2025

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SANITARY SURVEY AND SAMPLING PLAN FOR CLEGGAN BAY, CO. GALWAY- APRIL 2025

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DISCLAIMER

Under EU Regulation 2019/627, which lays down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption, a sanitary survey relevant to bivalve mollusc production in Cleggan Bay was undertaken in 2025. This will provide an appropriate hygiene classification zoning and monitoring plan based on the best available information with detailed supporting evidence. Aqualicense Limited undertook the desktop component of the work on behalf of the SFPA.

STATEMENT OF USE

Every effort is made in preparing the material and content of this sanitary survey for publication, but no responsibility is accepted by or on behalf of the SFPA for any errors, omissions, or misleading statements on these pages.

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ABBREVIATIONS

BMPA	Bivalve Mollusc Production Area (i.e. “production area”)
COP	Code of Practice
CSO	Central Statistics Office or Combined Sewer Overflow
DWWTS	Domestic Waste Water Treatment System
E. coli	*Escherichia coli*
ED	Electoral Division
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EU	European Union
GPS	Global Positioning System
GSI	Geological Survey of Ireland
IE	Industrial Emissions
IFI	Inland Fisheries Ireland
IPC	Integrated Pollution Control
ITM	Irish Transverse Mercator
I-WeBS	Irish Wetland Bird Survey
MPN	Most Probable Number
NAP	Nitrates Action Programme
NPWS	National Parks and Wildlife Service
PSU	Practical Salinity Unit
RMP	Representative Monitoring Point
SAC	Special Area of Conservation
SFPA	Sea Fisheries Protection Authority
SPA	Special Protection Area
SPR	Source-Pathway-Receptor
UWWTP	Urban Waste Water Treatment Plant
WFD	Water Framework Directive
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

Faecal contamination in shellfish waters poses a significant public health risk, particularly for filter-feeding bivalve molluscs such as oysters and mussels. These species can accumulate harmful microorganisms, increasing the risk of foodborne illness. To mitigate these risks, a sanitary survey is required in advance of the classification of shellfish production areas, in accordance with Article 56 of Regulation (EU) 625/2017 and Implementing Regulation (EU) 2019/627.

In line with the EU Regulation (EU) 2019/627, Aqualicense was commissioned by the Sea-Fisheries Protection Authority (SFPA) to conduct a sanitary survey of the Cleggan Bay Bivalve Molluscs Production Area (BMPA), located in Co. Galway.

This survey supports the classification of blue mussels (*Mytilus edulis*) for commercial harvest and includes the following key components:

- A desk-based assessment of potential faecal contamination sources using a Source–Pathway–Receptor (S-P-R) model;
- A field-based shoreline survey conducted by SFPA officers to confirm known risks and identify additional sources;
- A bacteriological survey of selected inflows and runoff points;
- A recommendation on the extent of the production area (geographic delineation) based on hydrodynamics, catchment influence, and aquaculture activity;
- Identification of a Representative Monitoring Point (RMP) within the classified area; and Development of a species-specific sampling plan in line with EU and SFPA requirements.

The desk-based study employed a Source-Pathway-Receptor (S-P-R) model to assess contamination risks within Cleggan Bay. This approach allowed for the identification of potential pollution sources, their transport pathways ("Contributing Catchment," included multiple river networks and associated sub-basins draining into the bay), and circulation patterns within the Bivalve Mollusc Production Area (BMPA) (i.e. the receptor), accounting for seasonality and microbial loads. Each key step and findings of the SPR model is outlined below.

1. The Bivalve Mollusc Production Area (BMPA), spans approximately 34.4 km² within Cleggan Bay, Co. Galway. Currently, blue mussels are the sole bivalve species cultivated in the area, with one active shellfish licence located along the northern shore of the bay. Mussels are grown sub-tidally and may be harvested year-round, depending on market demand.
2. The desk-based study examined the movement of pollutants, hydrological pathways to, and hydrodynamics within the production area. It also assessed the influence of weather patterns on hydrography and hydrodynamics. The findings indicate that the primary source of freshwater inflow, and consequently potential contamination, is via Lough Anillaun, located in the inner portion of the bay. Areas of greatest groundwater vulnerability were identified along the inner bay and the northern shoreline extending towards Cleggan Head. Hydrodynamic analysis determined that, while the bay has a relatively short flushing time, localised areas of pollutant accumulation may occur within the inner bay. Additionally, sediment resuspension was identified as a potential factor during south-westerly winds, particularly affecting shallower areas. Seasonal variations in surface water run-off were also

noted, with heavy rainfall events in summer and winter likely to influence microbial loads entering the bay.

3. An inventory of potential pollutants was compiled, identifying agricultural activity and septic tanks as the primary sources of contamination. Seasonal variations are expected to influence pollutant levels, particularly in summer when higher livestock stocking densities may lead to increased faecal loads. Additionally, extended dry periods can heighten the risk of pollutant runoff when rainfall occurs.

The overall SPR assessment highlighted the area in proximity to the inflow from Lough Anillaun inner bay as the key area of concern, with additional risks associated with smaller freshwater inflows and areas of high groundwater vulnerability, particularly along the northeastern shore. Currently, there are no active BMPA classifications in the bay.

A shoreline survey was conducted by the SFPA to confirm the findings of the desk-based study, and to identify any additional sources of contamination. A total of 15 observations were made, including six inflows into the bay. In addition to the inflows identified in the desk-based study, three additional surface runoff areas were documented, all draining agricultural land. Algae growth was noted at six locations, including at the inflow from Lough Anillaun.

Bacteriological sampling was conducted at 10 sites identified within the shoreline survey where faecal contamination was suspected. The sampling indicated that most sites recorded low E. coli concentrations (<10 MPN/100mL), which is consistent with dry weather and reduced winter livestock stocking densities. However, these findings may not reflect seasonal peaks in contamination. The highest contamination level was recorded at Cleggan Harbour and Slip (>2010 MPN/100mL), indicating a likely localised point-source input related to human activity

The Bivalve Mollusc Production Area (BMPA) in Cleggan Bay is recommended to cover an area of approximately **34.4 km²**. This boundary has been defined based on “catchment characteristics”, the extent of shellfish cultivation, and hydrodynamic patterns influencing contaminant distribution. It includes licensed site T09-524A, where *Mytilus edulis* are grown subtidally. The delineated area encompasses the zone most likely to be impacted by faecal contamination sources, including the Lough Anillaun inflow and identified surface runoff points. This boundary is proposed for use in classification and monitoring.

A single Representative Monitoring Point (RMP) has been identified to support the classification and monitoring of the BMPA. The selected RMP is located in the southern portion of site T09/524A, positioned to capture faecal contamination from both the Lough Anillaun inflow and nearby agricultural runoff sources. Hydrodynamic analysis indicates that contamination from Cleggan Village, despite high local E. coli levels, is unlikely to influence this site due to the prevailing current direction. The location is considered the most appropriate for capturing representative contamination risk within the BMPA, considering its size, circulation patterns, and the status of the licensed site. The T09/524A station has been identified as the most suitable location, as it is equidistant from two runoff sources and influenced by contaminants from the Lough Anillaun inflow. Its proximity to agricultural land ensures effective monitoring of faecal contamination from rural sources. In contrast, pollution from Cleggan Village is unlikely to impact the site due to prevailing hydrodynamic conditions.

A microbiological sampling plan has been developed in accordance with the SFPA Code of Practice (2020) and Regulation (EU) 2019/627. The plan specifies monthly sampling of *Mytilus edulis* at the designated RMP (ITM coordinates: 460269.908, 759089.656). Samples must be collected within 100 metres of this point, as close to the surface as possible (within the top 1 metre of the water column), and consist of at least 15 market-size mussels (≥ 4 cm). Sampling will be coordinated by the SFPA Ros An Mhíl Port Office, with SFPOs responsible for compliance with sampling procedures.

Based on the desk-based Source–Pathway–Receptor model, shoreline survey, and bacteriological monitoring:

- The Cleggan Bay Bivalve Mollusc Production Area has been delineated to encompass approximately 34.4 km²;
- A single Representative Monitoring Point (RMP) has been identified in the southern portion of licensed site T09/524A, positioned to capture relevant contamination from Lough Anillaun and adjacent agricultural sources ; and
- A species-specific microbiological sampling plan has been developed for *Mytilus edulis* to support the initial classification and to guide the ongoing official control monitoring programme.

In conclusion, a sanitary survey has been completed in accordance with Article 56 of Regulation (EU) 2017/625 and Regulation (EU) 2019/627.

1. INTRODUCTION

The presence of faecal contamination in the marine environment can result in the accumulation of harmful microorganisms in shellfish, posing a public health risk. Bivalve molluscs such as oysters, mussels, and clams are filter feeders, meaning they draw in and process large volumes of water, which can lead to the concentration of microbial contaminants. *Escherichia coli* (*E. coli*) is a key indicator organism used to assess faecal contamination, as its presence suggests potential pollution from human or animal waste. If such contamination includes pathogenic bacteria or viruses, it can increase the risk of foodborne illness for consumers.

To mitigate these risks, the European Union has established a regulatory framework (Regulation (EC) No 2073/2005) governing the classification and monitoring of shellfish production and relaying areas. Ireland transposed the Shellfish Waters Directive via S.I. No. 268/2006 (as amended by S.I. No. 464/2009). EU Regulation 2019/627 outlines the requirements for sanitary surveys. Article 56 of the Regulation mandates that competent authorities (i.e. the SFPA in an Irish context) conduct a sanitary survey before classifying a production or relaying area. This survey must include:

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, waste-water treatment, etc.; and*
c) *determination of the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal cycle in the production area.*

Furthermore, under the SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas in Ireland (SFPA, 2020), a sanitary survey may include four elements:

1. A desk-based study to identify pollution sources;
2. A shoreline survey to confirm initial findings of the desk-based study;
3. A bacteriological survey; and
4. Data assessment

In addition, ongoing monitoring is required under Article 57, ensuring that sampling programmes are informed by sanitary surveys and designed to produce representative data on water quality and potential contamination risks. Article 58 further stipulates that authorities must establish procedures to ensure that both sanitary surveys and monitoring programmes accurately reflect the conditions within shellfish production areas.

Cleggan Bay has not previously been classified as a Bivalve Mollusc Production Area (BMPA). Therefore, this report presents the findings of the sanitary survey conducted in advance of its classification. It examines all potential sources of faecal contamination, pathways, circulation and seasonal variations, with particular consideration of the area's rural context. The report aims to inform classification decisions and provide the necessary evidence for effective monitoring in line with EU regulatory requirements.

2. Desk-Based Study

2.1. Introduction to the General Area

Cleggan Bay is a north-westerly facing bay, located in Co. Galway. It is bordered by Cleggan Head to the northeast and the Aughrus Peninsula to the southwest, covering approximately 500 hectares. Lough Anillaun, a natural sedimentary lagoon, lies at the bay's innermost section, separated by a barrier and bridged road (Figure 2.1).

In addition to the current bivalve production discussed in Section 2.2, the bay hosts one non-bivalve aquaculture licence (T09/434A, Cleggan Seaweed Ltd) for seaweed cultivation on the north shore, covering 8 hectares (Figure 2.2). Self-seeded *Alaria esculenta, Palmaria palmata, Saccharina latissima,* and *Himanthalia elongata* which are grown on long-line ropes.

Commercial inshore fishing targets crayfish (Astacidea spp.), brown crab (*Cancer pagurus*), lobster (*Homarus Gammarus*), and shrimp (*Palaemon serratus*) (Marine Institute, 2025a).

2.2. Characterisation of the Production Area

Key characteristics of the production area are outlined in Table 2-1.

Table 2-1. Characterisation of the production area.

Criteria	Description
Location and extent	This Bivalve Mollusc Production Area (BMPA) is within Cleggan Bay, Co. Galway. It covers an area of c. 34.4 km^2.
Bivalve species	Blue mussels (*Mytilus edulis*) are currently the only bivalve species produced within the BMPA.
Aquaculture or wild stocks	There is currently only one active shellfish license in the bay (T09/524AA; Figure 2-3). This license is for the cultivation of blue mussels on the north shore of Cleggan Bay, at a site covering 6.58 hectares. There is no commercial harvesting of wild bivalve stocks within the BMPA.
Seasonality of harvest	Shellfish may be harvested year-round in accordance with market demand.
Growth and harvesting techniques	Blue mussels in this BMPA are grown subtidally on long lines. Seed is collected on a suspended collection rope.
Any conservation controls (e.g. closed season)	No conservation controls are employed.
Existing classification data	There is currently no historic classification data for this BMPA as this is a new shellfish production area.

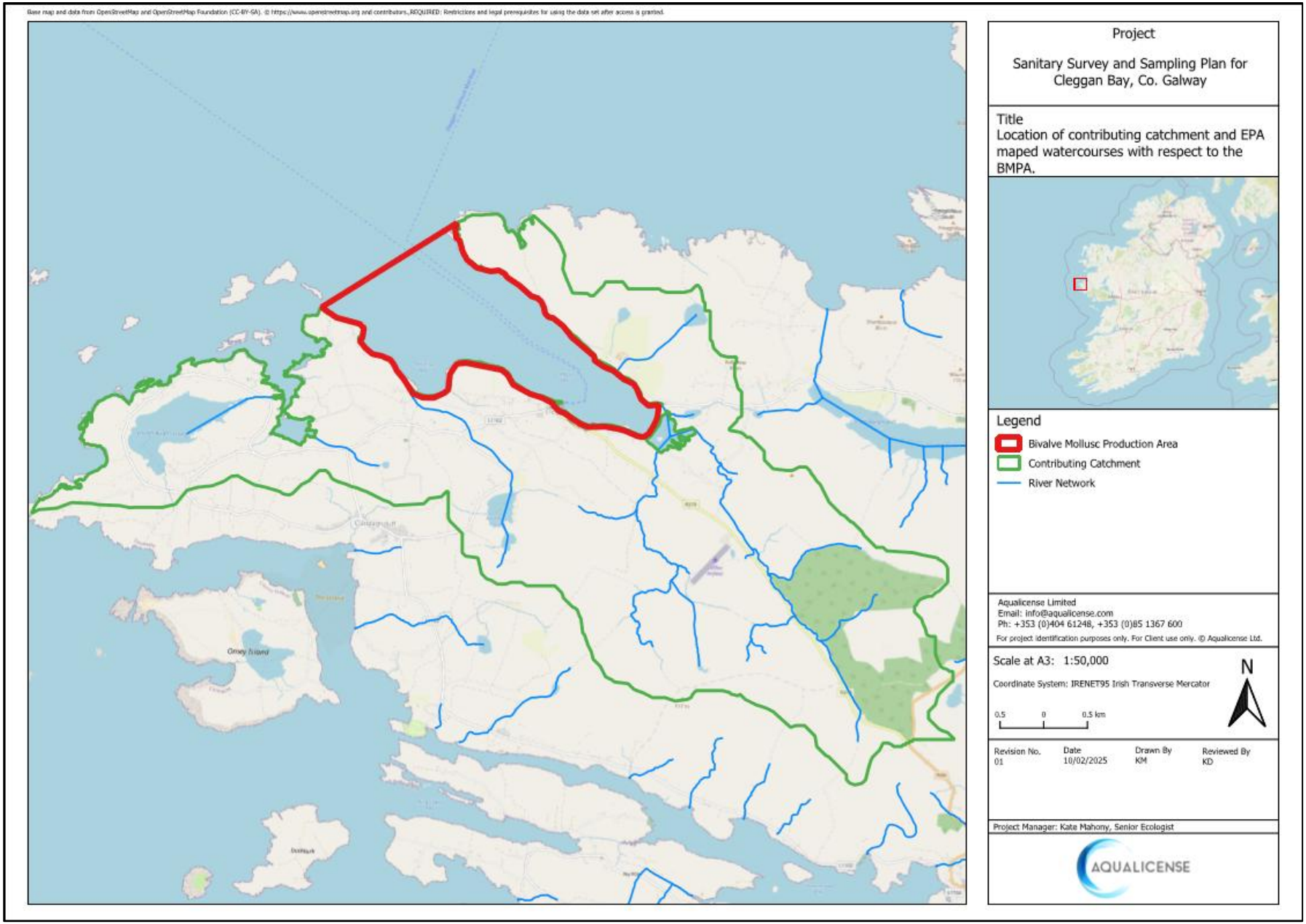


Figure 2-1. Location of contributing catchment and EPA mapped watercourses with respect to the BMPA.

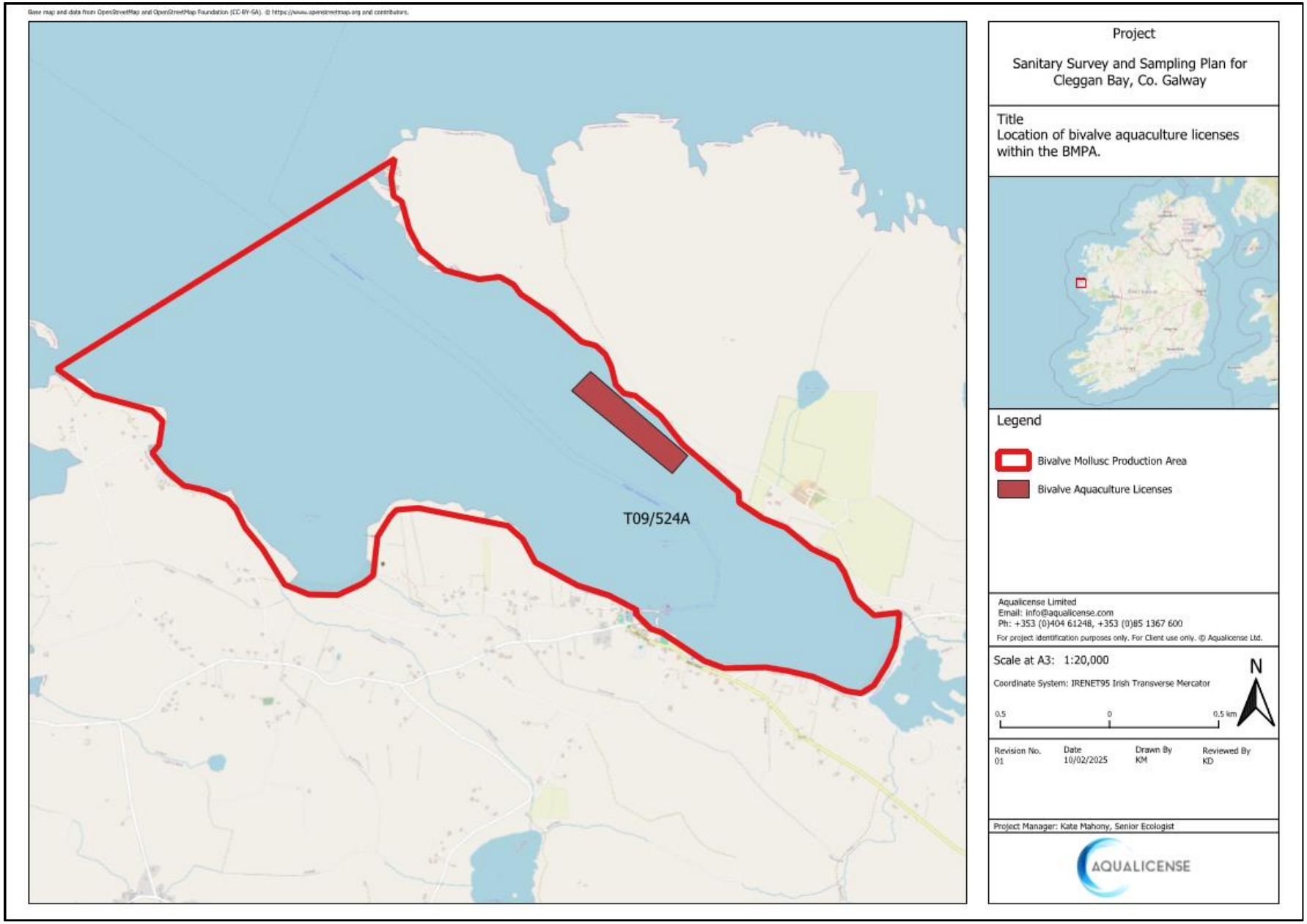


Figure 2-2. Location of bivalve aquaculture licences within the BMPA

2.3. Bivalve Mollusc Production Area Delineation Process

The process for defining a Bivalve Mollusc Production Area (BMPA) boundary is that the SFPA proposes the BMPA boundary by assessing the maximum area suitable for aquaculture that can be effectively covered by a localised sanitary survey. This is done in consultation with key stakeholders involved in aquaculture development and licensing, such as BIM, industry representatives, and the Department of Agriculture, Food and the Marine (DAFM).

The boundary is then finalised based on the outcomes of the sanitary survey, specifically with regard to the area that can be reliably represented by the designated Representative Monitoring Point(s) (RMPs).

