the 2023 shoreline survey (numbering cross-referenced to Table 6-6).

6.2.2 Bacteriological Analysis Results

The water sample results listed in **Table 6-6** and **Figure 6-17** show the magnitude of *E. coli* in the water samples, measured as colony forming units (cfu) per 100 ml (cfu *E. coli*/100 ml). The highest results were recorded at station 34 (discharge pipe), 21 (stream), 27 (discharge pipe), 14 (pipe), 31 (discharge pipe), 11 (pipe), 22 (stream), 50 (stream), and 43 (pipe), all of which exceeded 10,000 cfu/100 ml. There were more sample stations on the

western shore compared to the eastern shore. Of the eastern shore stations, there was a high frequency of *E. coli* results in excess of 1,150 cfu/100 ml, particularly between Ture Point and Quigleys Point, and between Castlecary and Moville. On the western shore, only three stations exceeded 1,150 cfu/100 ml during the bacteriological survey (**Figure 6-17**). While there was no visual trend, there appears to be higher results near towns/population centres, though this was not always the case it is plausible that areas with higher populations will have higher levels of pollution entering the system. It is of note that there are more population centres on the eastern coastline of Lough Foyle compared to the western coastline. This may be an artefact of the navigational channel location potentially increasing trade, employment, and revenue in the past, which would have driven the need for improved infrastructure. This may have influenced the increased level of discharges and subsequent sample stations observed along the eastern coastline. Of the eight stations which exceeded 11,404 cfu/100 ml, only one was situated on the western coastline of Lough Foyle, and of the 16 stations which exceeded 2,136 cfu/100 ml, only three were located on the western shoreline (**Figure 6-17**).

The majority of water samples taken were from streams (30), however there were 11 discharge pipes, eight pipes, two groundwater discharges, one sample taken from the Roe River, and one from a water course. The Roe River result was 953 cfu/100 ml.

7. Production Areas for Monitoring

In the 2010 and 2022 sanitary surveys, proposed production areas were based on hydrographical and spatial features (*i.e.,* areas of similar depth, tidal currents, residence times, suspended sediment levels, and freshwater influence, as well as the results from the shellfish and water sampling surveys). The RMP's O3 and O4 are no longer monitored, and mussels are used to represent oysters in these fisheries from the M3 and M4 monitoring points. These four production areas and the RMPs from the 2010 and 2022 reports can be seen in **Figure 6-8**.

8. Discussion/Conclusion

This section summarises potential pollution sources affecting Lough Foyle, focusing on *E. coli* contamination. It considers local population, boating activities, sewage discharges, agricultural operations, and the contributions of rivers and streams. It also discusses how contaminants move based on currents, tides, and bathymetry. Other factors like tourism, agricultural variations, and seasonal precipitation are considered. This section includes a pollution source inventory from the 2023 shoreline survey, alongside bacteriological sampling results, and provides details on nearby SPAs and SACs.

Shellfish water quality in Lough Foyle is monitored and regulated in accordance with Regulation (EU) 2017/625 and Implementing Regulation (EU) 2019/627. Under these regulations, the Food Standards Agency of Northern Ireland is responsible for defining the locations and boundaries of shellfish production areas and monitoring the levels of *E. coli* within these areas. Based on the levels of *E. coli* found in the harvested shellfish, the areas are classified into one of three categories: A, B, or C (**section 6.1.2**).

The FSA in Northern Ireland and the SFPA in the Republic of Ireland conduct monthly sampling of shellfish flesh from the designated production areas within Lough Foyle to monitor microbiological contamination. The species currently under surveillance include mussels, native oysters, and Pacific oysters. These samples are used to assess the classification of the production areas, which are sampled monthly and reviewed annually.

Currently, the FSA samples shellfish in Production Areas 3 and 4, while the SFPA samples shellfish in Production Areas 1 and 2. Lough Foyle is currently classified as a Class B shellfish production area, meaning that the shellfish from these waters required purification or other treatments before they could be marketed. Despite some variability in *E. coli* levels across different monitoring points, the results suggest that shellfish quality in the region has remained relatively stable, with contamination levels typically within the permissible range for Class B. The classification system used for shellfish production areas is summarised in **Table 6.1**, which details the permitted *E. coli* levels and the subsequent actions required based on the classification. These classifications ensure that shellfish reaching the consumer meet the necessary public health standards.

Additionally, the historical classification of shellfish beds in Lough Foyle from 2014 to 2024 was that mussel beds such as M1, M2, M3, and M4 have predominantly maintained a Class

B status throughout this period, with some sites going dormant in recent years. Native oyster beds (O1 and O2) have similarly held a consistent B classification. Monitoring points O3 and O4 are no longer monitored, instead mussels from the M3 and M4 are used as a proxy to represent oysters in these fisheries.