2.4. Assessment Methodology

The desk-based study will follow SFPA guidelines (COP SH01) and align with EU Regulation 627/2019, Article 56. It forms the first part of the sanitary survey, informing the shoreline and bacteriological surveys (if required).

Using a Source-Pathway-Receptor (S-P-R) model to determine and describe the flow of possible environmental pollutants from a source, through different pathways to the potential receptor, the study ensures a focused assessment by identifying contamination risks.

This assessment applies the S-P-R model to evaluate the ecological risk associated with faecal contamination within the BMPA (i.e. the receptor).

- **Source:**
  Faecal contaminants originate from identifiable inputs including agricultural runoff, wastewater treatment plant effluents, combined sewer overflows, and diffuse urban or wildlife sources. These inputs introduce microbiological pollutants such as E. coli, enteric viruses, and protozoan cysts into the aquatic environment.
- **Pathway:**
  Contaminants are transported via hydrological and tidal processes, surface water flows, and stormwater conveyance systems. Transport dynamics are influenced by rainfall events, land use, catchment topography, and the retention or resuspension of faecal material in sediments. Temporal variation is considered to identify peak contamination windows.
- **Receptor:**
  Shellfish species, particularly filter feeders, accumulate faecal contaminants present in the water column. These organisms serve as biological indicators and direct receptors of microbial loading.

If any element (source, pathway, receptor) is absent, no impact occurs, allowing targeted evaluation for the production area.

Key S-P-R components are indicated in Figure 2-3.

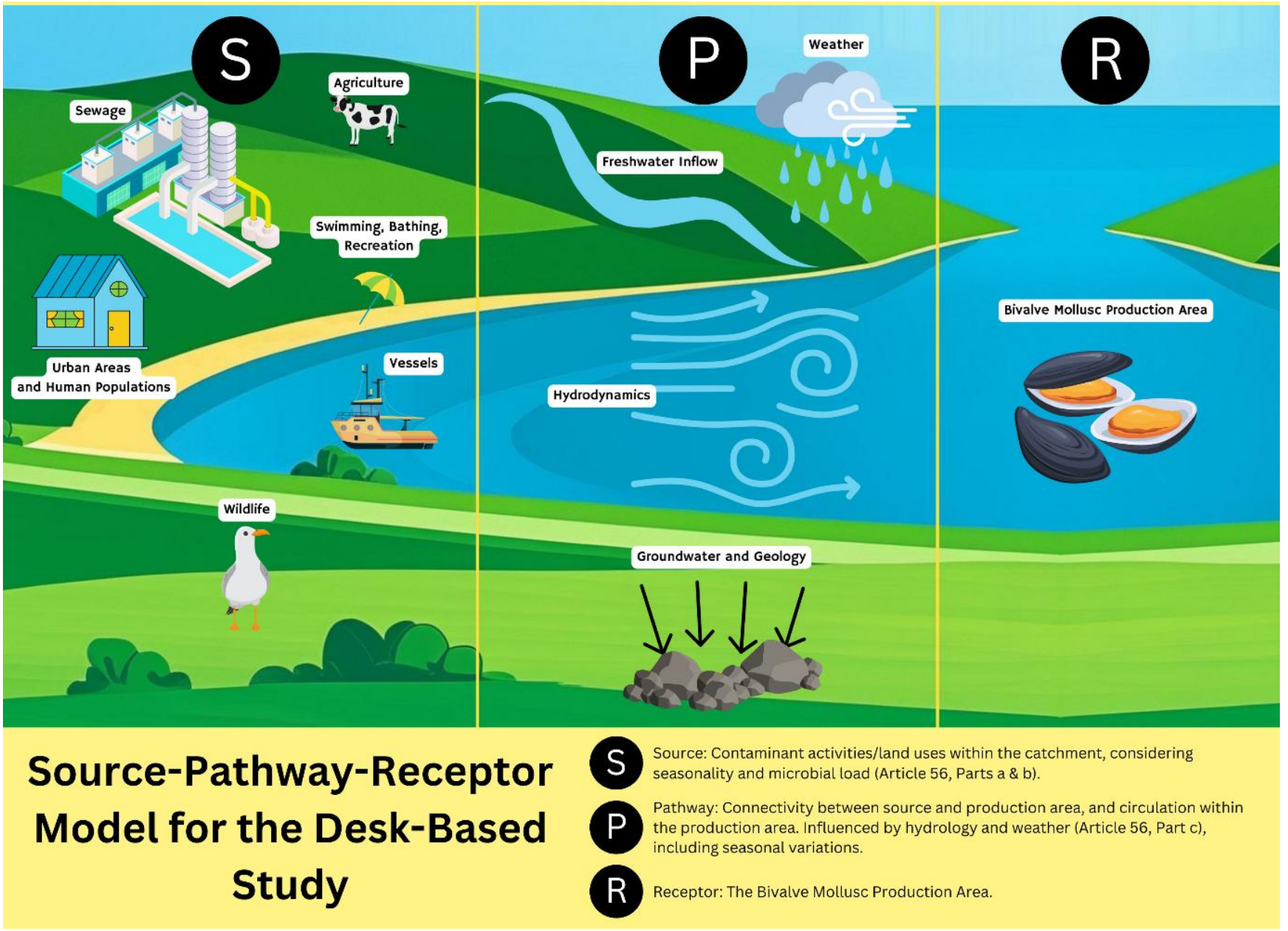


Figure 2-3. Key elements to be considered in this Desk-Based Study under the S-P-R Model.

2.4.1 CONTRIBUTING CATCHMENT

As the receptor has been defined as the BMPA, to assess sources and pathways the "Contributing Catchment" was defined. These are the areas from which there is a pathway from potential sources to the production area.

A catchment is defined as "*an area of land that drains into a river, lake or other body of water*" (EPA, 2025a). The EPA further identifies catchments and sub-catchments for the purposes of Water Framework Directive (WFD) monitoring; however, these are at too large a scale for the purposes of a sanitary survey. Therefore, a specific "Contributing Catchment" has been allocated solely for the purposes of this survey. This contributing catchment has been selected by identifying all river networks (EPA, 2022) which enter the BMPA. Subsequently, to account for land draining into these river networks, the EPA river sub-basin (EPA, 2022), through which each river flows, is also included in the contributing catchment (EPA, 2022).

The identified contributing catchment covers an area of 23.5 km^2 and contains a single sub-basin, the Cloon_010. The defined contributing catchment is identified in Figure 2-1.

2.5. CHARACTERISTICS OF CIRCULATION OF POLLUTANTS

Prior to identifying pollution sources and their seasonality, an examination of pollutant circulation in the production area will be conducted. This will provide a foundation for detailed analysis of pathways in subsequent sections of this desk-based study. This section examines the movement of pollutants and explores hydrological pathways to, and hydrodynamics within, the production area. It also considers weather patterns, which may have seasonal influences on hydrography and hydrodynamics.

2.5.1 FRESHWATER INFLOWS

The contributing catchment consists exclusively of the Cloon_010 sub-basin (Figure 2-1), with all identified watercourses classified under the Cloon_010 waterbody. These watercourses have been categorised based on their points of inflow to the production area (Table 2-2). Assessing these inflows is the first step in understanding the entry of pollutants and lays the foundation for further examination of pollutant circulation.

No hydrometric gauges are present within the contributing catchment. However, the majority of watercourses discharge into Lough Anillaun, which subsequently flows into the inner bay at Inflow 5 (Figure 2-4). In the absence of flow data, this is considered the largest inflow due to its greater number of tributaries. Lough Anillaun is a natural sedimentary lagoon, and while it experiences occasional influxes of seawater salinity, it has a low salinity due to substantial freshwater inputs (Irish Lagoons, 2019).

The Water Framework Directive (WFD) aims to protect and enhance the quality of rivers, lakes, transitional waters, coastal waters, and groundwater. WFD monitoring assesses biological, physico-chemical, and hydromorphological parameters to determine waterbody status. While not all WFD parameters are directly relevant to sanitary surveys, some, such as the assessment of nutrients (nitrogen and phosphorus) and dissolved oxygen, serve as key indicators of organic pollution, including faecal contamination. WFD monitoring also identifies pressures on water quality, such as nutrient enrichment, wastewater discharges, and diffuse pollution, which are further explored in Section 2.5 to assess their relevance as pollutant sources.

The WFD status of Lough Anillaun (2016–2021) was classified as "Good". However, given the extensive drainage area, this inflow is identified as the primary pathway for pollutant transport to the production area. While all other surface waterbodies were classified as "Good" during Cycle 2 of the WFD, they all drain agricultural land and thus have the potential to contribute to pollutant loads. For example, Inflow 6 enters the bay approximately 600m south-southeast of the licensed bivalve site (T09/524A; Figure 2-4). This will be discussed in more detail in Section 2.5 in respect of individual pollution sources.

Table 2-2. Locations of freshwater inflow to the production area.

CODE	NAME (EPA CODE)	COMMENT
1	Aughrus_Beg (32A17)	Does not enter the production area.
2	Attigoddaun (32A13)	Does not enter the production area.
3	Moorneen (32M10)	Enters at Selerna Beach, within the production area.
4	Potential Drainage Ditch	Not listed by EPA, identified by Google satellite mapping (04/02/2025) and may enter at Selerna Beach.
5	Laghtanabba (32L07)	Enters Lough Anillaun and is named outflow from Lough Anillaun
	Trean 32 (32T32)	Enters Lough Anillaun (Source is Woongar Lough)
	Cloon 32 (32C37) and unnamed tributaries	Enters Lough Anillaun and ultimately a tributary of Laghtanabba via Lough Anillaun.
	Courhoor (32C55)	Tributary of Cloon 32
	Sheeauns (32S23)	Tributary of Laghtanabba
	Shinnanagh (32S16) and unnamed tributaries	Tributary of Laghtanabba
6	Cleggan (32C64)	Drains Natawny Lough

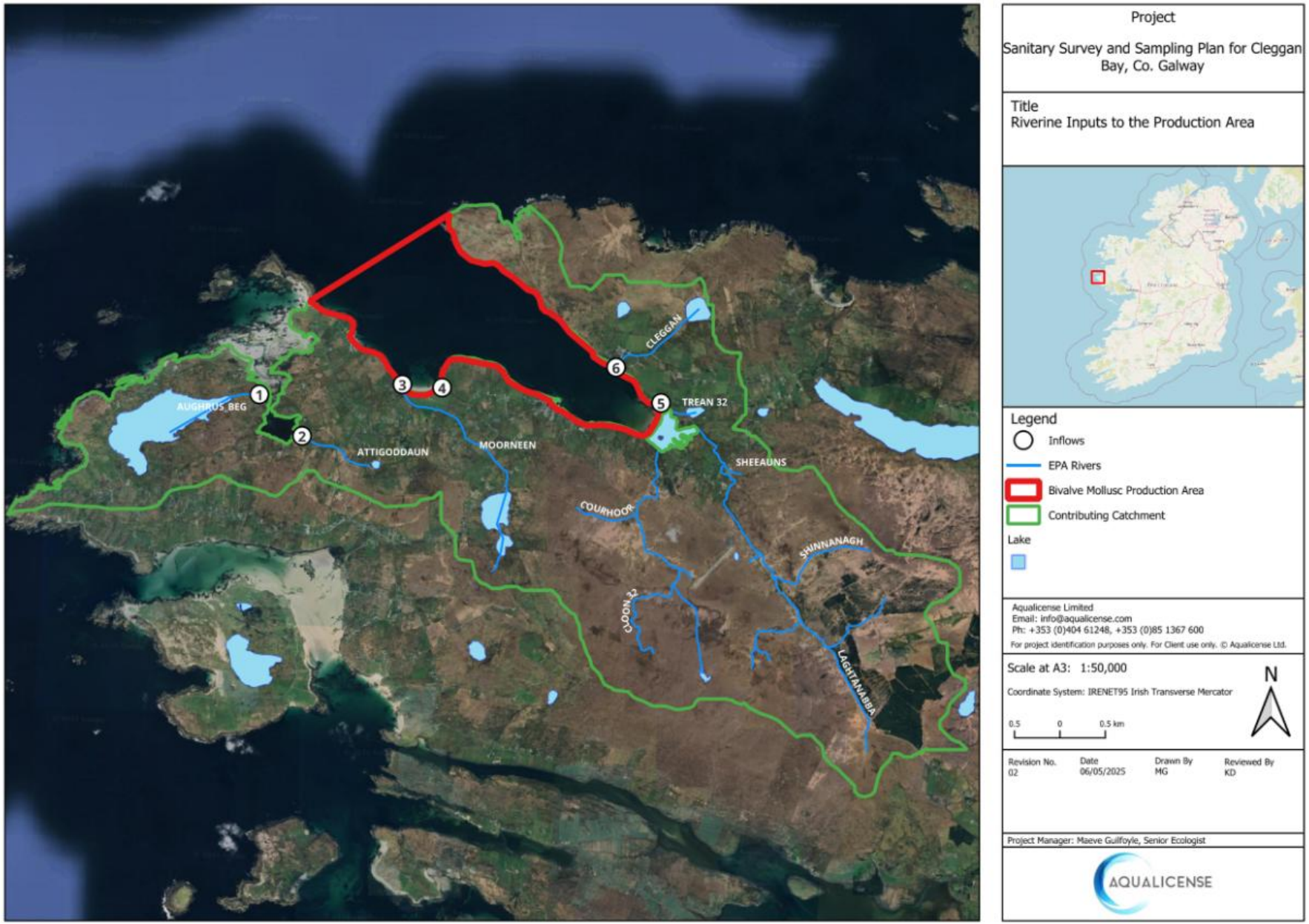


Figure 2-4. Riverine inputs to the production area

2.5.2 GEOLOGY AND GROUNDWATER

The movement of microbial pollutants, such as *E. coli*, within a catchment is influenced by the underlying geology. Groundwater plays a role in contaminant transport, as pollutants can infiltrate through soil and bedrock, entering the marine environment. Understanding the geological features, particularly groundwater vulnerability, helps assess how contaminants may disperse. Section 2.5 will provide further detail on groundwater in relation to individual pollution sources.

Pollutants can enter the marine environment via groundwater through two primary pathways. The first is via surface water, where groundwater inflow contributes to rivers, lakes, and other surface waters that eventually discharge into the marine environment. The second pathway is direct submarine groundwater discharge, where groundwater seeps directly into the sea from the seabed, including the intertidal zone (Arévalo-Martínez *et al.*, 2023).

The contributing catchment overlies two groundwater bodies: “Clifden Castlebar” and “Letterfrack Marbles”, both of which were classified as having a “Good” WFD status from 2016–2021 (EPA, 2023).

An analysis of groundwater vulnerability (GSI, 2021) within the contributing catchment reveals that 33.5% and 16.9% of the contributing catchment as having “Rock at or near Surface or Karst” and “Extreme” vulnerability respectively (Figure 2-5). These areas, located to the southeast and east of the contributing catchment and extending from the shoreline, pose the highest risk for pollutant infiltration via groundwater, particularly where they intersect with surface water pathways

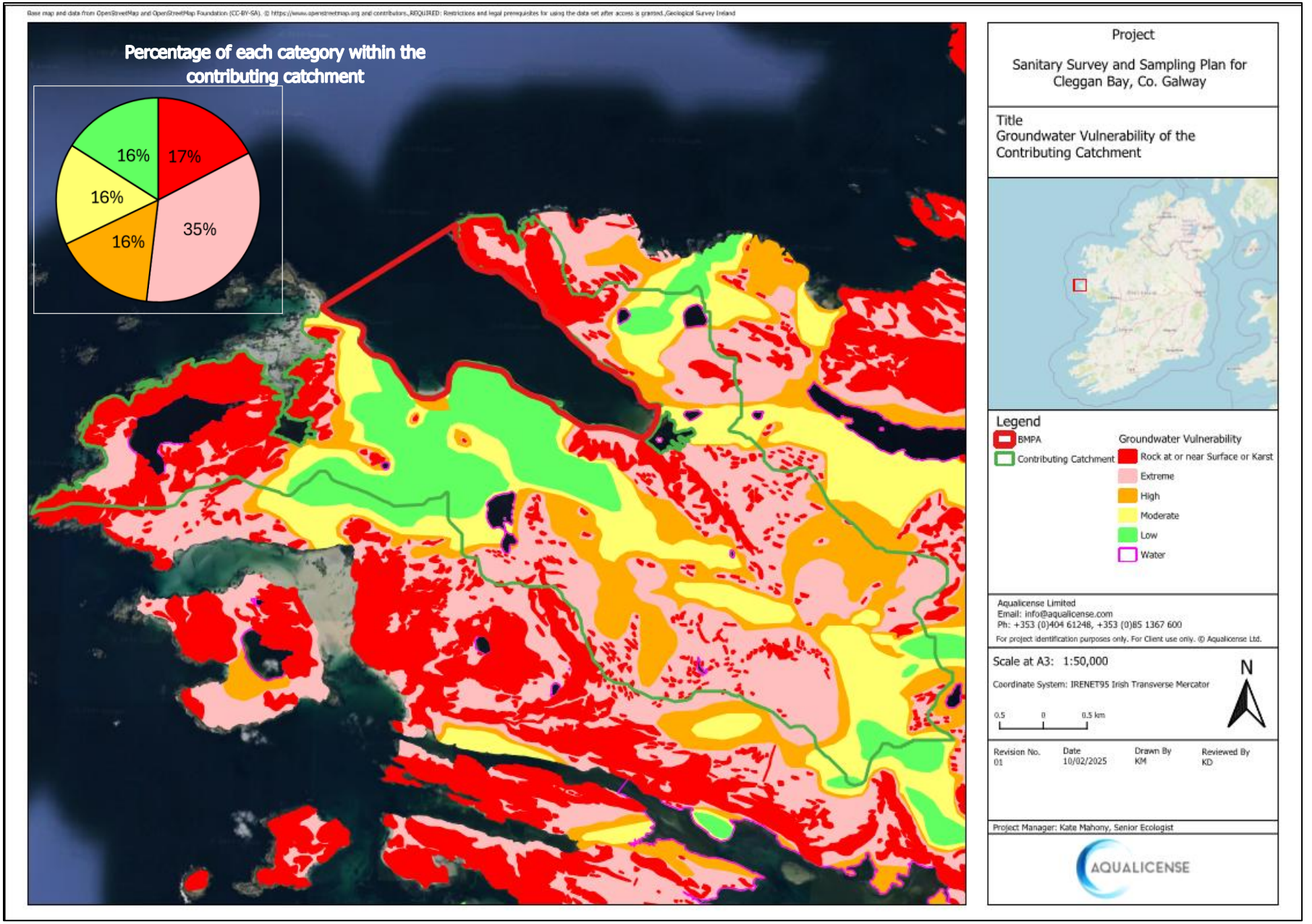


Figure 2-5. Groundwater vulnerability of the contributing catchment.

2.5.3 HYDRODYNAMICS

No detailed hydrodynamic studies specific to Cleggan Bay are available. The Irish Marine Institute's Connemara Model (CONN2D; Marine Institute, 2025b) and Admiralty Map 2707 (UK Hydrographic Office, 2025) have been consulted to describe the hydrodynamics of Cleggan Bay. Hydrodynamic models have been developed for the adjacent Ballinakill Harbour, and where relevant, have been consulted to infer data for Cleggan. The validity of this model to Cleggan has been assessed below, and potential limitations and assumptions where relevant have also been highlighted.

2.5.3.1 BATHYMETRY

Bathymetry was assessed through Admiralty Map 2707. The southern and southwestern coasts of the production area, particularly the inner bay through Cleggan Village, Sellerna Bay, and Roiellaun, feature a shallower, more gently sloping seafloor with larger intertidal zones (Figure 2-6). In contrast, the northeastern shore increases more steeply. Depths generally remain below 20 metres in the outer bay and below 10 metres in the inner bay, with the deepest areas located near Cleggan Point.

2.5.3.2 TIDAL INFLUENCE

Based on the hydrodynamic model for Ballinakill Bay (Aquafact, 1991b as read in SFPA, 2022), the following is inferred. The predicted spring and neap tidal ranges are 3.6 metres and 1.5 metres, respectively. Depths are similar to Cleggan (as evidenced in Admiralty Map 2707), the inner part of Ballinakill Harbour has estimated mean depths of approx. 5 metres. Therefore, considering similar depths and its simple geography, it is also predicted that the inner harbour water of Cleggan Bay is completely refreshed during spring tides. The Ballinakill model demonstrates that the direction of tidal flow is variable, particularly after high tide, with wind influencing surface currents. This is assumed to be similar for Cleggan, considering both bays face in a north-easterly direction, and will be further elaborated on below (Section 2.4.3.4) considering the CONN2D model.

2.5.3.3 TEMPERATURE AND SALINITY

The CONN2D model from 12th February 2025 shows that salinity remains relatively uniform at 34 PSU, with minor variations during the tidal cycle (Appendix 1). Variations are most pronounced in the inner bay, where freshwater influence is more significant. Salinity decreases during the ebb tide due to freshwater input and increases during the flood tide as seawater enters the bay, similar to findings in other sanitary surveys, e.g. Roaringwater Bay (SFPA, 2024). Temperature follows a similar pattern, rising on the flood tide and falling on the ebb. Full details of these cycles are provided in Appendix 1.

2.5.3.4 CURRENT PATTERNS

The CONN2D was used to assess the bay's current patterns. Outputs from 12th February 2025 (Figure 2-7) illustrate a full tidal cycle within the bay. Compared to the open waters outside, water movement within the bay is relatively weak, with stronger currents concentrated in the outer sections. During the flood tide, water primarily enters the bay around Cleggan Head. As the tide progresses, the inflow transitions to a south-westerly direction, gradually spreading inward. During the ebb tide, water exits the bay predominantly along the southern coastline, following the curvature of the Aughrus Peninsula. The strongest outflow occurs here, with water moving in a north-westerly direction back toward open waters.

Although no data is available on the flushing time or current velocities for Cleggan Bay, these parameters may be inferred from temperature and salinity data from the CONN2D model. Since

salinity and temperature quickly respond to tidal exchange (Section 2.4.3.3), the flushing time is likely relatively short in similarity with nearby Ballinakill Harbour (approx. 1.7 days).

Current velocities in Cleggan Bay are expected to closely resemble those of Ballinakill Harbour, with surface currents reaching 1.0 knots and bottom tidal currents reaching 0.6 knots. Given the similar directionality, depth ranges, and tidal ranges of the bays, the flushing time in Cleggan Bay is likely to be comparable to the flushing time of Ballinakill Harbour.

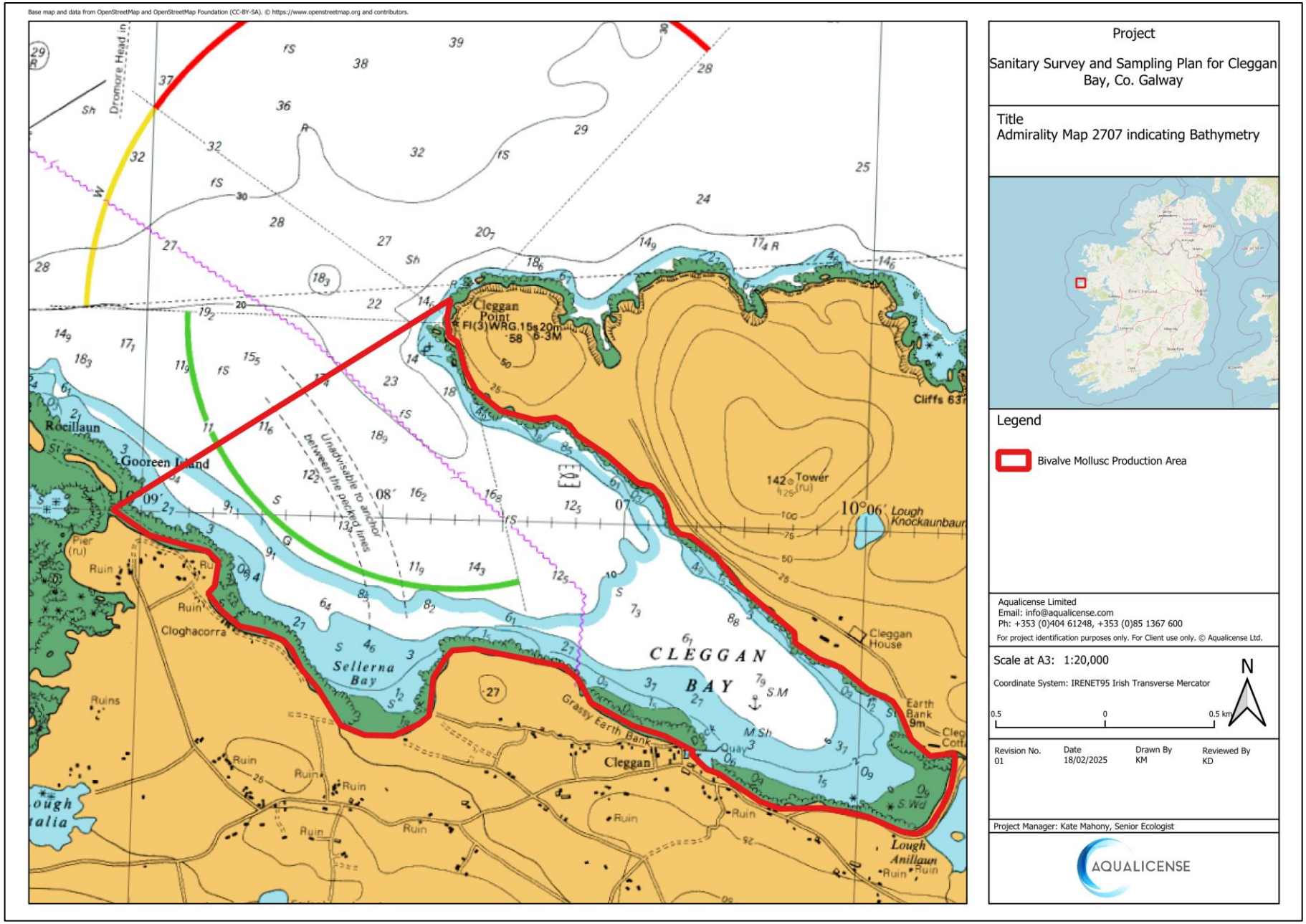


Figure 2-6. Admiralty Map 2707 indicating bathymetry.

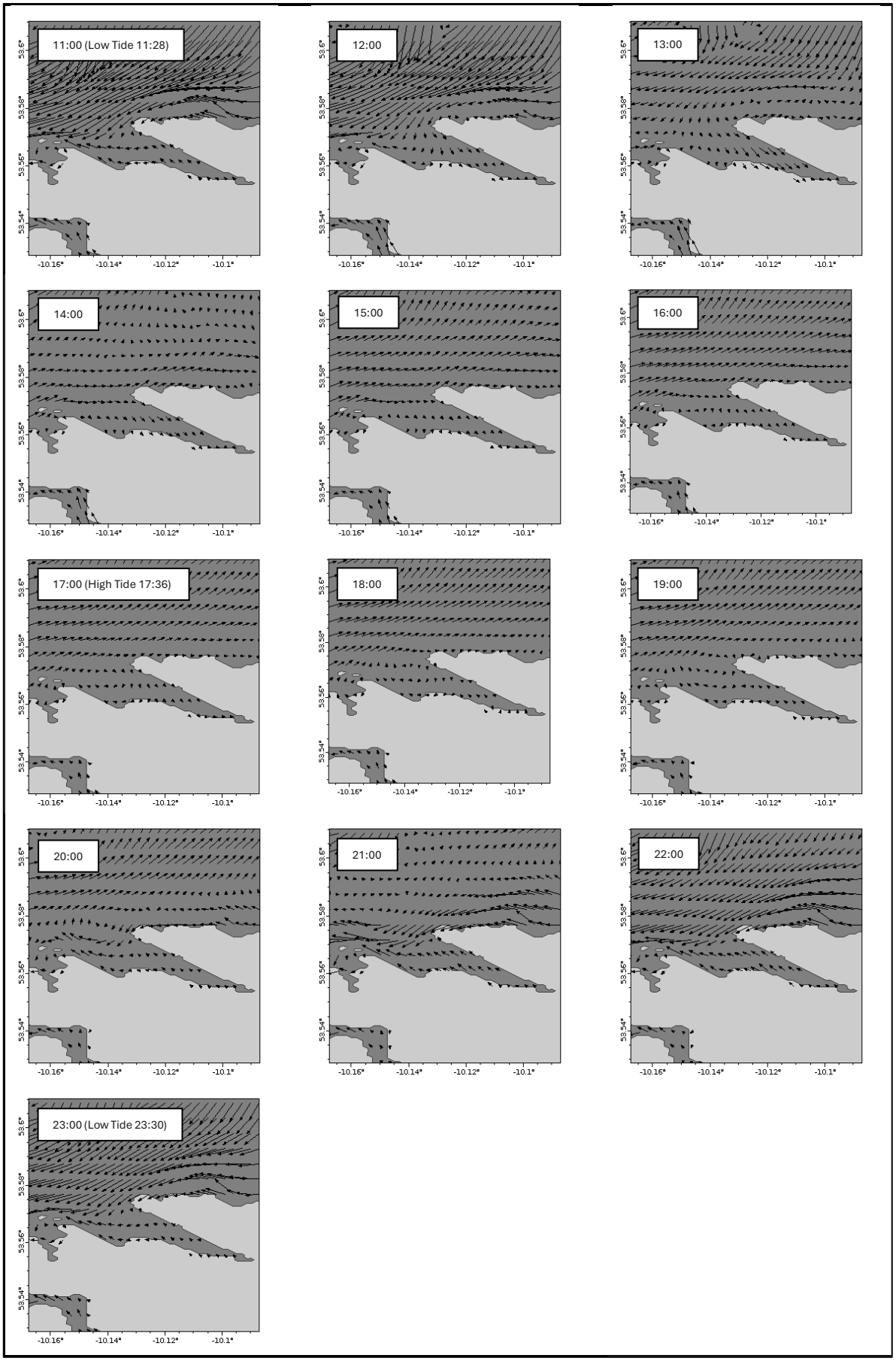


Figure 2-7. Vector arrows representing current direction, based on the u and v barotropic velocity components (0.2 m/s). Data sourced from the Irish Marine Institute's Connemara Model (CONN2D; Marine Institute, 2025b). Model output corresponds to 12th February 2025.

2.5.4 WEATHER

Weather patterns significantly influence the transport of organic pollutants. The nearest synoptic weather station to the production area is Mace Head, located c. 28.5 km southeast. Data from this station from January 2015 to December 2024 inclusive (Met Éireann, 2025a, 2025b) have been used to infer weather patterns and seasonality influencing pollutant circulation within the production area.

2.5.4.1 WIND AND WAVES

Waves and currents play a crucial role in hydrographic conditions. Of relevance to sanitary surveys, wind-driven waves facilitate sediment resuspension and transport (Green and Coco, 2014) These waves are primarily generated by local prevailing winds and travel in the direction of those winds. Their characteristics are influenced by factors such as wind speed, duration, and fetch (Young, 1999).

The prevailing wind direction is westerly, accounting for 26% of all winds (Figure 2-8). Westerly winds also have the highest maximum wind speeds at 8.29 m/s, followed closely by south-westerly winds at 8.74 m/s. Winds from the south make up 16% of the total, with a maximum mean wind speed of 8.3 m/s. South-westerly winds, which are more common in summer, autumn, and winter, also account for 16% of winds. For further details refer to Appendix 2.

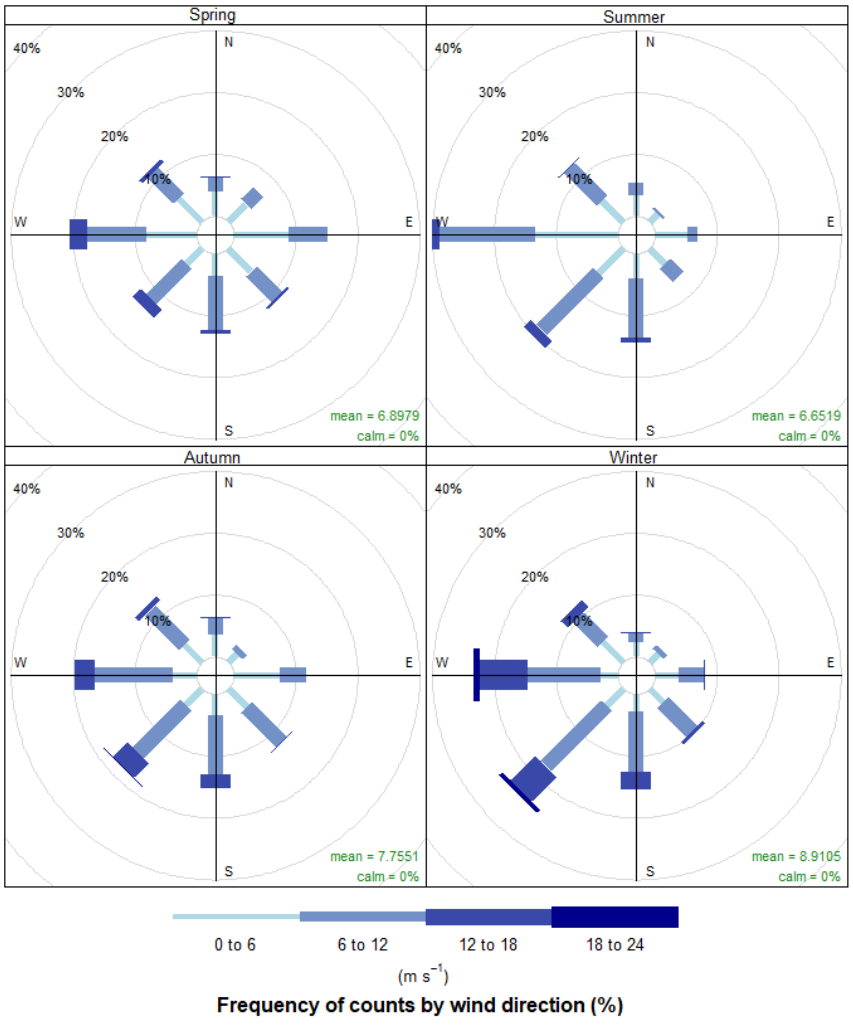


Figure 2-8. Seasonal wind roses for Mace Head weather (January 2015 to December 2024 inclusive).

Assuming findings from the Ballinakill Harbour wave study are applicable to Cleggan (Aquafact, 2001 as read in Aquafact & SFPA, 2022), wind speed and direction are key factors influencing wave generation. According to this study, predictions for the 50-year wind (70 km/h) are:

- From the south: max wave height ~1.03 m,
- From the south-southwest: max wave height ~1.2 m,
- From the south-southeast: max wave height ~0.9m.

The prevailing westerly winds in Cleggan typically direct wave movement towards the northern shore of the bay, where the licensed site is located. Fetch distances in this area are relatively short due to the Aughrus peninsula. With the bay's north-easterly orientation, significant sediment re-suspension is most likely to occur during south-westerly winds (which are frequent in Cleggan). However, this would predominantly affect the inner bay, away from the licensed sites. Furthermore, considering the predicted wave heights, sediment re-suspension is expected to impact shallower areas (<2 m), in which there are no licensed sites.

2.5.4.2 PRECIPITATION

Heavy rainfall can lead to surface runoff, transporting organic pollutants from land-based sources, such as farms and wastewater overflows, into surface water bodies and potentially to the production area. Monthly rainfall is lowest in spring, followed by summer, and peaks in autumn and winter (Figure 2-9).

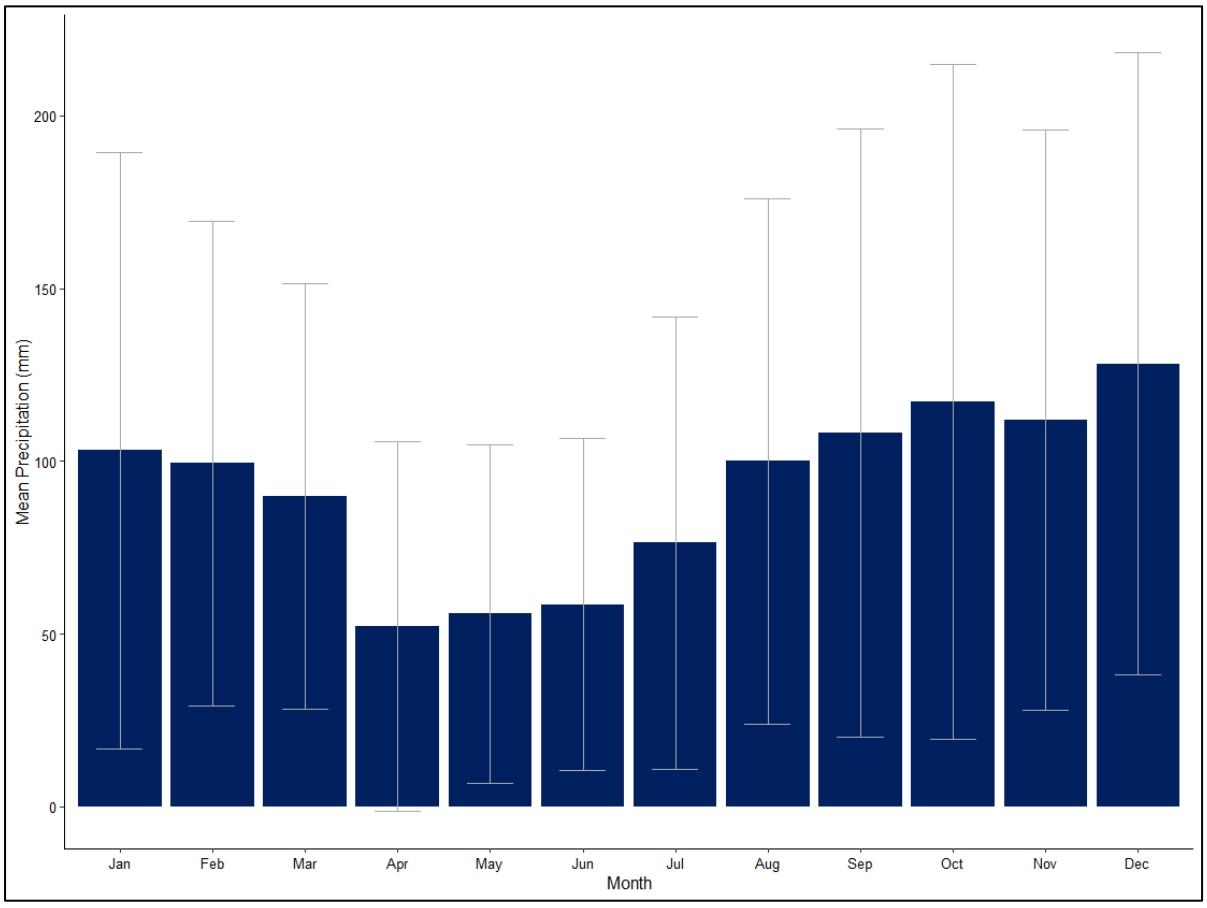


Figure 2-9. Mean monthly precipitation (± 1 standard deviation) at Mace Head from January 2015 to December 2024 inclusive.

Although the mean daily rainfall is highest in December (4.14 mm), significant variation is observed. For instance, the heaviest single-day rainfall recorded was 58.4 mm on 15th September 2015. Similarly, high rainfall events can occur at any time of year, such as 27.1 mm on 1st April 2016.

Heavy rainfall during the spring and summer, when the land is dry and compacted, reduces the soil's ability to absorb water (Qiu *et al.*, 2021), leading to increased runoff. During this period, higher faecal loadings are likely due to increased stocking densities and the accumulation of faecal contamination throughout the summer. Therefore, the influence of precipitation on circulation of pollutants will be further discussed in Section 2.5 as relevant for each source of contamination.

2.5.5 Summary of the Characteristics of Circulation of Pollutants

For clarity at this stage of the Sanitary Survey, a brief overview of the findings of this section of the report will be provided. Key characteristics identified include:

- **Freshwater Inflows**: The majority of watercourses within the contributing catchment enter Lough Anillaun, which subsequently enters the inner bay. This is considered to be the primary inflow of freshwater to the bay.
- **Groundwater**: Groundwater vulnerability is high in areas located to the southeast and east of the contributing catchment. These areas extend to the shoreline inner bay, and northern shoreline towards Cleggan Head. These are the areas at greatest risk in terms of groundwater infiltration.
- **Hydrodynamics**: Current and tidal patterns may lead to localised areas of pollutant concentration, particularly within the inner bay. However, there is good potential for pollutant dilution as flushing time within the bay is short (c. 1.7 days).
- **Weather**: Sediment resuspension may occur during south-westerly winds, particularly affecting the inner bay and shallower areas. Heavy rainfall may influence the seasonality of surface water run-off, particularly during the summer and winter seasons.

These factors collectively affect the entry, movement, and dispersion of pollutants in the production area, with further details on individual pollution sources to be discussed in subsequent sections

2.6. Inventory of Pollution Sources and Seasonal Variations of Pollutants

An inventory will be compiled detailing potential pollution sources of human and animal origin, focusing solely on those containing faecal matter. All identified sources within the contributing catchment (Figure 2-1) will be assessed, considering seasonal variations where relevant. This assessment complies with Part 1a and 1b of Article 56 of Commission Implementing Regulation (EU) 2019/627 (see Section 1 for details).

2.6.1 Sewage Discharges

This section examines sewage discharges from human sources, primarily Urban Wastewater Treatment Plants (UWWTPs) and septic tanks. Contamination risk is influenced by factors such as location, size, treatment level, and discharge frequency. The following sections (2.5.1.1 -2.5.4.1) will provide a detailed analysis of all identified discharges within the contributing catchment.