The ongoing monitoring and classification of shellfish production areas in Lough Foyle play a crucial role in ensuring the safety and quality of shellfish entering the market, aligning with both EU regulations and national oversight by the FSA and SFPA.

9. Sampling Plan

9.1 Identification of Production Area Boundaries & RMPs

Lough Foyle is a transboundary water body subject to overlapping jurisdictional claims between the Republic of Ireland and Northern Ireland. For the purposes of shellfish classification under Regulation (EU) 2017/625 and 2019/627, the FSA NI and the SFPA operate independently within their respective jurisdictions. The BMPA boundaries and RMPs in Lough Foyle have historically been developed and maintained by the FSA NI, with oversight of monitoring and sanitary surveys for both sides of the lough. In practice, SFPA, as the competent authority for the Republic of Ireland under Regulation (EU) 2017/625, has adopted these boundaries and RMPs for the purposes of classification within the Irish jurisdiction. While FSA NI leads the sanitary survey process for Lough Foyle, formal classification decisions for production areas located within ROI are made solely by the SFPA. This arrangement reflects long-standing operational cooperation but does not alter the separate legal responsibilities of each competent authority.

There has been no change to the licensed production area boundaries that were set out in the 2011 sanitary survey and used in the subsequent 2022 report. There has been no change to unlicenced production area boundaries. There has also been no change to the classicisation status of the production areas since the 2022 report. The current/recent review and 2023 shoreline survey did not find sufficient evidence of change within the lough to require any alterations of the production area boundaries or monitoring points.

Table 9-1: Representative monitoring point (RMP) locations in Lough Foyle. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish National Grid.

RMP	Species	Longitude	Latitude	Easting	Northing
M1	Mussels	-7.18933	55.08143	251825	426315
M2	Mussels	-7.11855	55.14134	256261.5	433039.5
M3	Mussels	-7.11498	55.07741	256578.8	425924.9
M4	Mussels	-7.04556	55.12635	260929	431407
O1	Native oysters	-7.15416	55.09353	254054.7	427688.5
O2	Native oysters	-7.15541	55.14099	253911.5	432971.6
O3	Native oysters	-7.09158	55.08839	258058	427166.4
O4	Native oysters	-7.04677	55.12064	260870	430794.9
PO1	Pacific oysters	-7.25043	55.05182	247958	422974.7