2.6.1.1 Urban Wastewater Treatment Plants

UWWTPs are linked to various discharges, primarily the continuous release of treated and untreated sewage. They also produce intermittent discharges, including rainfall-dependent releases via combined sewer overflows (CSOs) and stormwater overflows, as well as emergency discharges under exceptional circumstances.

Following examination of EPA data (EPA, 2025b), no UWWTPs are present within the contributing catchment.

2.6.1.2 Septic Tanks and Other Sewerage types

Ireland has nearly half a million Domestic Waste Water Treatment Systems (DWWTSs), primarily septic tanks (EPA, 2021). In 2023, 45% of these systems failed inspection, posing risks to household drinking water and the wider environment, including surface and groundwater. The EPA categorises DWWTS risk zones as follows:

- Zone 1: Higher risk to surface waters.
- Zone 2: Higher risk to household wells.
- Zone 3: Lower risk areas.

Currently, no comprehensive database exists for DWWTS locations. Therefore, this section relies on Census 2022 small-area statistics (CSO, 2023c). Table 2-3 and Figure 2-10 present the percentage of each small area overlapping the contributing catchment and its population density.

Table 2-3. Statistics for Small Areas overlapping the contributing catchment and corresponding population density (CSO, 2023c).

Small Area Code	Contributing Catchment Overlap	Population Density (People per km^2)
A067199001	40.1%	19
A067059003	9.4%,	8
A067199002/067199004	43.2%	16
A067058002	44.3%	9
A067058001	100%	56
A067199003	98%	30

Sewerage type estimates were also obtained from Census 2022 data (CSO, 2023c). These figures are presented as percentages for entire small areas, as individual data for overlapping catchments would not be representative (small areas do not directly align with the contributing catchment, see Table 2-3. Figure 2-11 highlights the heavy reliance on individual septic tanks, likely due to the area's predominantly rural character and its distance from UWWTPs.

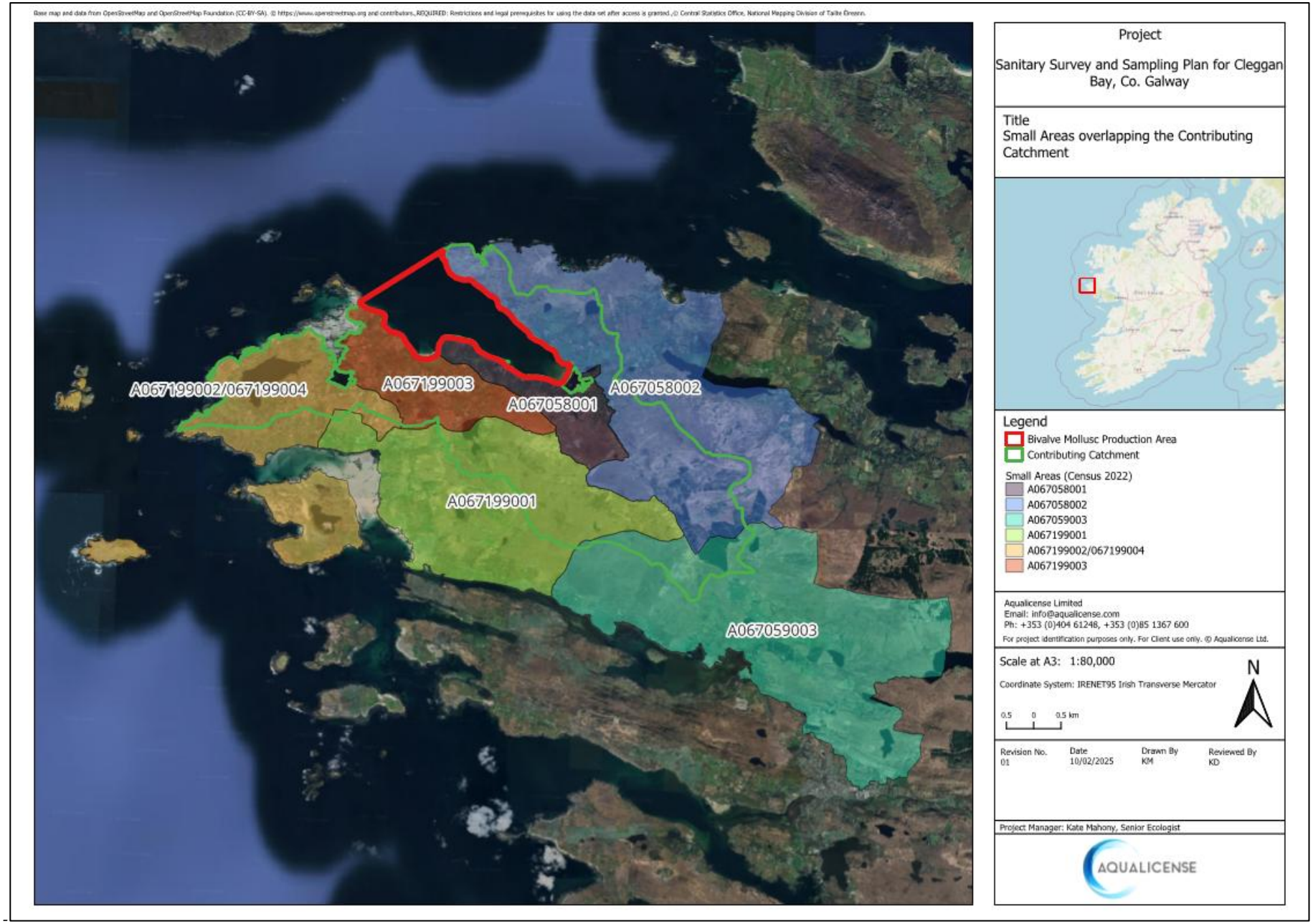


Figure 2-10. Small Areas overlapping the Contributing Catchment

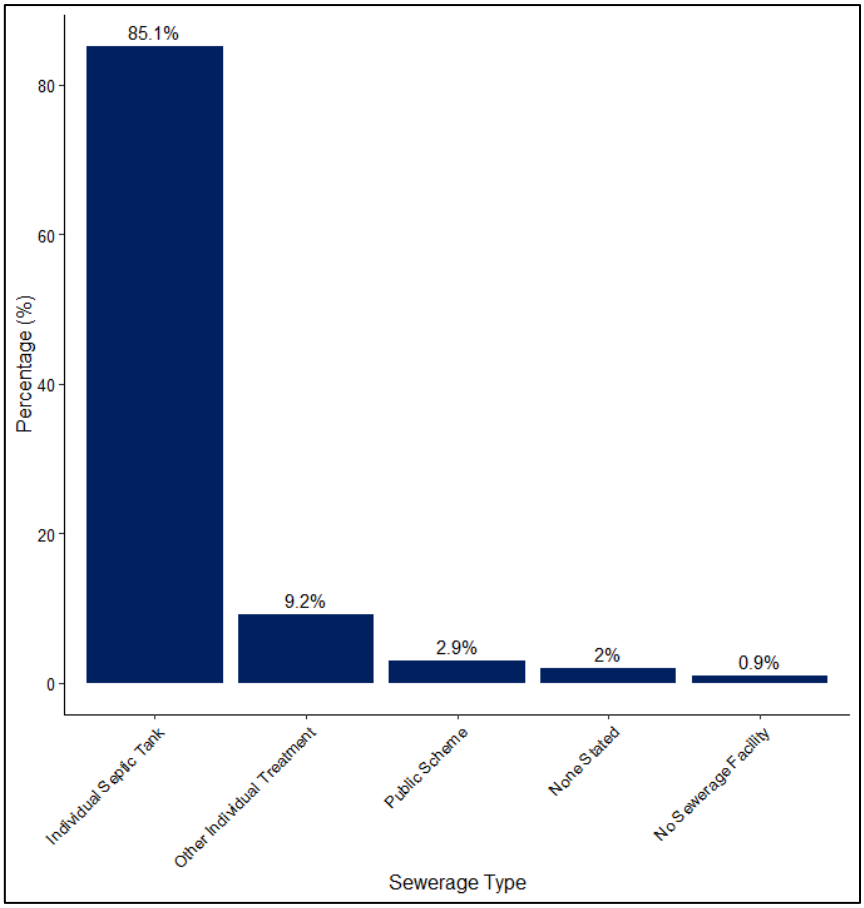


Figure 2-11. Percentage estimates of sewerage types for permanent private households according to the 2022 census.

The majority of the contributing catchment falls within Zone 3 (low risk) for DWWTS (EPA, 2021), with small portions, particularly along the northern coast of the bay, classified as Zone 2, posing a potential risk to human health (Figure 2-12). No areas are designated as Zone 1 (high environmental risk). While these risk zones indicate potential contamination, other factors must be considered when assessing susceptibility to DWWTS failure or non-compliance. Given the widespread reliance on septic tanks, population density and hydrography provide valuable insights into the potential risk to the BMPA.

While Zone 2 areas are present within small area A067058002, its low population density (9 people/km²) and lack of visible houses within the Zone 2 boundary (as seen in satellite imagery on 04/02/2025) suggest minimal risk. In contrast, the highest population density occurs in A067058001, which corresponds to Cleggan and is located in an area classified as having “extreme” or “rock-at-surface” groundwater vulnerability (GSI, 2021).

Surface water hydrology also plays a crucial role in contamination risk. Most tributaries in the contributing catchment flow through Lough Anillaun before discharging into the inner bay, potentially increasing contamination risk in this area.

Therefore, considering groundwater vulnerability, surface water flows, and population density, the inner bay is the most likely location for sewage-contaminated discharges from DWWTSs.

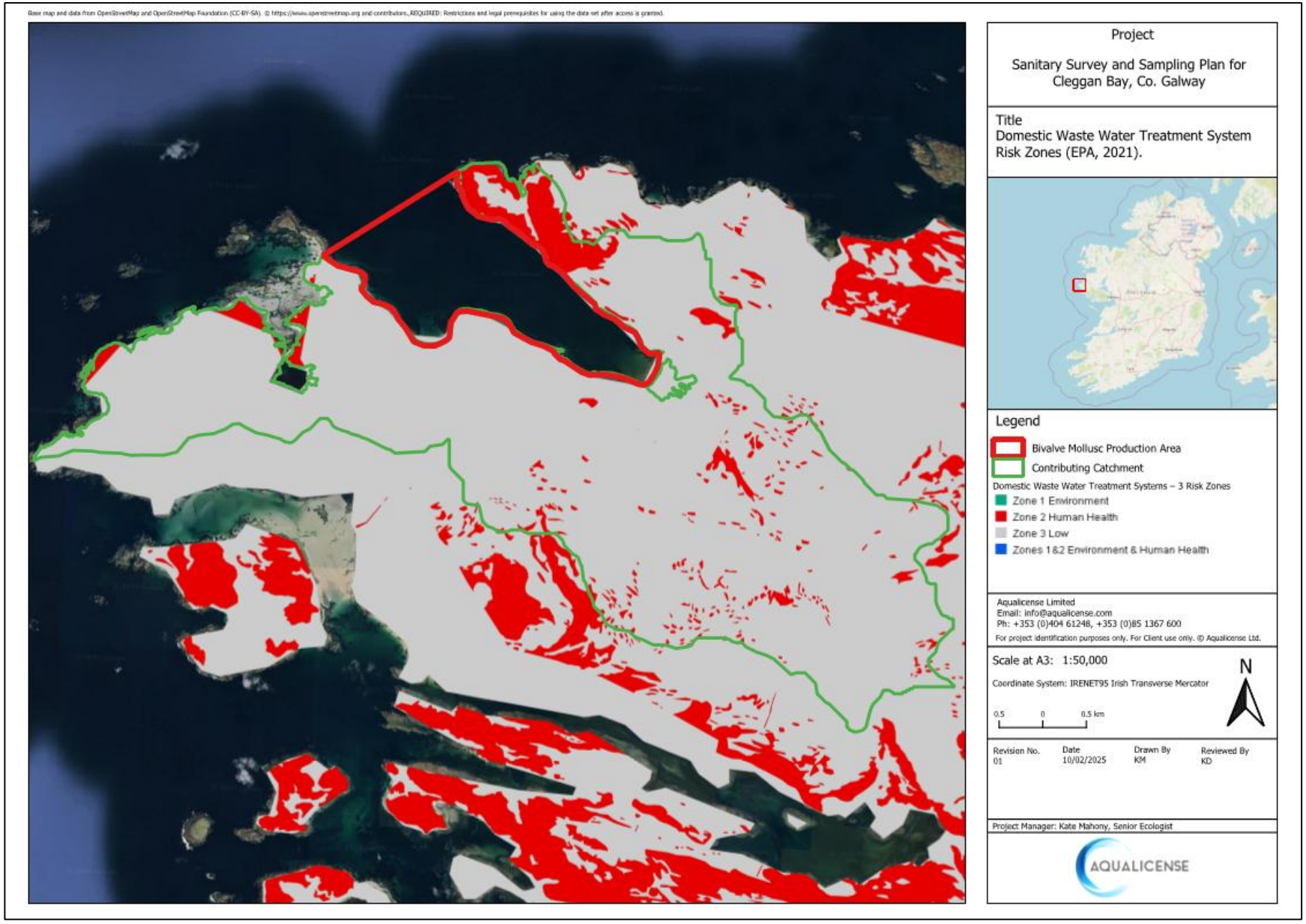


Figure 2-12. Domestic Waste Water Treatment System Risk Zones (EPA, 2021).

2.6.2 INDUSTRIAL EMISSIONS

2.6.2.1 IE AND IPC LICENSES

The EPA regulates specific industrial and agricultural activities in Ireland through Industrial Emissions (IE) licences and Integrated Pollution Control (IPC) licences. While these cover a broad range of activities, only those relevant to potential faecal contamination from human or animal sources are considered in this desk-based study. The key categories assessed include:

- Food and Drink
- Waste
- Intensive Agriculture (Poultry and Pigs)
- Other Activities (including wastewater treatment)

There are no IE/IPC licenses granted within the contributing catchment (EPA, 2024a), therefore emissions from such facilities will not be further considered in this desk-based study.

2.6.2.2 SECTION 4 DISCHARGES

Section 4 Discharge licences, issued under Section 4 of the Local Government (Water Pollution) Act 1977 (as amended in 1990), regulate the discharge of trade and sewage effluent into surface water and groundwater. These licences set conditions to ensure effluent is treated and controlled to protect the receiving environment.

There are no IE/IPC licenses granted within the contributing catchment (EPA, 2024b) therefore emissions from such facilities will not be further considered in this desk-based study.

2.6.3 LAND USE

According to Corine (2018), land cover within the contributing catchment is dominated by peat bogs (13 km^2, 55.4%; Figure 2-13). Agriculture (Land principally occupied by agriculture with significant areas of natural vegetation) is the next most dominant land cover type (6.6 km^2, 28.1%). Other land types within the contributing catchment are: natural grassland (1.4 km^2, 6.1%), transitional woodland scrub (1.4 km^2, 5.9%), coniferous forests (0.6 km^2, 2.4%), waterbodies (0.5 km^2, 2.1%) and intertidal flats (0.01 km^2, 0.04%). Of the above land cover types, agriculture is the most likely to give rise to faecal contamination in the contributing catchment.

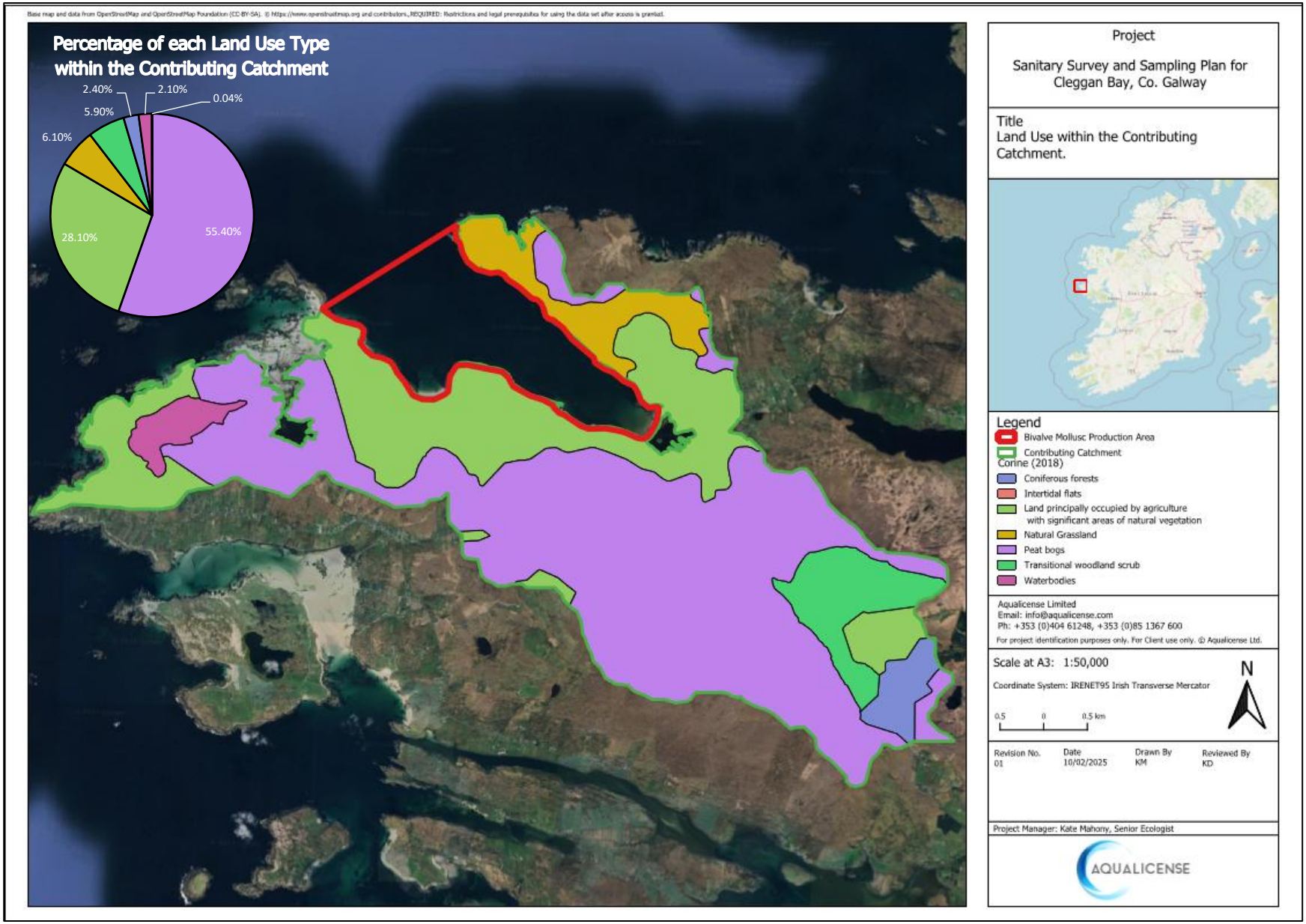


Figure 2-13. Land Use within the Contributing Catchment.

2.6.3.1 AGRICULTURE

Animals

Faecal production and *E. coli* loads from domestic animals are often comparable to or greater than those from humans (Table 2-4). Sheep have the highest daily *E. coli* load, followed by pigs, cows, humans, and chickens. Contamination can occur through direct deposition into watercourses or run-off following rainfall, with seasonal patterns influencing agricultural contamination (see Section 2.4.4.2). Stocking densities also play a role, with higher faecal contamination typically observed during summer months (Hunter *et al.*, 1999).

Table 2-4. Estimated faecal production and E. coli *loadings of selected domestic animals in comparison with humans (Jones and White, 1982 as read in Taylor (2003)).*

	FAECAL PRODUCTION (G/DAY)	AVERAGE NUMBER (*E. COLI*/G)	DAILY LOAD (*E. COLI*)
Human	150	13×10^6	1.9×10^9
Cow	23600	0.23×10^6	5.4×10^9
Sheep	1130	16×10^6	18.1×10^9
Chicken	182	1.3×10^6	0.24×10^9
Pig	2700	3.3×10^6	8.9×10^9

The most comprehensive agricultural data available is derived from 2020 Census of Agriculture (CSO, 2020) with the smallest reporting unit being the Electoral Division (ED). While data are not provided on chickens or pigs, intensive poultry farms (>40,000 places[1]) and pig farms requiring licences (>750 sows or >3,000 production pigs) that fall under EPA licensing control are discussed in Section 2.5.2.1.

A total of three Electoral Divisions (EDs) overlap with the contributing catchment (Figure 2-14). However, these EDs do not directly correspond to the contributing catchment boundary, requiring an estimation of the percentage overlap (Table 2-5). Table 2-5 also presents grazing animal census data for each ED, including both total livestock numbers and corrected estimates based on an assumed even distribution of animals across the ED.

Table 2-5. Statistics from the Census of Agriculture 2020 relating to grazing farm animals within the Electoral Divisions overlapping the contributing catchment.

ELECTORAL DIVISION	PERCENTAGE OVERLAP OF CONTRIBUTING CATCHMENT	TOTAL (CORRECTED) DAIRY COWS	TOTAL (CORRECTED) LIVESTOCK	TOTAL (CORRECTED) OTHER COWS	TOTAL (CORRECTED) CATTLE	TOTAL (CORRECTED) SHEEP
Sillerna	51.0%	0(0)	507 (259)	272 (139)	589 (301)	1253 (640)
Cleggan	51.3%	0(0)	423 (217)	117 (60)	317 (163)	2207(1132)
Clifden	6.9%	0(0)	564 (39)	222 (15)	499 (34)	2287 (157)

[1] Refers to places for birds e.g. broilers, layers etc.

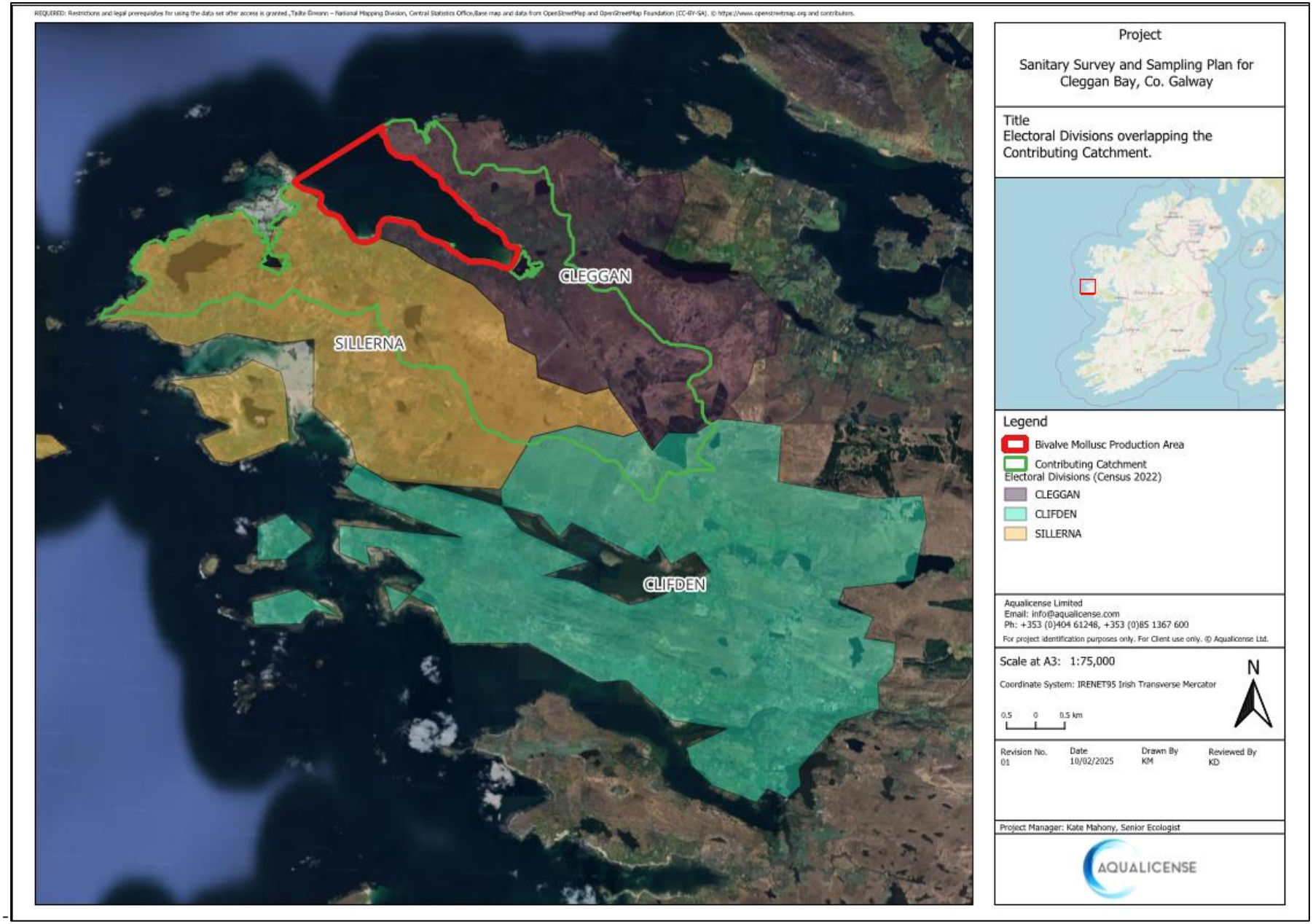


Figure 2 14. Electoral Divisions overlapping the Contributing Catchment

Under Ireland's Water Framework Directive (WFD) monitoring programme, waterbodies classified as "At Risk" of failing to meet their water quality objectives undergo assessment for significant pressures that must be addressed. Of particular relevance to this section are pressures from agriculture[2]. As part of the third WFD cycle, the groundwater bodies underlying the contributing catchment (Clifden Castlebar, and Letterfrack Marbles) are not considered "At Risk" and therefore have not been classified for agricultural pressures.

Surface waters in the area are classified as requiring further review[3]. In the absence of review data, there remains a potential risk to surface waters and, ultimately, the BMPA due to agricultural pressures on these waterbodies.

The contributing catchment overlaps the Electoral Divisions (EDs) of Sillerna and Cleggan by more than 50% each, with a smaller portion extending into Clifden (Table 2-5; Figure 2-14). Sheep are the dominant grazing animals in the catchment, with a corrected population of 1,929 recorded. While Sillerna has the highest overall livestock numbers, Cleggan has the highest corrected sheep population. As discussed, sheep contribute the highest daily *E. coli* load (Table 2-4).

Although no significant agricultural pressures have been identified for the underlying groundwater body, certain areas overlapping the Cleggan ED within the inner bay and along the northeastern coastline are classified as having "extreme" or "rock-at-surface" groundwater vulnerability (GSI, 2021). These areas therefore pose a risk in terms of diffuse pollution from grazing animals. Areas with watercourse inflows (Figure 2-2) originating within this ED are likely to be at the highest risk of pollution, particularly during the summer months post-lambing and pre-culling, as well as following rainfall events.

Therefore, considering grazing animal densities, groundwater vulnerability, and surface water inflows, the inner bay and northeastern coast are the most likely location for pollution discharges from farm animals. The potential for contamination is likely to be greatest during the summer months and following periods of high precipitation.

Land

In addition to the direct source of organic pollution from animals, agricultural land use contributes to organic pollution through the spreading of slurry and soiled water. To provide a clearer understanding of agricultural land use, the 2020 Census of Agriculture (CSO, 2020) can again be consulted, with a correction to account for the percentage overlap of each ED in the contributing catchment (Table 2-6). The largest assumed area of farmed land is in the Cleggan ED, followed by Sillerna. Cereal farming is absent across all EDs, and all recorded farmland is grassland, indicating a landscape used for grazing rather than arable farming.

In accordance with the 5th Nitrates Action Programme (Government of Ireland, 2022), the contributing catchment lies in Zone B, where a closed period for slurry spreading runs from 15th October to 15th

[2] Not all parameters from the WFD apply, please refer to Section 2.5.

[3] Waterbodies fall into the "Review" category for one of two reasons:

1. Additional information is required to determine their status before allocating resources and implementing targeted measures.
2. Measures have already been undertaken, but their effectiveness has yet to be assessed.

January. The spreading of soiled water is also prohibited in December. Therefore, the greatest risk to the BMPA primarily exists outside this period, assuming the regulations are adhered to.

In areas designated as "Extreme Vulnerability Areas on Karst Limestone Aquifers" under S.I. No. 113/2022, there are further restrictions on the spreading of soiled water. However, the contributing catchment does not overlie a karst limestone aquifer (GSI, 2023). A portion of the catchment does overlie areas of extreme groundwater vulnerability or areas with rock at or near the surface (Figure 2-5), suggesting karst vulnerability, which will be discussed further below.

Considering the 2020 Agriculture Census, c. 50% of the contributing catchment is farmed. As there are no refined spatial data available for the Census, Corine mapping has been used to calculate areas of higher groundwater vulnerability overlapping agricultural land. Approximately 40.9% (c. 2.7 ha) of agricultural land overlaps areas classified as having "extreme" or "rock-at-surface" groundwater vulnerability (GSI, 2021). Such areas which directly border the coastline are localised to the innermost area of Cleggan Bay. Additionally, all EPA-mapped rivers (Figure 2-2) in the contributing catchment flow through agricultural land before entering the BMPA.

Therefore, considering the agricultural land use and groundwater vulnerability, in addition to all riverine inputs, the inner bay and northern shore are the most likely locations for pollution discharges from spreading of slurry and soiled water. Considering the regulatory restrictions in place, this risk is likely to be greatest from mid-January to September inclusive.

Table 2-6. Statistics from Census of Agriculture 2020 relating to land utilisation within the Electoral Divisions overlapping the contributing catchment.

Electoral Division	Percentage Overlap of Contributing Catchment	Total (Corrected) Number of Holdings	Average Size of Holdings	Total (Corrected) Area Farmed (Hectares)	Total (Corrected) Cereals	Total (Corrected) Grassland
Sillerna	51.0%	64 (33)	15.5	991.6 (506)	0 (0)	991.6 (506)
Cleggan	51.3%	31 (16)	34.8	1078 (553)	0 (0)	1078 (553)
Clifden	6.9%	66 (5)	24.9	1641.2 (113)	0 (0)	1641.2 (113)

2.6.3.2 Urban Areas and Human Populations

Human populations contribute to contamination from sewerage, as previously discussed in Section 2.5.1. However, examining urban areas and population dynamics can provide further insight into pollution sources and the seasonality of contamination.

No urban areas[4] are present within the contributing catchment (Tailte Éireann, 2023). The primary settlement is Cleggan Village, on the southeastern shore at the head of Cleggan Bay. The highest population density (Table 2-3) is recorded in Small Area A067058001, which includes Cleggan Village (Figure 2-10). However, this density remains below the national average of 73 persons/km² (CSO, 2023b). During the most recent census (3rd April 2022), 29% of houses within the contributing catchment were identified as unoccupied holiday homes (CSO, 2023a). This represents a high

4 The CSO classifies urban areas based on the following "Buildings in Urban Areas are within a group of at least 100 buildings and buildings need to be within 65 meters of another building. Building groups of 100 buildings or more must be within 500 meters of each other." (Tailte Éireann, 2023).

proportion of holiday properties, likely contributing to seasonal increases in organic pollution during the summer. For further information refer to Section 2.5.1.2 relating to septic tanks.

In addition to domestic and urban wastewater treatment, facilities such as nursing homes, schools, hospitals, and other large developments can be sources of pollution. A search of the Environmental Impact Assessment (EIA) database did not identify developments requiring EIA in the contributing catchment since 2017 (Department of Housing, 2024). A search of Google Maps for relevant facilities (e.g. schools, universities, nursing homes, hospitals, barracks, and prisons) yielded only one facility of note: Scoil na Naomh Uile, a primary school approximately 60 m southwest of the BMPA in Cleggan Village.

Tourist facilities can contribute to organic pollution, particularly in peak seasons. The contributing catchment lies within a medium-density area of accommodation providers, including hotels, B&Bs, and campsites (Fáilte Ireland, 2018). While hotels and B&Bs typically use domestic or urban wastewater treatment, campsites and caravan parks may pose additional pollution risks. A Google Maps search found no such facilities within the contributing catchment, suggesting minimal direct tourism-related discharges.

2.6.4 Other Pollution Sources

2.6.4.1 Marine Vessels

Marine vessels, including ferries, cargo ships, fishing boats, and recreational craft, may contribute to faecal contamination, depending on passenger volume, waste management practices, onboard treatment, and regulatory compliance. Under S.I. No. 492/2012 (which transposes Annex IV of the MARPOL Annex IV), treated sewage can be discharged at a minimum of 3 nautical miles from shore, while untreated sewage must be released no closer than 12 nautical miles. Since sewage is typically discharged at sea or stored onboard for disposal, vessels are unlikely to be a major source of organic contamination. However, for this desk-based study, the greatest risk is in areas where vessels converge, given the potential for accidental spillages and compliance variations.

Cleggan village has a pier that serves as a ferry port (MaREI, 2016a), serving the islands of Inishbofin and Inishturk. No commercial ports are located within the BMPA (Marine Institute, 2010). The pier is not listed as a fishing port capable of handling large vessels[5], however it serves small commercial fishery vessels, sea angling, and shore angling (IFI, 2012; Inshore Fisheries Forums, 2025). A slipway is also located here, as identified by satellite mapping. Mooring facilities are located at the pier, while anchorage is possible near the quay or in the outer bay. A review of Google satellite imagery was conducted on 04/02/2025 to identify additional slips, piers, or jetties within the contributing catchment, but none were found. Therefore, any vessel-related discharges within the BPMA are most likely to occur in the vicinity of Cleggan Pier. However, given the scale of operations and expected compliance with S.I. No. 492/2012, the risk of contamination from vessels is relatively low. Instead, discharges from land are more likely to pose a more significant source of contamination.

2.6.4.2 Swimming, Bathing and Recreation

The recreational use of beaches and shorelines acts as a source of faecal contamination. Bathers are a non-point source of faecal bacteria, including *E. coli,* due to the shedding of microbes from skin

[5] This dataset refers to harbours handling both large (>15 m) and small vessels (<15 m) (MaREI, 2016b).

(Elmir *et al.*, 2007). Dog walking is also a contamination source in recreational waters (An *et al.*, 2020), and may contribute up to 20% of faecal indicator bacteria in urban Irish areas (Martin *et al.*, 2024). Such contamination is expected to peak during the summer months in association with warmer weather.

Google satellite imagery (Search Date: 04/02/2025) was used to identify beaches and coastal walks within the BMPA. Several named beaches were located within the contributing catchment (Figure 2-15), mainly along the southern coasts, from the outer bay to the inner head. No Blue Flag-listed beaches or designated bathing waters are present; therefore, no data are available regarding swimmer numbers or bacteriological quality. Given the rural nature of the area, it is assumed that swimmer and dog walking numbers are low, resulting in minimal source of contamination.

2.6.4.1 WILDLIFE

Wildlife, including birds and aquatic animals, has been shown to act as a source of faecal contamination in the marine environment (Alderisio and Deluca, 1999; Godino Sanchez *et al.*, 2024). To identify key areas of wildlife-related faecal contamination, a search was conducted for locations with potentially high densities of animals in proximity to the BMPA (Figure 2-16, Table 2-7). This search included Special Protection Areas (SPAs), Special Areas of Conservation (SACs), and Irish Wetland Bird Survey (I-WeBS) sites (Birdwatch Ireland, 2025; NPWS, 2025). Only SACs where fauna are listed as a qualifying interest were examined further.

However, given the relatively low numbers of birds recorded at the Rossadillisk site and the large area beyond the BMPA available for the dispersion of dolphins and porpoises within the SAC, the potential contribution of wildlife to contamination in this area is likely to be minimal.

Table 2-7. Wildlife areas within or bordering the BMPA.

TYPE	NAME (CODE)	SPECIES	LOCATION
I-WeBS	Rossadillisk (0G902)	Species include waders, waterfowl, gulls, and seabirds. Mean peak counts for the most numerous species (ringed plover (98), sanderling (32), and herring gull (20)) occur in September.	Northeastern boundary of the BMPA
SAC	West Connacht Coast SAC (002998)	Bottle-nosed Dolphin (*Tursiops truncatus*) Harbour Porpoise (*Phocoena phocoena*)	Overlapping the entire BMPA

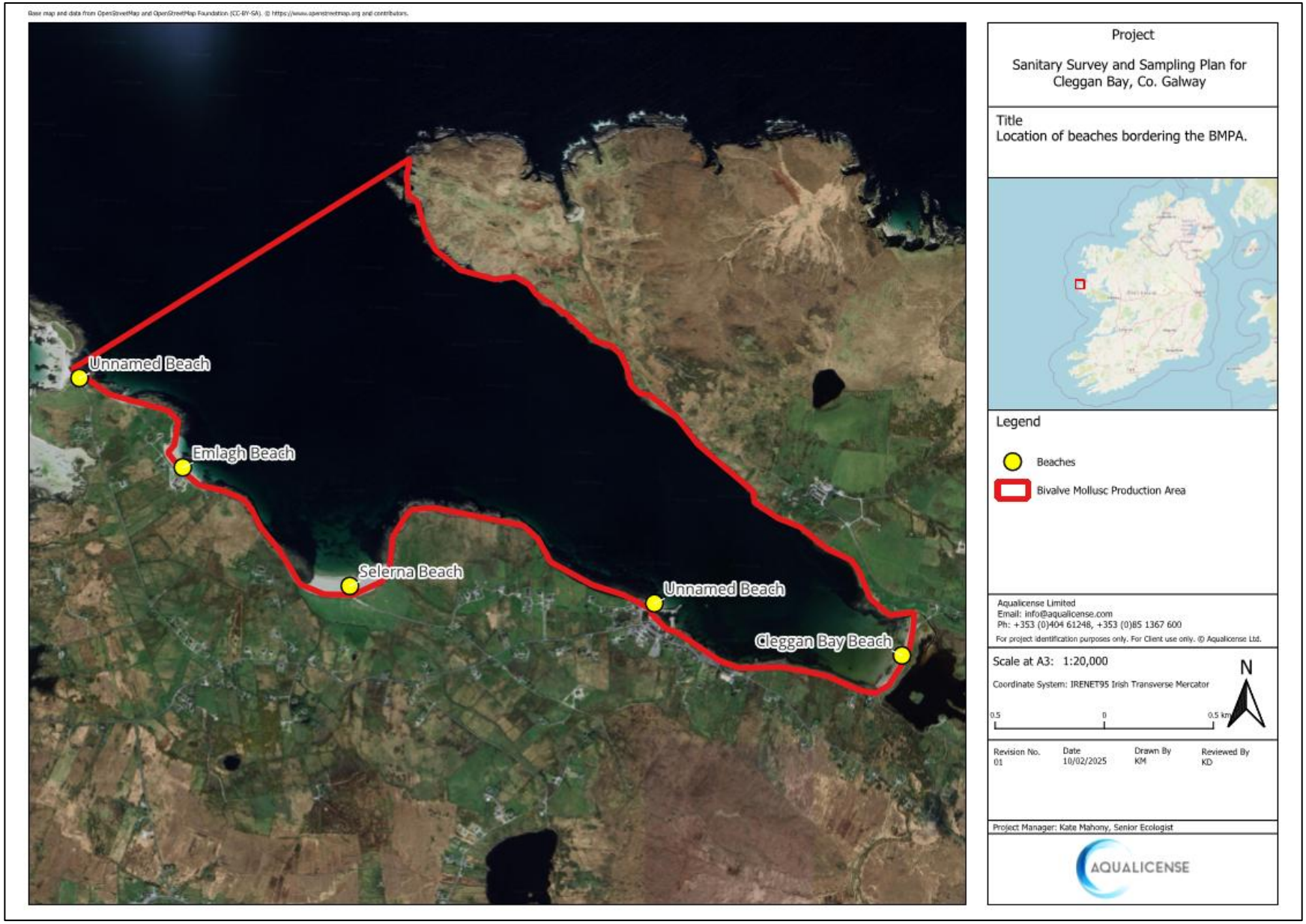


Figure 2-15. Location of beaches bordering the BMPA.