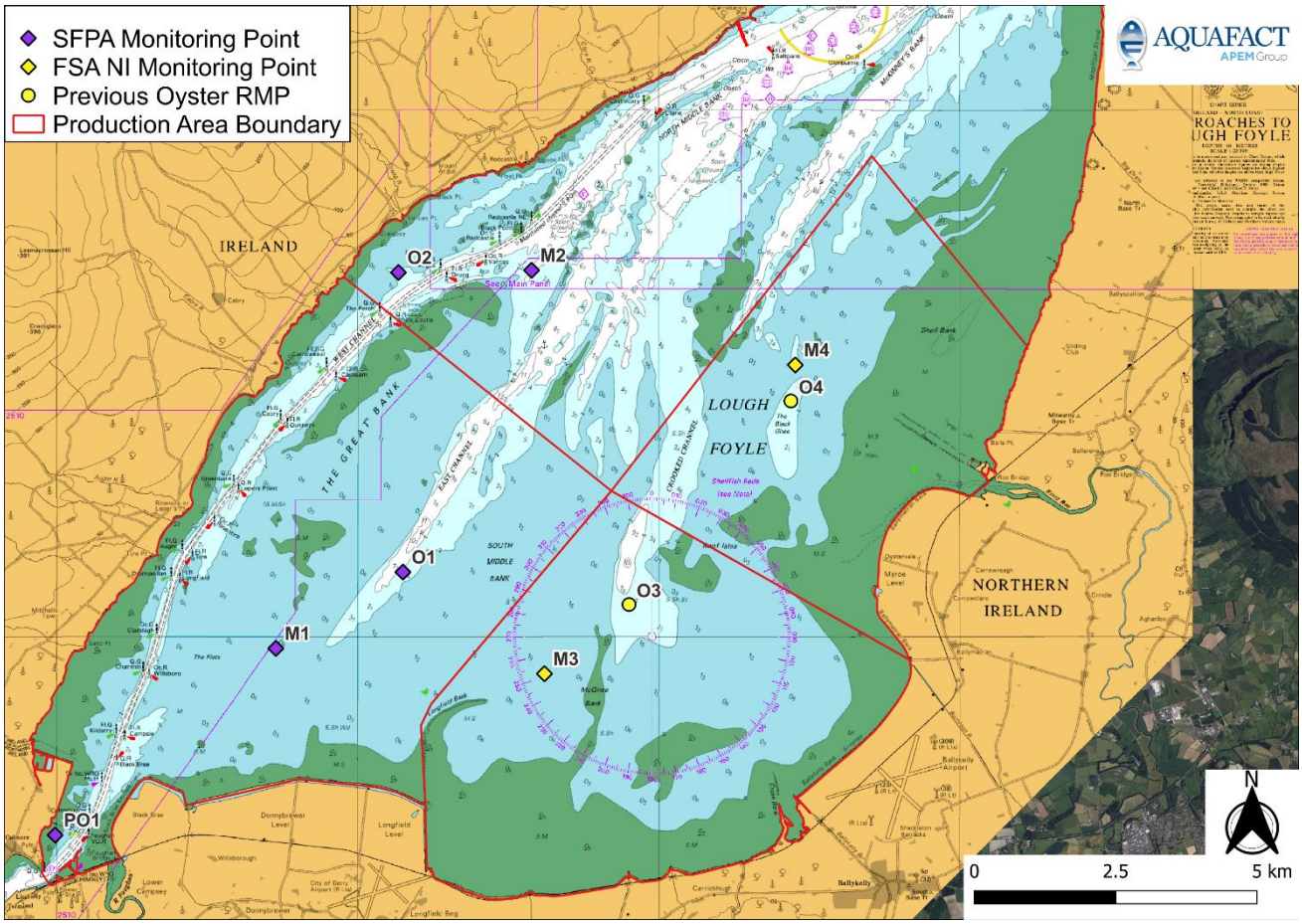

Figure 9-1: Locations of FSA and SFPA representative monitoring points (RMPs) and production areas. See Table 9-1 for Lough Foyle RMP coordinates. Monitoring points O3 and O4 are no longer monitored, instead mussels from the M3 and M4 are used as a proxy to represent oysters in these fisheries.

9.2 Sampling Plan

9.2.1 Methodology

All methodologies for the FSA in NI should follow the UK NRL (National Reference Laboratory) Microbiological Sampling Protocol. All sampling for the SFPA in RoI should follow the Sea Fisheries Protection Authority's own Code of Practice for the Microbiological Monitoring of Bivalve Mollusc Production Areas. The following sections (**9.2.2** to **9.2.10**) outline the protocol to be followed for microbiological sampling.

9.2.2 Time of Sampling

Sampling shall be undertaken, where practical, on as random a basis as possible with respect to likely influencing environmental factors, *e.g.,* tidal state, rainfall, wind, *etc.,* to avoid introducing any bias to the results.

9.2.3 Frequency of Sampling

Sampling should be carried out on a monthly basis, at least.

9.2.4 Sampling method

Wherever possible, species shall be sampled by the method normally used for commercial harvesting. The temperature of the surrounding seawater at the time of sampling should be recorded on the sample submission form.

9.2.5 Size of individual animals

Samples should only consist of animals that are within the normal commercial size range. In circumstances where less mature stock is being commercially harvested for human consumption then samples of these smaller bivalves may be gathered for analysis.

9.2.6 Sample composition

The following sample sizes (in terms of number of individuals by species) are recommended for submission to the laboratory:

- Oysters (*Crassostrea gigas* and *Ostrea edulis*): 12-18
- Mussels (*Mytilus* spp.): 18-35

9.2.7 Preparation of samples

Any mud and sediment adhering to the shellfish should be removed. This is best achieved by rinsing/scrubbing with clean seawater or freshwater of potable quality. If these are unavailable the seawater from the immediate area of sampling may be used instead. Do not totally re-immerse the shellfish in water. Allow to drain before placing in a food grade plastic bag.

9.2.8 Sample transport

A cool box containing freezer packs should be delivered to the laboratory as soon as practicable but the maximum time between collection and commencement of the test should not exceed 24 hours. Samples should not be frozen and freezer packs should not come into direct contact with the samples. The cool boxes used for such transport should be validated using appropriate temperature probes, to ensure that the recommended temperature is achieved and maintained for the appropriate period. The number and arrangement of freezer packs, and the sample packaging procedure, shown to be effective in the validation procedure should be followed during routine use. Where validation data already exists for a specific type of cool box, there is no need to take a local revalidation.

9.2.9 Sample Submission form

Sample point identification name, map co-ordinates, time and date of collection, species sampled, method of collection and seawater temperature should be recorded on the submission form. Any other information deemed relevant should also be recorded.

9.2.10 Delivery of samples

Samples should be properly labelled and accompanied by a completed sample submission form. Samples should be brought within 24 hours to the chosen accredited laboratory for analysis.

10. Republic of Ireland Monitoring Information

Site Name: Lough Foyle

Site Identifier: PO1 (Muff)

Sample Point Identifier: DL-LF-PO1-PO

Monitoring Point Coordinates: 55˚.05180N 007˚.25043W

Species: *Magallana gigas*

Sample Depth: Samples should be taken as close to the surface as possible, within the top one metre of the water column.

Sample Frequency: Samples shall be taken monthly upon reviewed classification of Lough Foyle BMPA. Sampling will occur throughout the year.

Responsible Authority: SFPA

Authorised Samples: It is the responsibility of the SFPA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

Sampling Size: A minimum of 10 Pacific oysters of market size (minimum length of 8 cm).

Sampling Method: Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.

Site Name: Lough Foyle

Site Identifier: M1 (Dormant)

Sample Point Identifier: DL-LF-M1-MU

Monitoring Point Coordinates: 55°.08140N 007°189330W

Species: *Mytilus edulis*

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly upon reviewed classification of Lough Foyle BMPA. Sampling will occur throughout the year.

Responsible Authority: SFPA

Authorised Samples: It is the responsibility of the SFPA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

Sampling Size: A minimum of 15 mussels of market size (minimum length of 4 cm).

Sampling Method: Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.

Site Name: Lough Foyle

Site Identifier: M2

Sample Point Identifier: DL-LF-M2-MU

Monitoring Point Coordinates: 55˚.14130N 007˚.11855W

Species: *Mytilus edulis*

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly upon reviewed classification of Lough Foyle BMPA. Sampling will occur throughout the year.

Responsible Authority: SFPA

Authorised Samples: It is the responsibility of the SFPA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

Sampling Size: A minimum of 15 mussels of market size (minimum length of 4 cm).

Sampling Method: Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.

Site Name: Lough Foyle

Site Identifier: O1

Sample Point Identifier: DL-LF-O1 -NO

Monitoring Point Coordinates: 55˚.09350N 007˚.15416W

Species: *Ostrea edulis*

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly upon reviewed classification of Lough Foyle BMPA. Sampling will occur throughout the year.

Responsible Authority: SFPA

Authorised Samples: It is the responsibility of the SFPA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

Sampling Size: A minimum of 10 native oysters of market size (minimum length of 8 cm).

Sampling Method: Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.

Site Name: Lough Foyle

Site Identifier: O2

Sample Point Identifier: DL-LF-O2-NO

Monitoring Point Coordinates: 55˚.14100N 007˚.15541W

Species: *Ostrea edulis*

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly upon reviewed classification of Lough Foyle BMPA. Sampling will occur throughout the year.

Responsible Authority: SFPA

Authorised Samples: It is the responsibility of the SFPA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: Samples are to be collected within 100 m of the RMP. Where this is not possible, the SFPA sample coordinator and local industry shall be informed to agree an alternative sampling location.

Sampling Size: A minimum of 10 native oysters of market size (minimum length of 8 cm).

Sampling Method: Sampling will be conducted in accordance with the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas (SFPA, 2020), specifically in accordance with Appendix 9.2.

11. Northern Ireland Monitoring Information

Site Name: Lough Foyle

Site Identifier: Production Area M3 (Wild Fishery)

Monitoring Point Coordinates: 55°.0774 N 7°.11498 W

Species: *Mytilus edulis* (represents oysters)

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly and will occur throughout the year.

Responsible Authority: FSA

Authorised Samples: It is the responsibility of the FSA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: The sample must be taken from within 250 m of the sampling point.

Sampling Size: A minimum of 15-30 mussels. Samples should only consist of animals that are within the normal commercial size range.

Sampling Method: Sampling will be conducted in accordance with *Protocol for sampling and transport of shellfish for the purpose of Official Control Monitoring of classified shellfish production areas under Commission implementing Regulation (EU) 2019/627* (FSA, 2021). Shellfish samples should be collected by dredging.

Site Name: Lough Foyle

Site Identifier: Production Area M4 (Wild Fishery)

Monitoring Point Coordinates: 55°.1263 N 7°.04556 W

Species: *Mytilus edulis* (represents oysters)

Sample Depth: Samples are dredged from the seabed.

Sample Frequency: Samples shall be taken monthly and will occur throughout the year.

Responsible Authority: FSA

Authorised Samples: It is the responsibility of the FSA to arrange sampling, with designated sampling officers assigned to collect samples.

Maximum Allowed Distance from Sampling Point: The sample must be taken from within 250 m of the sampling point.

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