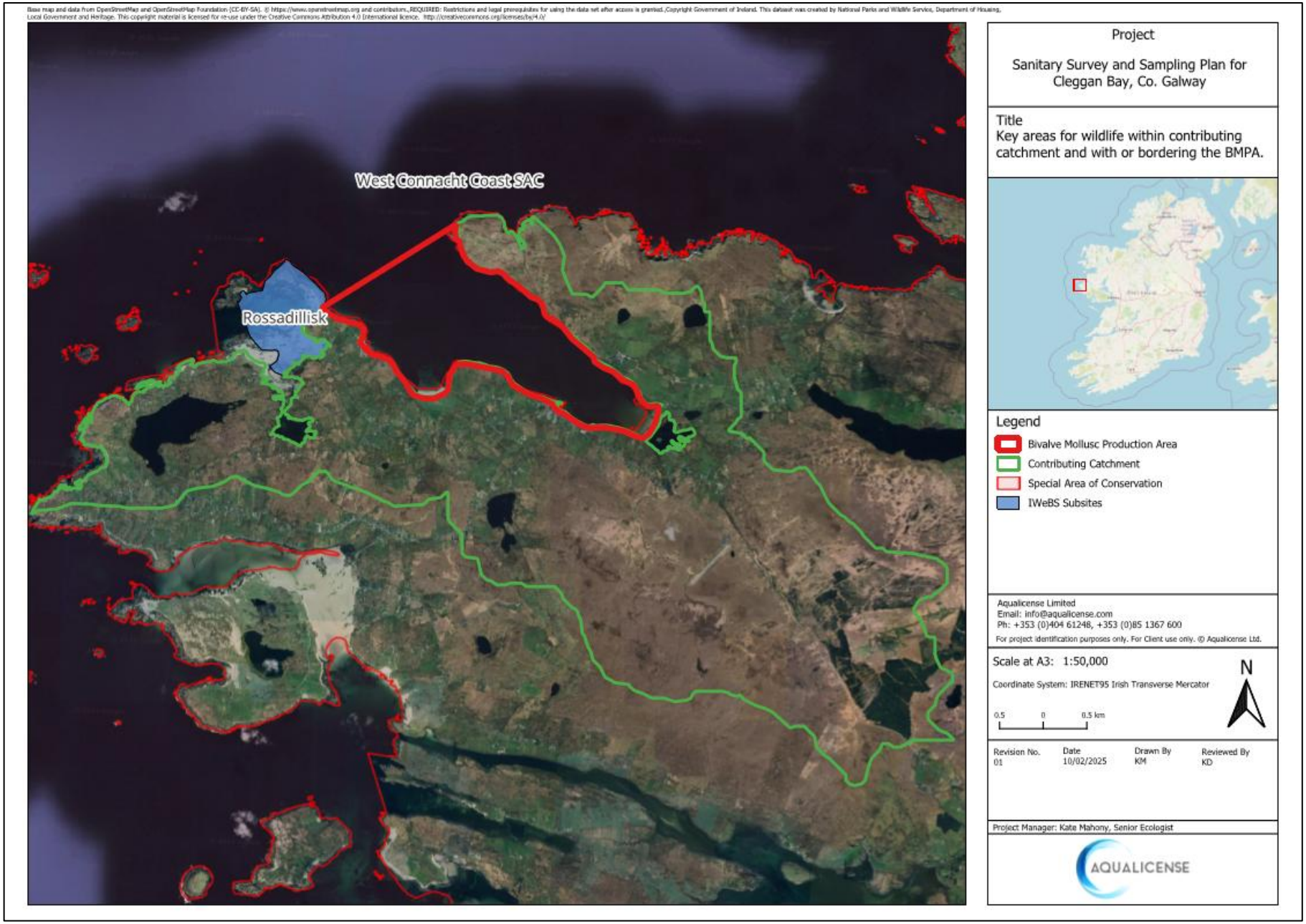


Figure 2-16. Key areas for wildlife within contributing catchment and with or bordering the BMPA.

2.6.5 Summary of Pollution Sources and Relative Risk

Considering the details in the above section, the S-P-R model was used to assess the relative risk of faecal contamination in Cleggan Bay by identifying potential contamination sources and transport pathways to the receiving environment (Table 2-8). The model evaluates each source based on its likelihood of contributing to contamination, potential contamination volumes, and entry pathways into the production area. The assessment also considers seasonal variations, such as increased agricultural runoff in winter and higher human activity in summer. This risk is assigned qualitatively considering potential volumes of pollution and the existence of pathways to the production area and licensed sites.

Table 2-8. Source-Pathway-Receptor Model and Relative Risk to the Production Area and Licensed Sites (T09/524AA).

SOURCE	SOURCE DESCRIPTION	PATHWAY TO PRODUCTION AREA	PATHWAY TO LICENSED SITES*	DETAILS	IMPACT
UWWTPs	No UWWTPs present within the contributing catchment.	NA	NA	• Based on the SPR model, there is no potential risk from UWWTPs.	**No** potential impact from this source
Septic Tanks and Other Sewerage Types	DWWTSs, primarily septic tanks, are the main sources of human sewage discharges. There are areas of higher population density in Cleggan Village.	Surface water via Lough Anillaun. Elevated groundwater vulnerability near Cleggan Village.	Site T09/524AA lies c. 1.2km northeast of the outflow from Lough Anillaun. Site T09/524AA lies c. 650m north of Cleggan Village.	• Sewage discharges are likely highest in the inner bay, adjacent to Cleggan Village and Lough Anillaun outflow. • Contamination is likely to be directed from the Lough Anillaun outflow in the direction of site T09/524A on the ebb tide. • Contaminants from Cleggan Village are unlikely to flow in the direction of site T09/524A, as currents in the south of the bay follow the southern coastline as they exit the bay. • Contamination risk increases in summer due to holiday home use.	**Yes** Presence of discharge points, known surface water run off and higher population densities all contribute to a significant possibility of risk. The variable seasonal rain levels and continual flushing of the bay would indicate a medium level of risk.
IE and IPC Licenses	No IE/IPC licenses granted within the contributing catchment.	NA	NA	• No potential risk from industrial or commercial licensed discharges.	**No** potential impact from this souce
Section 4 Discharges	No Section 4 discharges within the contributing catchment	NA	NA	• No potential risk from Section 4 discharges.	**No** potential impact from this souce
Agriculture	Sheep, which have the highest *E. coli* loading of assessed grazing animals, are the dominant livestock in Cleggan ED.	Surface water via Lough Anillaun, which lies in Cleggan ED. Elevated groundwater vulnerability in the inner bay and north-eastern coast.	Site T09/524AA lies c. 1.2km northeast of the outflow from Lough Anillaun. Site T09/524AA lies a minimum of 25m from areas of elevated groundwater vulnerability.	• Given the rural nature of the area, agriculture is the most significant potential contamination source. • Highest risk areas are the inner bay and north-eastern coast towards Cleggan Head. • Contamination is likely to be directed from the Lough Anillaun outflow in the direction of site T09/524A on the ebb tide. • Site T09/524A is in close proximity to areas of elevated groundwater vulnerability potentially introducing	**Yes:** The presence of grazing livestock (sheep), known surface water run off, and lough Anillaun outflow all contribute to a the possibility of risk. The variable seasonal rain levels and continual flushing of the bay,

Source	Source Description	Pathway to Production Area	Pathway to Licensed Sites*	Details	Impact
				contamination in the immediate vicinity of the site. • Risk increases in summer and following heavy rainfall.	movement of livestock and variable numbers would indicate a high level of risk (see Table 2-4).
Urban Areas and Human Populations	Cleggan Village is the primary settlement along the southern, inner shore of the bay. Contamination mainly via septic systems (as described above). Minimal tourism-related discharges.	Surface water via Lough Anillaun. Elevated groundwater vulnerability near Cleggan Village.	Site T09/524AA lies c. 1.2km northeast of the outflow from Lough Anillaun. Site T09/524AA lies c. 650m north of Cleggan Village.	• Due to the small size of Cleggan Village, additional pollution from urban areas is minimal and localised to the southern, inner bay. • Contaminants from Cleggan Village are unlikely to flow in the direction of site T09/524A, as currents in the south of the bay follow the southern coastline as they exit the bay. • Dispersed settlement exists around the bay beyond the borders of Cleggan Village, particularly in areas of elevated groundwater vulnerability in proximity of the site. This may pose a risk of contamination to site T09/524A.	**Yes**; the presence of Cleggan village and ground water run off represent a possible risk of contamination for the site. The bathymetry of the bay and the flushing cycles would indicate that this is a medium level of risk (see section 2.4.3.1-2.4.3.2)
Marine Vessels	Cleggan Pier serves as a ferry port and a hub for small commercial fishing and angling vessels.	Ship sewage entering into Cleggan Bay, with subsequent circulation.	Site T09/524AA lies c. 650m north of Cleggan pier.	• Considering current direction and the location of the pier, contaminants are unlikely to flow in the direction of site T09/524A, as currents in the south of the bay follow the southern coastline as they exit the bay. • Given the scale of operations and regulatory controls and MARPOL which all dictates that no blackwater or greywater discharges may be allowed within 3nm of the shore.	**No** potential impact from this souce
Swimming, Bathing and Recreation	Several beaches along the coast, but no Blue Flag-listed or designated bathing waters.	Contamination from beach users along the bay.	Site T09/524AA lies c. 1.2 km from the nearest beach (Cleggan Bay Beach).	• Considering current direction on the ebbing tide, contaminants from Cleggan Bay Beach may reach site T09/524A. • However, due to the rural setting and low visitor numbers, contamination from recreational activities is assumed to be minimal. • Risk increases during summer.	**No** potential impact from this souce would be negligible This is in combination with the hydrodynamics of the bay and

SOURCE	SOURCE DESCRIPTION	PATHWAY TO PRODUCTION AREA	PATHWAY TO LICENSED SITES*	DETAILS	IMPACT
					availability of public sanitation.
Wildlife	Rossadillisk (I-WeBS site) with species such as waders, waterfowl, gulls and seabirds. West Connacht Coast SAC, with bottlenose dolphins and harbour porpoises.	Direct input from wildlife into bay waters.	Site T09/524AA directly overlaps the West Connacht Coast SAC. Site T09/524AA lies c. 2.3 km southwest of the Rossadillisk I-WeBS site.	• Currents are unlikely to direct contamination from the Rossadillisk I-WeBS site in the direction of T09/524A. • Considering the ephemeral nature of marine life, contamination may directly be input in vicinity of site T09/524AA.	**Yes**: However, these levels are likely to be very low (see section 2.5.4.1)

*The pathway to the licensed site is considered based on the outflow of greatest risk, following from the "Pathway to Production Area Cell".

2.7. CONCLUSIONS OF THE DESK-BASED STUDY

This desk-based component of the sanitary survey employed the S-P-R model to assess the principal potential impacts from the possible sources of faecal contamination identified during the desktop study (sections: 2.5.1.1-2.5.4.1), the mechanisms by which these contaminants are transported, and their circulation dynamics within the production area. The analysis identified the inner bay—particularly the outflow of Lough Anillaun—as the principal zone of contaminant inflow, supplemented by minor contributions from diffuse discharges and small tributary streams distributed throughout the bay.

The predominant sources of faecal pollution were attributed to the widespread use of domestic septic tank systems and the extensive agricultural activity in the catchment, particularly livestock farming. Seasonal dynamics are expected to significantly influence contaminant loading, with elevated faecal inputs during summer months driven by increased animal stocking densities. Furthermore, extended dry periods followed by rainfall events may exacerbate pollutant runoff through the "first flush" effect.

Hydrodynamic modelling and existing data suggest that the bay experiences regular tidal flushing, which influences contaminant dispersion and dilution patterns. These physical processes were factored into the refinement of the BMPA boundary to ensure that designated shellfish harvesting areas are appropriately positioned relative to contaminant pathways and dilution zones. Specifically, the BMPA boundary was adjusted to exclude areas most vulnerable to faecal contamination based on the convergence of S-P-R analysis, bacteriological data, and predicted contaminant transport patterns.

Further validation and refinement of these findings will be undertaken upon completion of the shoreline survey, which will provide ground-truthed data on the presence and severity of faecal pollution sources, thereby enhancing the resolution and accuracy of the overall risk assessment and BMPA delineation.

3. SHORELINE SURVEY

This section of the sanitary survey relates to the shoreline survey, which has been undertaken by the SFPA following receipt of the desk-based study conducted by Aqualicense. The purpose of this shoreline survey is to confirm the findings of the desk-based study and identify any sources of contamination previously unidentified.

3.1. SHORELINE SURVEY METHODOLOGY

The SFPA Code of Practice for the Classification and Microbiological Monitoring of Bivalve Mollusc Production Areas identifies the methodology for carrying out shoreline surveys under Appendix 9.1 (SFPA, 2020). Any identified pollution risks were clearly documented, including GPS coordinates, photographs, and detailed descriptions. Photographs were also obtained for all identified risk locations.

In the course of the shoreline survey there were a total of 15 features identified (see Appendix 3: Shoreline Survey Photographs), of which there were 2 runoffs from marshland, 1 run off from mountainous ground, one site with cows, 5 beaches, 2 outfalls, 1 pier, 1 harbour and slip, 2 streams. From prior observations in the contributing catchment.

Evidence of faecal contamination, such as odours, discolouration, or algae growth, were documented. Surveyors recorded observations even in situations where there was uncertainty regarding potential contamination. Where faecal contamination of an inflow, waterbody, or discharge location was suspected, bacteriological samples were obtained in accordance with the COP. Details of bacteriological sampling are provided in Section 4.

3.2. SHORELINE SURVEY RESULTS

The entire shoreline of the BMPA was surveyed by SFPA personnel over a two-day period, from 19th March 2025 (13:00-17:00) to 20th March 2025 (11:00-15:00). Weather conditions during the survey were dry, with no recorded precipitation on the survey days or in the two days prior.

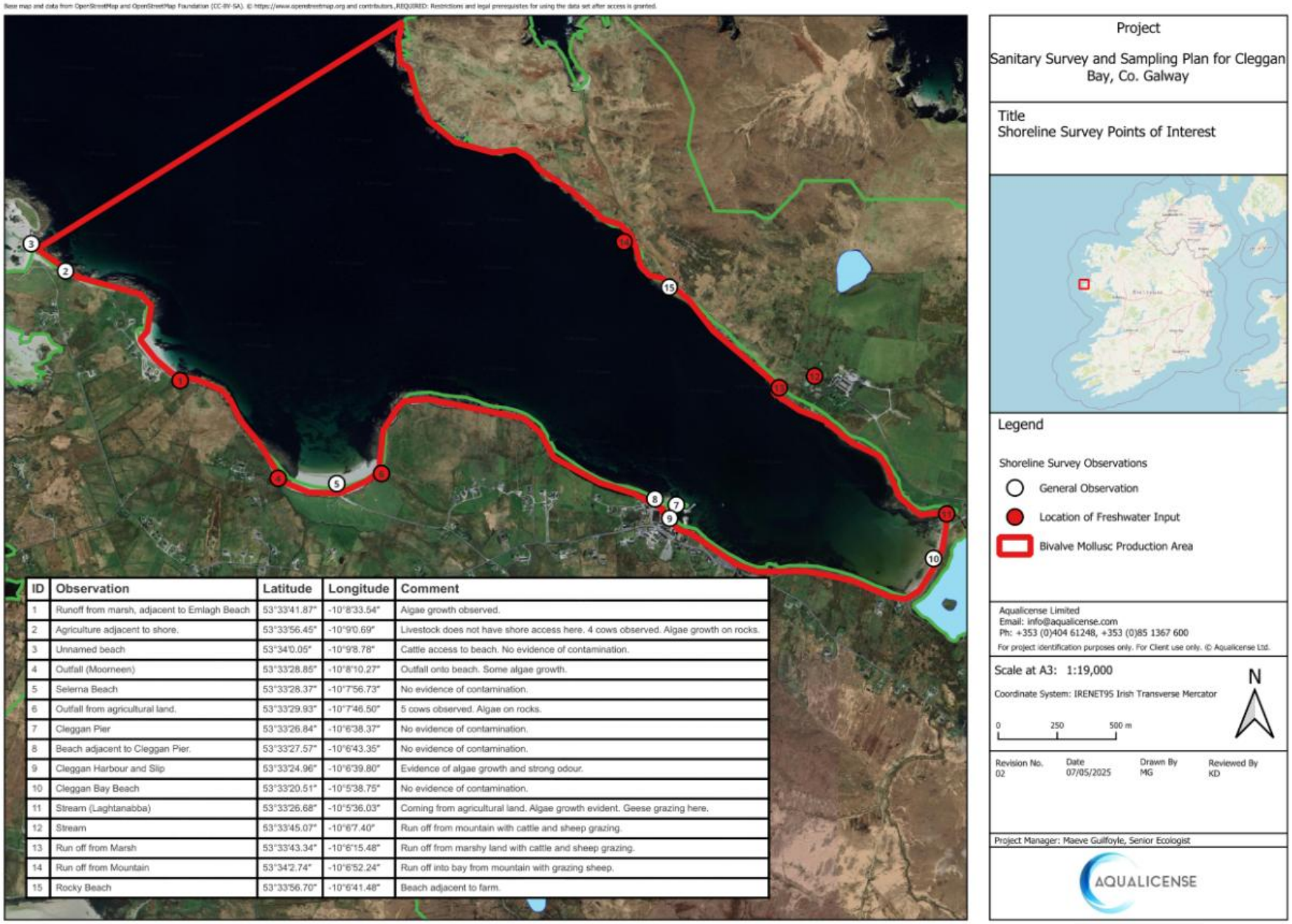
Table 3-1 and Figure 3-1 present all observations recorded during the shoreline survey. Photographs for each observation have been provided in Appendix 3, with the numbering of the photographs corresponding to the ID number in Table 3-1.

Table 3-1. Locations and details of observations made during the Shoreline Survey for Cleggan Bay in March 2025.

Date	High		Low		ID	Latitude*	Longitude*	Observation	Comment
	Time	Height (m)	Time	Height (m)		(WGS84)	(WGS84)		
19/03/2025	07:53 20:09	4.42m 4.37m	13:33 01:18	1.27m 1.12m	1	53.56611	-10.1516	Runoff from marsh, adjacent to Emlagh Beach	Algae growth observed.
					2	53.56538	-10.1485	Agriculture adjacent to shore.	Livestock does without shore access here. 4 cows observed. Algae growth on rocks.
					3	53.56256	-10.1442	Unnamed beach	Cattle access to beach. No evidence of contamination.
					4	53.55804	-10.1362	Outfall (Moorneen)	Outfall onto beach. Some algae growth.
					5	53.55788	-10.1324	Selerna Beach	No evidence of contamination.
					6	53.55754	-10.1113	Outfall from agricultural land.	5 cows observed. Algae on rocks.
					7	53.5571	-10.1101	Cleggan Pier	No evidence of contamination.
					8	53.55741	-10.0933	Beach adjacent to Cleggan Pier.	No evidence of contamination.
					9	53.5557	-10.0941	Cleggan Harbour and Slip	Evidence of algae growth and strong odour.
20/03/2025	08:27 20:45	4.16m 4.13 M	14:07 01:52	1.58m 1.38m	10	53.56061	-10.1009	Cleggan Bay Beach	No evidence of contamination.
					11	53.56252	-10.1021	Stream (Laghtanabba)	Coming from agricultural land. Algae growth evident. Geese grazing here.
					12	53.55696	-10.1109	Stream	Run off from mountain with cattle and sheep grazing.
					13	53.55831	-10.1296	Run off from Marsh	Run off from marshy land with cattle and sheep grazing.

Date	High		Low		ID	Latitude*	Longitude*	Observation	Comment
	Time	Height (m)	Time	Height (m)		(WGS84)	(WGS84)		
20/03/2025	08:27 20:45	4.16m 4.13m	14:07 01:52	1.58m 1.38m	14	53.56611	-10.1516	Run off from Mountain	Run off into bay from mountain with grazing sheep.
					15	53.56538	-10.1485	Rocky Beach	Beach adjacent to farm.

**further comparative table for latitude and longitude is provided in Appendix 4*



ID	Observation	Latitude	Longitude	Comment
1	Runoff from marsh, adjacent to Emlagh Beach	53°33'41.87"	-10°8'33.54"	Algae growth observed.
2	Agriculture adjacent to shore.	53°33'56.45"	-10°9'0.69"	Livestock does not have shore access here. 4 cows observed. Algae growth on rocks.
3	Unnamed beach	53°34'0.05"	-10°9'8.78"	Cattle access to beach. No evidence of contamination.
4	Outfall (Moorneen)	53°33'28.85"	-10°8'10.27"	Outfall onto beach. Some algae growth.
5	Selerna Beach	53°33'28.37"	-10°7'56.73"	No evidence of contamination.
6	Outfall from agricultural land.	53°33'29.93"	-10°7'46.50"	5 cows observed. Algae on rocks.
7	Cleggan Pier	53°33'26.84"	-10°6'38.37"	No evidence of contamination.
8	Beach adjacent to Cleggan Pier.	53°33'27.57"	-10°6'43.35"	No evidence of contamination.
9	Cleggan Harbour and Slip	53°33'24.96"	-10°6'39.80"	Evidence of algae growth and strong odour.
10	Cleggan Bay Beach	53°33'20.51"	-10°5'38.75"	No evidence of contamination.
11	Stream (Laghtanabba)	53°33'26.68"	-10°5'36.03"	Coming from agricultural land. Algae growth evident. Geese grazing here.
12	Stream	53°33'45.07"	-10°6'7.40"	Run off from mountain with cattle and sheep grazing.
13	Run off from Marsh	53°33'43.34"	-10°6'15.48"	Run off from marshy land with cattle and sheep grazing.
14	Run off from Mountain	53°34'2.74"	-10°6'52.24"	Run off into bay from mountain with grazing sheep.
15	Rocky Beach	53°33'56.70"	-10°6'41.48"	Beach adjacent to farm.

Figure 3-1. Location of observations made during the shoreline survey for Cleggan Bay in March 2025.

A total of 15 observations were recorded, each georeferenced and supported by photographic evidence. These included six beaches distributed around the bay, one of which (ID 15) had not been recorded in the desk-based survey. A single pier was observed at Cleggan Village, consistent with the desk-based findings, with a slipway located adjacent to the pier.

Six discharge points were confirmed, and three additional surface runoff locations were identified that were not evident in the desk-based assessment. Notable signs of potential faecal contamination included algae growth, strong odour, and proximity to livestock. Weather conditions were dry during the survey, which may have limited observable contamination signals.

Algae growth was observed at six locations around the bay, with the most notable occurrence at the inflow from Lough Annilaun (ID 11). This area had been identified in the desk-based survey as having the highest risk of contamination discharge into the BMPA. These locations, along with four additional sites draining agricultural land, were sampled for bacteriological analysis, the results of which are further detailed in Section 4.

A summary of each observation, its contamination risk level, and sampling location is included in Table 3.2. These findings informed both the delineation of the BMPA and the selection of the most appropriate Representative Monitoring Point (RMP). Observations from the northeastern and inner portions of the bay particularly supported the inclusion of runoff areas and the high-risk Lough Anillaun inflow within the designated production area.

Table 3-2. Summary of observations, contamination levels and proposed bacteriological sampling locations

ID	Latitude (WGS84)	Longitude (WGS84)	Observation	Comment	Bacteriological sample taken (Y/N)	MPN/ 100ml*
1	53.56611	-10.1516	Runoff from marsh, adjacent to Emlagh Beach	Algae growth observed.	Y	<10
2	53.56538	-10.1485	Agriculture adjacent to shore.	Livestock does without shore access here. 4 cows observed. Algae growth on rocks.	Y	<10
3	53.56256	-10.1442	Unnamed beach	Cattle access to beach. No evidence of contamination.	N	n/a
4	53.55804	-10.1362	Outfall (Moorneen)	Outfall onto beach. Some algae growth.	Y	<10
5	53.55788	-10.1324	Selerna Beach	No evidence of contamination.	N	n/a
6	53.55754	-10.1113	Outfall from agricultural land.	5 cows observed. Algae on rocks.	Y	50
7	53.5571	-10.1101	Cleggan Pier	No evidence of contamination.	N	n/a
8	53.55741	-10.0933	Beach adjacent to Cleggan Pier.	No evidence of contamination.	N	n/a
9	53.5557	-10.0941	Cleggan Harbour and Slip	Evidence of algae growth and strong odour.	Y	>2010
10	53.56061	-10.1009	Cleggan Bay Beach	No evidence of contamination.	N	n/a

ID	Latitude (WGS84)	Longitude (WGS84)	Observation	Comment	Bacteriological sample taken (Y/N)	MPN/ 100ml*
11	53.56252	-10.1021	Stream (Laghtanabba)	Coming from agricultural land. Algae growth evident. Geese grazing here.	Y	<10
12	53.55696	-10.1109	Stream	Run off from mountain with cattle and sheep grazing.	Y	10
13	53.55831	-10.1296	Run off from Marsh	Run off from marshy land with cattle and sheep grazing.	Y	<10
14	53.56611	-10.1516	Run off from Mountain	Run off into bay from mountain with grazing sheep.	Y	<10
15	53.56538	-10.1485	Rocky Beach	Beach adjacent to farm.	Y	<10

4. BACTERIOLOGICAL SURVEY

Where possible, the COP (SFPA, 2020) recommends that water samples for *E. coli* should be taken from inflows or watercourses discharging near the shellfish harvesting areas. Shellfish sampling may also be conducted if uncertainty regarding RMPs remains following the desk-based survey and shoreline survey.

For the purposes of this sanitary survey, bacteriological surveys and analysis are the responsibility of the SFPA, with Aqualicense relaying the relevant results within the report.

4.1. BACTERIOLOGICAL SURVEY METHODOLOGY

To complement shoreline observations and better understand contamination risks under current conditions, a bacteriological survey was carried out by SFPA at 10 targeted locations where faecal contamination was suspected. The sampling was undertaken at low tide using protocols outlined in Appendix 9.2 of the SFPA Code of Practice (2020). The COP recommends collecting samples under worst-case conditions, such as after heavy rainfall, to provide a more representative assessment of contamination levels.. Each sample is assigned a clear identification code, with location codes following the format SS1, SS2, etc., to designate them as sanitary survey shellfish samples.

Samples are gathered in sterile plastic bottles. All samples are transferred to the testing laboratory within 48 hours of collection and are maintained at a temperature below 15ºC during transport to ensure sample integrity.

4.2. BACTERIOLOGICAL SURVEY RESULTS

A total of 10 water samples were obtained at areas where faecal contamination was suspected. Samples were obtained at low tide. While it is recommended within the COP to obtain samples under worst-case environmental conditions, samples were obtained during dry weather conditions for logistical reasons. Sampling results are presented in Table 4-1.

Table 4-1. Results of water sampling for E. coli *in Cleggan Bay. ID corresponds with observations from the shoreline survey (Figure 3-1 and Table 3-1).*

WATER SAMPLE	OBSERVATION (ID)	MPN/100ML*	DATE	LATITUDE (WGS84)	LONGITUDE (WGS84)
1	Runoff from marsh, adjacent to Emlagh Beach (ID: 01)	<10	19/03/25	53.56163	-10.14265
2	Agriculture adjacent to shore (ID: 02).	<10	19/03/25	53.56568	-10.15019
3	Outfall (Moorneen) (ID: 04)	<10	19/03/25	53.55801	-10.13618
4	Outfall from agricultural land (ID: 06).	50	19/03/25	53.55831	-10.12957
5	Cleggan Harbour and Slip (ID: 09)	>2010	19/03/25	53.55687	-10.11103
6	Stream (Laghtanabba) (ID: 011)	<10	20/03/25	53.55736	-10.09268
7	Stream (ID: 012)	10	20/03/25	53.56244	-10.10208
8	Run off from Marsh (ID: 013)	<10	20/03/25	53.56204	-10.1043
9	Run off from Mountain (ID: 014)	<10	20/03/25	53.56743	-10.11451
10	Rocky Beach (ID: 015)	<10	20/03/25	53.56508	-10.11196

*Most Probably Number of *E. coli* per 100 millilitres of a sample. See appendix 4 for comparative location data

The bacteriological water sampling results indicate varying levels of contamination across the BMPA. Most of the sampled sites recorded low levels of *E. coli*, with an MPN/100mL of <10, suggesting minimal faecal contamination. These locations include runoff from marshes near Emlagh Beach (Sample 1), agricultural land adjacent to the shore (Sample 2), and multiple streams and runoff areas (Samples 6,7 8, 9and 10). The low readings at these sites indicate limited contamination at the time of survey. However, caution should be applied when considering these results, due to the dry period when sampling was conducted and the likely reduced stocking densities occurring during winter.

However, some locations exhibited elevated *E. coli* concentrations, indicating potential contamination sources. Sample 4, which represents an outfall from agricultural land, recorded an MPN/100 mL of 50. This may be attributed to livestock farming or fertiliser runoff, which can contribute to faecal contamination in surface water pathways. Similarly, Sample 7, a stream, recorded a slightly elevated level of 10 MPN/100mL, suggesting minor but detectable contamination.

The most significant contamination was observed at Cleggan Harbour and Slip (Sample 5), where *E. coli* levels exceeded 2010 MPN/100mL. This result indicates a substantial faecal contamination source, potentially linked to sewage discharge, boat effluent, or other human-related activities near the slip or adjacent village.

The results of the bacteriological water sampling indicate that Cleggan Harbour and Slip pose the highest risk of faecal contamination within the BMPA, with *E. coli* levels exceeding 2010 MPN/100mL at the time of sampling. However, the desk-based survey identified the inflow connecting to Lough Anillaun as the highest-risk location, suggesting a discrepancy between predicted and observed contamination levels. This may be attributed to the timing of sampling during a dry winter period, with reduced runoff and lower stocking densities. Despite lower *E. coli* levels at the Lough Anillaun inflow, evidence of nutrient enrichment was observed, supporting concerns over potential contamination. Additionally, the shoreline survey identified runoff areas in close proximity to the existing licensed site. These results informed the final decision on the BMPA boundary and confirmed the location of the RMP.

5. SANITARY SURVEY CONCLUSION

The sanitary survey findings were synthesised through the integration of the three primary data sources: a desk-based study which utilised the S-P-R model, the shoreline survey, and bacteriological analysis. Each component contributed distinct and complementary information toward the overall assessment.

The desk-based study identified two primary sources of potential sewage related faecal contamination: the inner bay adjacent to Cleggan Village and the inflow from Lough Anillaun. These preliminary conclusions were substantiated by field-based shoreline surveys and bacteriological sampling, both of which confirmed the presence of faecal contamination in these locations through the detection of faecal indicator organisms (Table 3-1).

Diffuse pollution from agricultural activities was identified as the predominant source of microbial contamination to this rural Bivalve Mollusc Production Area (BMPA), as per the desk-based land use and catchment pressure analysis. The shoreline survey documented multiple runoff points exhibiting signs of faecal pollution, with direct observational evidence of livestock (cattle and sheep) along the foreshore and surrounding land. Although *E. coli* concentrations associated with agricultural inflows

were not elevated during the time of sampling, these levels are expected to exhibit seasonal variation, with elevated risk during the summer months due to higher densities of grazing livestock espically following high rainfall events due to increased surface runoff and mobilization of contaminants.

Hydrodynamic considerations indicate that effluent from the Lough Anillaun inflow is likely transported in the direction of site T09/524A on the ebb tide. In contrast, discharges from the vicinity of Cleggan Village are less likely to impact site T09/524A, as prevailing current patterns in the southern section of the bay are oriented along the southern coastline during tidal outflow. A further two sources of surface runoff were identified in close proximity to site T09/524A: one located approximately 320 metres to the southeast, and another immediately adjacent to the northeastern perimeter of the site.

While *E. coli* levels were highest at the slip, the desk-based survey indicated a high-risk of contamination adjacent to the inflow from Lough Anillaun and inflows near the site T09/524A. Therefore, these areas represent the area of greatest risk for shellfish within the BMPA.

6. Bivalve Mollusc Production Area (BMPA)

The shoreline survey results contributed to defining the boundary by identifying potential contamination sources that were not apparent in existing datasets, such as EPA maps. These findings helped refine the spatial coverage of the Bivalve Mollusc Production Area (BMPA) and confirm the location of the Recommended Monitoring Point (RMP). In collaboration with the SFPA, a boundary has been established to define a Bivalve Mollusc Production Area (BMPA) for the existing mussel licence T09-434 and any future bivalve production sites. The BMPA extends from the mouth of Cleggan Bay and encompasses the full extent of the bay (Table 6.1) as well as the current T09-434 site (Figure 7-1).

Table 6-1: The outer bay coordinates of the BMPA in Cleggan Bay Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish Transverse Mercator

Corner	Latitude	Longitude	Latitude	Longitude	Easting	Northing
North	53.575434	-10.129877	53° 34' 31.5624'' N	10° 7' 47.5572'' W	58987	260481
South	53.566234	-10.152447	53° 33' 58.4424'' N	10° 9' 8.8092'' W	57461	259503

7. Sampling Plan

Following on from the SFPA guidelines (SFPA, 2020) a Representative Monitoring Point (RMP) is a designated geographical location used for taking samples to assess the water quality and health of shellfish in a given area. RMPs are selected based upon a combination of desktop analysis, findings from the shoreline survey and the availability of shellfish stocks for ongoing shellfish sampling. The Representative Monitoring Point should be located where the highest levels of E. coli are expected, serving as a benchmark for food safety, since all other shellfish within the BMPA should theoretically contain lower concentrations of E. coli.

7.1. Representative Monitoring Point

The recommended RMP is located at ITM coordinates 53.56308 N, -10.10933 W (53° 33' 47.088'' N, 10° 6' 33.588'' W), within the southern portion of licensed site T09/524A (Figure 6-1).

Based on the findings of the desk based current pattern analysis (Section 2.4.3.4, Figure 2.7), S-P-R outcome (Table 2-8) and sanitary survey, summarised in Section 5, the southern portion of the licensed site T09/524A was identified as the most representative sampling location. This area is

approximately equidistant from two identified runoff sources and is likely to be influenced by contaminants transported from the Lough Anillaun inflow. Its proximity to agricultural land and associated runoff further supports its suitability as a monitoring site, ensuring the RMP captures potential faecal contamination from rural sources.

In contrast, pollution originating from Cleggan Village, despite the high recorded levels of *E. coli*, is unlikely to circulate to the licensed area due to prevailing hydrodynamic conditions. As a result, considering the size of the BMPA, prevailing circulation patterns, and the current status of the licensed site, a single RMP is recommended.

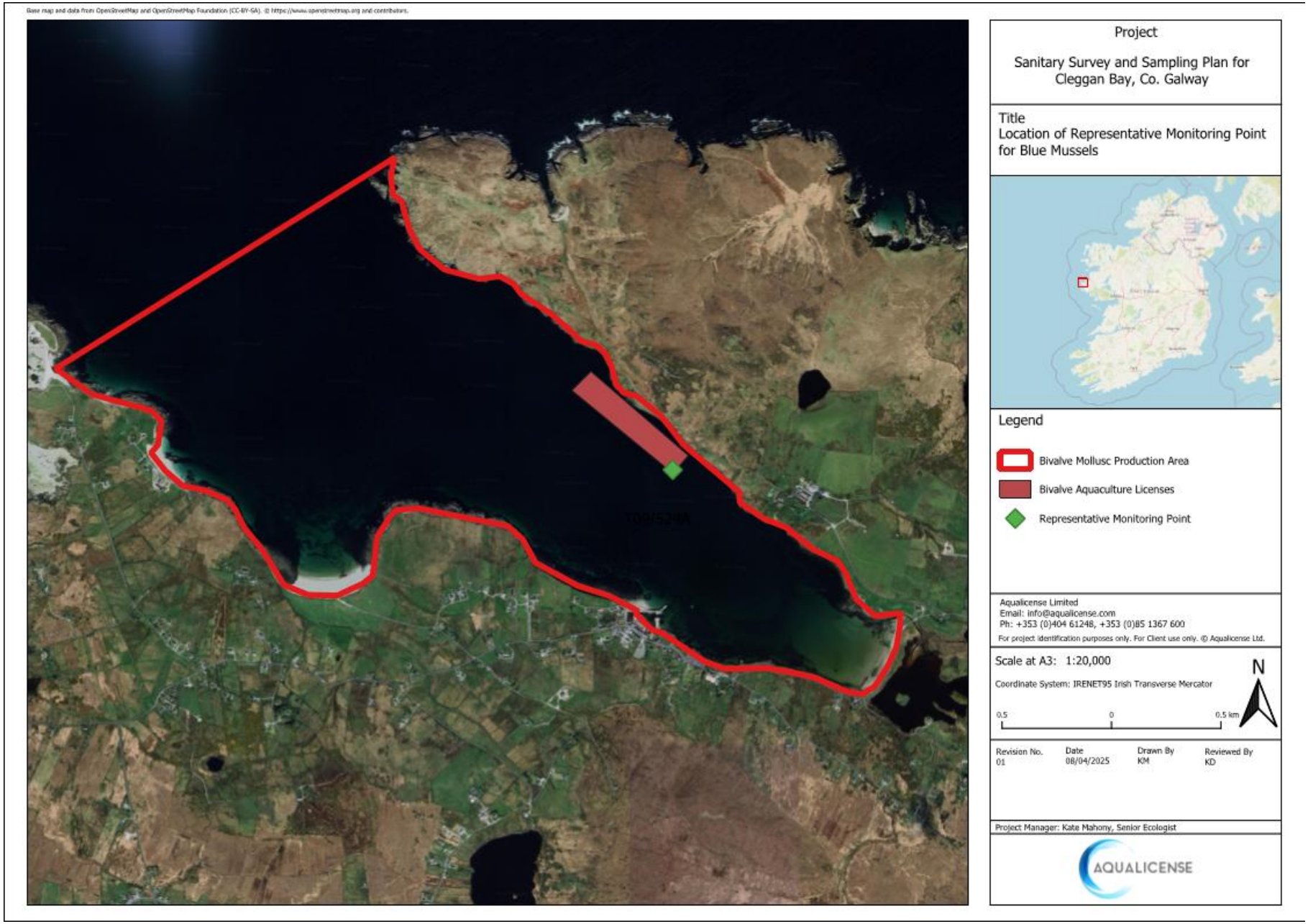


Figure 7-1. Location of Representative Monitoring Point for Blue Mussels in Cleggan Bay BMPA.

7.2. Sampling Plan

A species-specific sampling plan has been developed in line with EU Regulation 2019/627 and the SFPA Code of Practice (2020). Key features of the plan include:

Table 6-1. Sampling Plan for Cleggan Bay BMPA

Species	*Mytilus edulis*
Site Name	Cleggan Bay
Sample Point Identifier	GY-CB-CB
Geographical location of sampling point (RMP)	53.56308 N, -10.10933 W (WGS84) (53° 33' 47.088'' N, 10° 6' 33.588'' W)
Sampling Frequency	Samples shall be taken monthly upon classification of Cleggan Bay BMPA. Sampling will occur throughout the year.
Sampling Depth	Samples should be taken as close to the surface as possible, within the top one metre of the water column.
Maximum Allowed Distance from Sampling Point	Samples are to be collected within 100m 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 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.
Sample Size	A minimum of 15 mussels of market size (minimum length of 4 cm).
Authorised Samplers	It is the responsibility of the SFPA Ros An Mhil Port Office to arrange sampling, with designated sampling officers assigned to collect samples.

This plan ensures the data collected will be representative of contamination affecting the production area, supporting both initial classification and ongoing official controls.

8. Conclusions

A sanitary survey has been conducted in accordance with Article 56 of Regulation (EU) 2017/625 and Regulation (EU) 2019/627. The survey integrated a catchment-scale desk assessment, field-based shoreline verification, and bacteriological sampling to evaluate faecal contamination risks in Cleggan Bay. These findings informed the delineation of the Bivalve Mollusc Production Area (BMPA), identification of a Representative Monitoring Point (RMP), and the development of a microbiological sampling plan.

The outputs of the survey are as follows:

- A geographically defined BMPA boundary of approximately 34.4 km²;
- A single representative sampling point located to capture the dominant contamination pressures; and
- A species-specific sampling plan for *Mytilus edulis*, in line with SFPA and EU regulatory requirements.

These components provide the scientific basis for the classification and ongoing monitoring of Cleggan Bay as a shellfish production area.

9. REFERENCES

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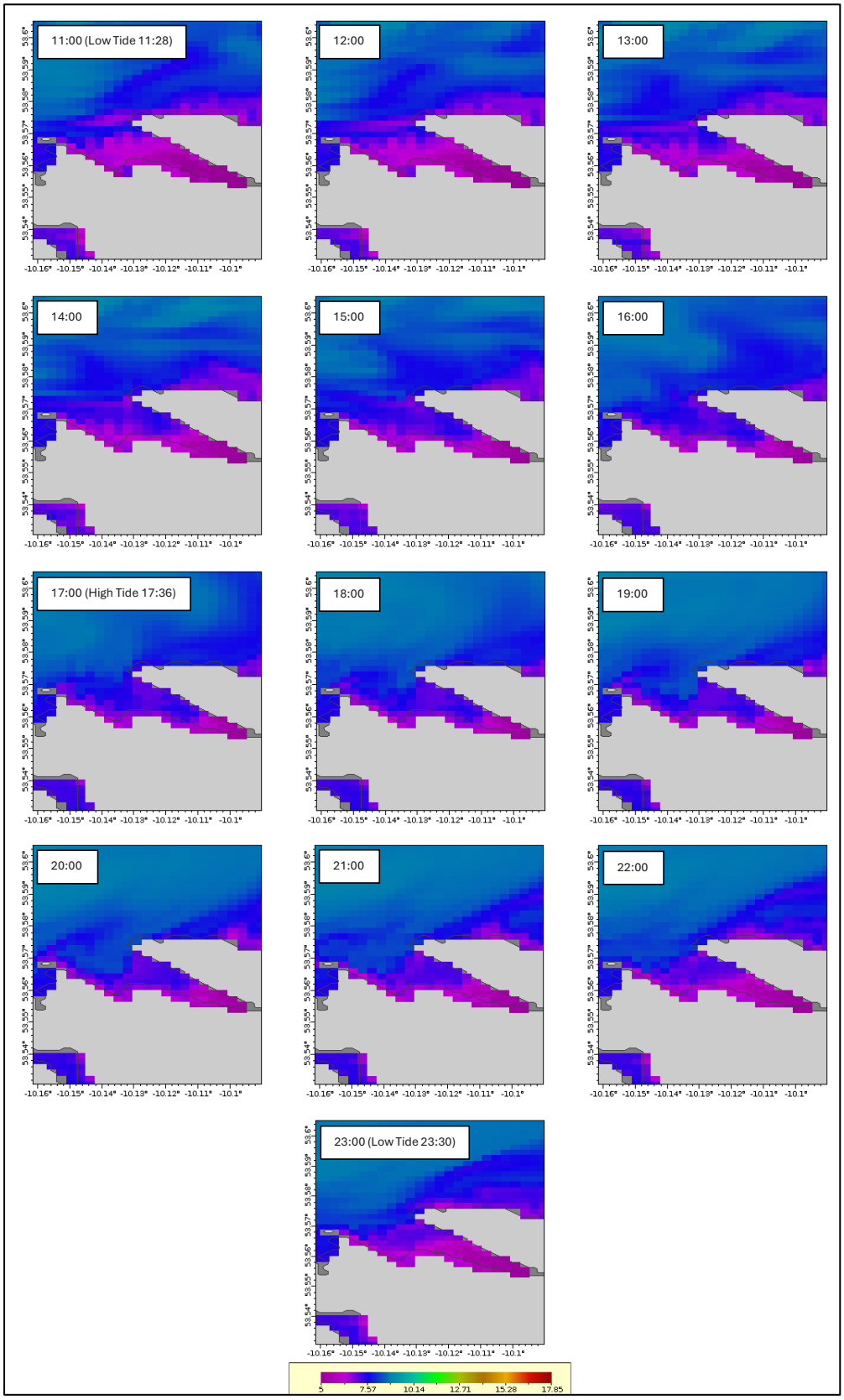
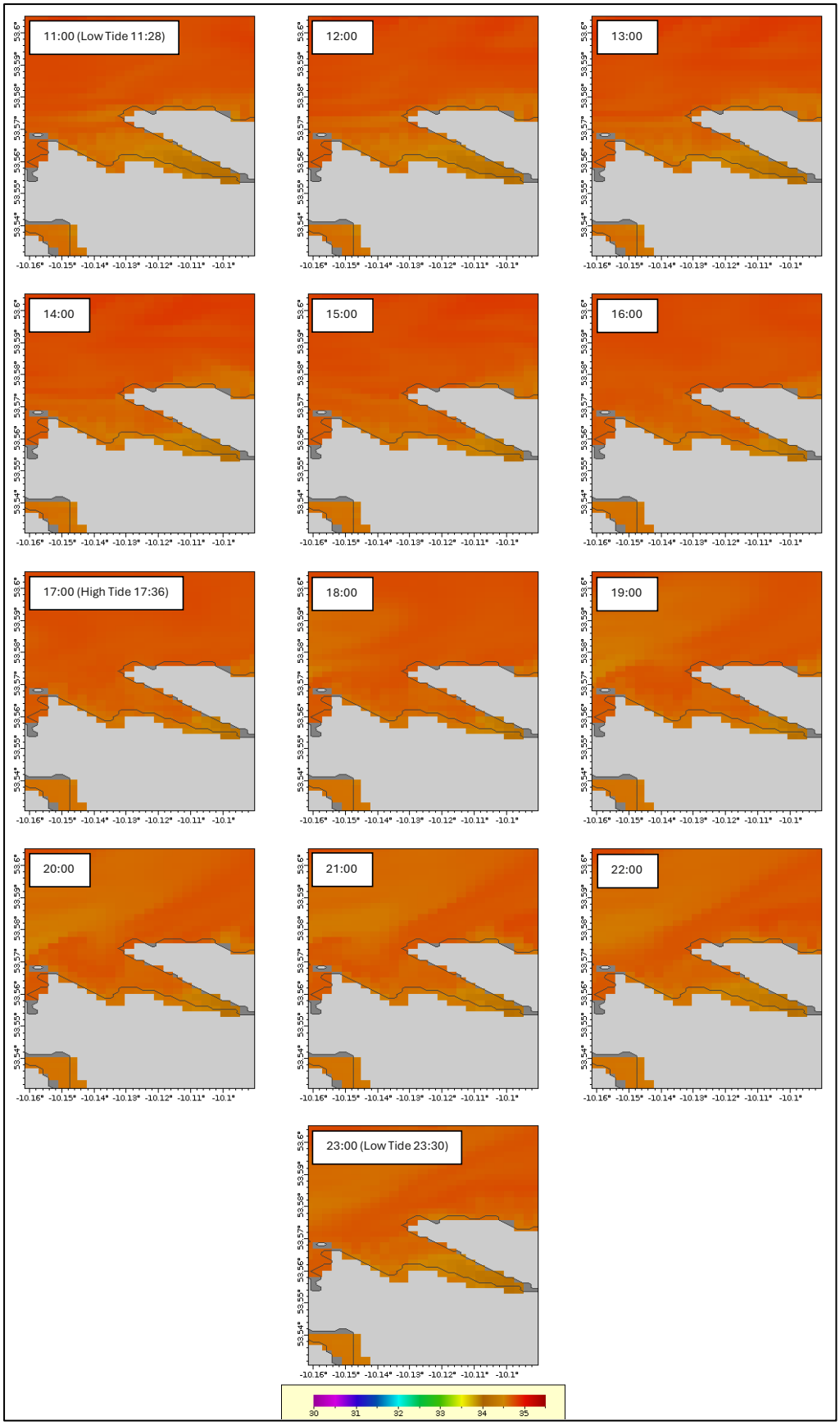
Appendix 1 SALINITY AND TEMPERATURE FLUCTUATIONS



Appendix 1A. Water temperature (°C) fluctuations within Cleggan Bay. Data sourced from the Irish Marine Institute's Connemara Model (CONN2D; Marine Institute, 2025b). Output from 12/02/2025.



Appendix 1B. Salinity (PSU) fluctuations within Cleggan Bay. Data sourced from the Irish Marine Institute's Connemara Model (CONN2D; Marine Institute, 2025b). Output from 12/02/2025.

Appendix 2 SUMMARY STATISTICS FOR WEATHER

Appendix 2A. Summary statistics for wind derived from Mace Head weather station (January 2015 to December 2024 inclusive)

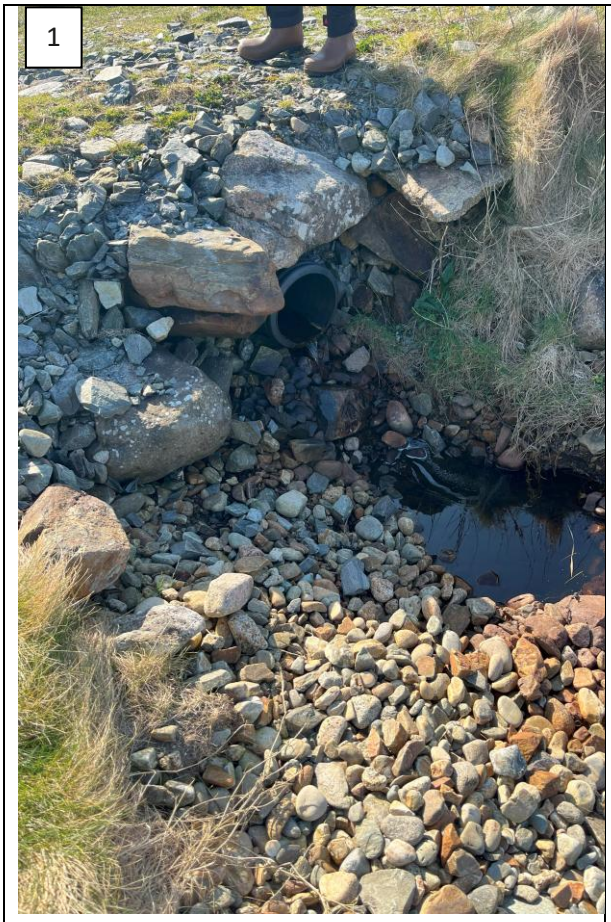
DIRECTION	FREQUENCY (%)	MAX. MEAN WIND SPEED (M/S)	MEAN WIND SPEED (M/S)
W	26.0	20.4	8.3
SW	16.8	20.2	8.7
S	16.2	17.9	8.3
E	11.7	14.0	5.7
NW	10.9	17.0	7.1
SE	9.0	15.1	6.8
N	6.1	14.8	5.6
NE	3.3	11.8	5.4

Appendix 2B. Summary statistics for daily rainfall derived from Mace Head weather station (January 2015 to December 2024 inclusive)

MONTH	MAX. DAILY RAIN (MM)	MEAN DAILY RAIN (MM)	MEDIAN DAILY RAIN (MM)
Sep	58.4	3.585667	0.7
Oct	35.4	3.783548	1.7
Aug	35.3	3.225806	1
Jul	33.2	2.464839	0.5
Dec	31.6	4.136452	2.1
Nov	30.7	3.732667	1.7
Mar	29.3	2.898065	1
Apr	27.1	1.741333	0.2
Jun	24.1	1.952	0.4
Jan	24	3.324839	1.8
Feb	23.8	3.510247	1.8
May	16.7	1.801613	0.2

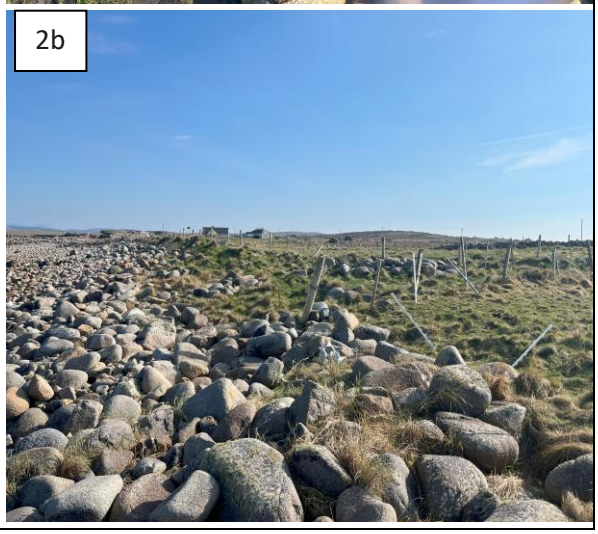
Appendix 3 SHORELINE SURVEY PHOTOGRAPHS

1



2a

2b



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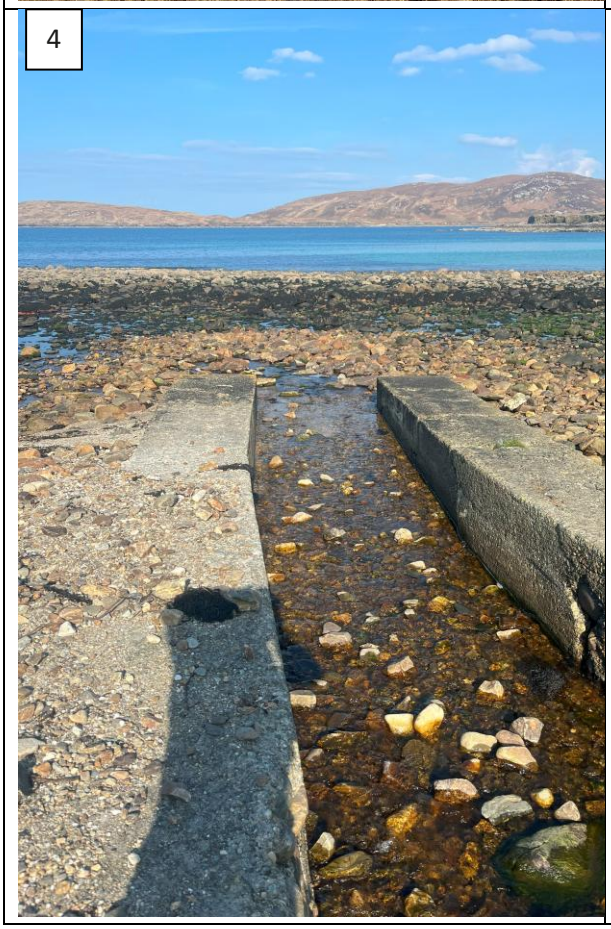

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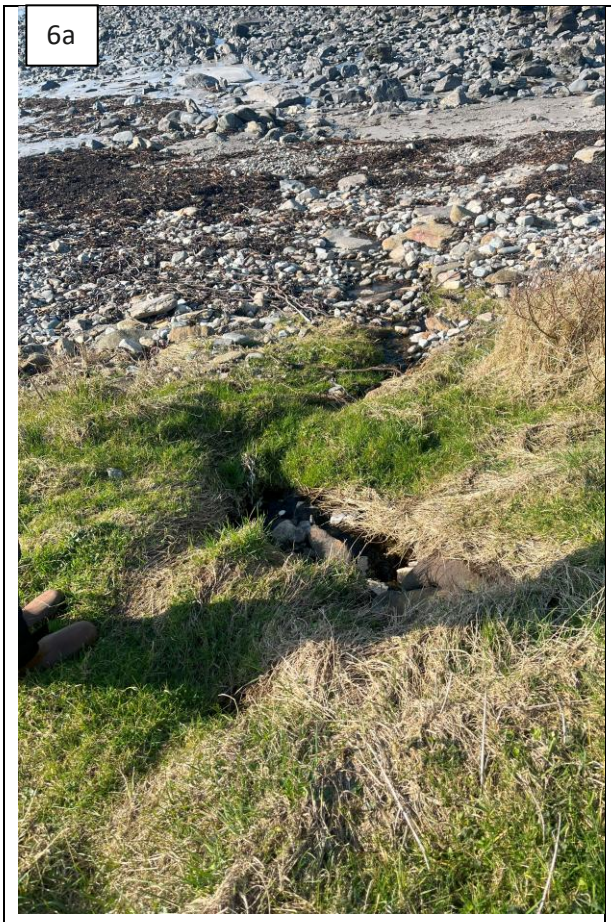
6a



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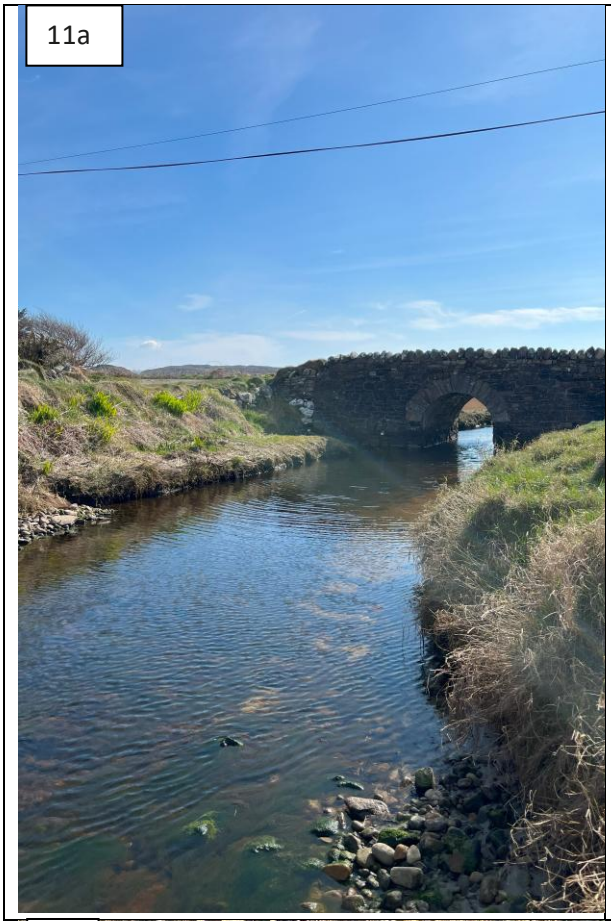
11a



11b

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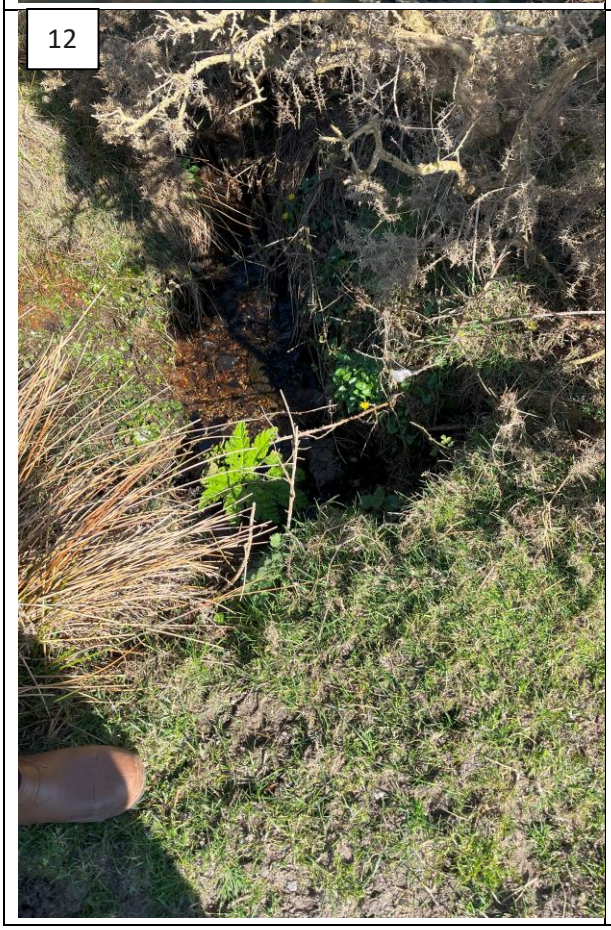

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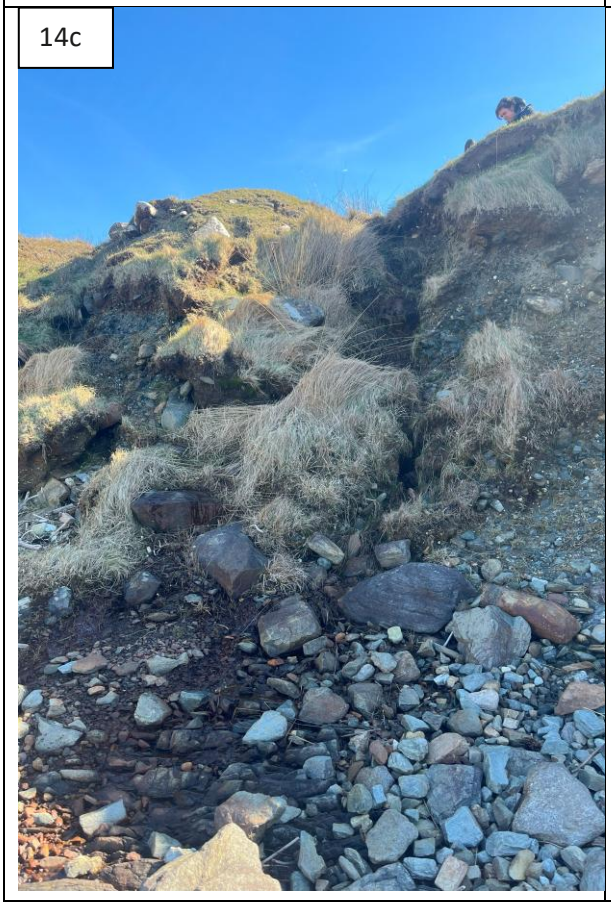
14a

14b

14c



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Appendix 4 COMPARATIVE COORDINATES

Appendix 4a: Table of Comparative coordinates for the various stations. Latitude and longitude values are in coordinate reference system (CRS) WGS84, easting and northing values are in CRS Irish Transverse Mercator (ITM)

ID	Easting (ITM)	Northing (ITM)	Latitude (WGS84)	longitude (WGS84)	Latitude (WGS84)	Longitude (WGS84)
1	457482	759509	53.56611	-10.1516	53° 33' 57.996'' N	10° 9' 5.76'' W
2	457684	759423	53.56538	-10.1485	53° 33' 55.368'' N	10° 8' 54.6'' W
3	457956	759100	53.56256	-10.1442	53° 33' 45.216'' N	10° 8' 39.12'' W
4	458476	758582	53.55804	-10.1362	53° 33' 28.944'' N	10° 8' 10.32'' W
5	458722	758556	53.55788	-10.1324	53° 33' 28.368'' N	10° 7' 56.64'' W
6	460119	758477	53.55754	-10.1113	53° 33' 27.144'' N	10° 6' 40.68'' W
7	460198	758425	53.5571	-10.1101	53° 33' 25.56'' N	10° 6' 36.36'' W
8	461310	758427	53.55741	-10.0933	53° 33' 26.676'' N	10° 5' 35.88'' W
9	461254	758238	53.5557	-10.0941	53° 33' 20.52'' N	10° 5' 38.76'' W
10	460823	758797	53.56061	-10.1009	53° 33' 38.196'' N	10° 6' 3.24'' W
11	460749	759012	53.56252	-10.1021	53° 33' 45.072'' N	10° 6' 7.56'' W
12	460146	758411	53.55696	-10.1109	53° 33' 25.056'' N	10° 6' 39.24'' W
13	458912	758598	53.55831	-10.1296	53° 33' 29.916'' N	10° 7' 46.56'' W
14	457482	759509	53.56611	-10.1516	53° 33' 57.996'' N	10° 9' 5.76'' W
15	457684	759423	53.56538	-10.1485	53° 33' 55.368'' N	10° 8' 54.6'' W