WWDA Review Application

Killala - D0067-01

Assessment of Impact on Receiving Surface Water Report

August 23

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Attachment D.2.1 - Assessment of Impact on Receiving Surface Water

1 Introduction

This document provides a summary of the Impact Assessments prepared to determine the impact of the discharges from the Killala Waste Water (WW) Agglomeration (D0067-01) on the receiving coastal waterbody of Killala Bay (IE_WE_420_0000) and addresses the criteria as outlined in Section D.2 of the EPA Guidance Document.

Killala is a WW agglomeration approximately 7km north of Ballina, Co. Mayo. The WW agglomeration is served by a combined sewage system, a *secondary stage* Waste Water Treatment Plant (WWTP) and 4 No. Pumping Stations (PS's) (2 No. small outlying PS's – Ballina Road PS & Courthouse PS and 2 No. larger PS's – Quay Road PS & Ballycastle Road PS). The recently constructed Ballycastle Road PS is sized to pump three times Dry Weather Flow (3DWF) to the new Killala WWTP, via a new 180mm rising main.

The WWTP is designed for a PE of 2,300 based on the Full Cycle Activated Sludge – FCAS process, this biological treatment was developed based on a *Sequencing Batch Reactor (SBR)* which incorporates all the biological treatment steps into one single structure. The system comprises three streams in parallel with each stream capable of accommodating the FFT, ensuring a carbonaceous removal and full nitrification processes as required to comply with the ELV's established in the existing Waste Water Discharge Licence (WWDL) for Killala D0067-01. The design incorporates 3 no. FCAS for biological secondary waste water treatment, each with its own aeration, mixing, decanting and excess sludge pumping systems.

Since the commissioning of the WWTP (in 2020), all effluent discharging into Killala Bay is compliant with the EU Directives and National Regulations (as demonstrated in this report and Attachment B.5 – EIA Screening Report and Attachment D.2-3 - AA Screening Report), by providing appropriate treatment for the WW agglomeration, including regulations S.I. No.272/2009 Surface Water Regulations 2009 and S.I. No.254/2001 - Urban Waste Water Treatment Regulations, 2001.

Treated effluent from the WWTP is discharged into Killala Bay (coastal waterbody) via an existing 600mm – 750mm outfall pipe from the old Asahi development. The Primary Discharge Point SW001 is located approximately 875m northeast of Bartragh Island at Irish National Grid (ING) coordinates 124144E, 331285N. The outfall pipe comprises sections of concrete, steel, and GRP pipe material. As detailed in Section 12 there is a high dilution capacity at this Primary Discharge Point SW001. In addition, Bartragh Island shelters the designated shellfish beds from the discharge to Killala Bay, which further mitigates any risk the discharge poses to the designated shellfish areas. According to the 2022 Annual Environmental Report (AER), the final effluent is compliant with Emission Limit Values (ELVs) stipulated in the existing WWDL D0067-01.

2 Receiving Water Environment

As outlined above, the Primary Discharge SW001 from the Killala WWTP is into the coastal waterbody of Killala Bay (IE_WE_420_0000). The results of the WFD monitoring programme (2016-2021) categorise Killala Bay as having 'Good' status. It is categorised "Not at Risk" of achieving WFD objectives. In coastal waters the primary biological quality elements used for assessment of ecological status are phytoplankton and benthic invertebrates.

The most recent assigned trophic status based on the Trophic Status Assessment Scheme was designated as "Unpolluted" based on 2015-2017 data. Killala Bay is designated as ''Unassigned'' under the more recent 2018-2020 designation.

Bathing waters within Killala Bay are located at Ross Beach 2.35km northwest of the Primary Discharge Point SW001 and at Enniscrone Beach located 3.9km east-southeast of the Primary Discharge Point. The bathing water quality at Ross Beach and Enniscrone Beach are classified as 'Excellent' and 'Good'

quality respectively in accordance with the Bathing Waters Quality Regulations (S.I. no. 79/2008) based upon an evaluation of environmental microbiological monitoring results for the previous four bathing seasons. Tables 2-1 below outlines the performance standards for the classification of bathing waters.

Table 2-1*: Performance standards for the classification of bathing water quality (SI No. 79/ 2008).*

Parameter	Excellent	Good	Sufficient
Intestinal enterococci	≤ 100cfu/100ml[1]	≤ 200cfu/100ml[9]	≤ 185cfu/100ml[2]
Escherichia coliforms *E. coli*	≤ 250cfu/100ml[9]	≤ 500cfu/100ml[9]	≤ 500cfu/100ml[Error! Bookmark not defined.]

The Killala Bay designated Shellfish Waters are located 1.4km southwest of the Primary Discharge Point SW001, south of Bartragh Island. Bartragh Island acts as a barrier between the designated shellfish waters and the Primary Discharge Point SW001. This reduces the potential impact of the WWTP Primary Discharge on the water quality at the shellfish waters. Per the ''2023/2024 List of Classified Bivalve Mollusc Production Areas in Ireland'' the Killala Bay Shellfish Production Area is classified as Class B. As there is no in-water environmental quality standards (EQS) for the determination of Designated Shellfish Water Quality, an in-water proxy EQS value is required to assess whether discharges are impacting Designated Shellfish Waters. In the absence of a regulatory standard in the water column for shellfish waters, the IW-TEC-100- 015 Technical Standards for Marine Modelling stipulates that the following indicative quality shall be assessed against the targets of E. Coli concentrations:

1. 97th Percentile ≤ 1500 cfu/100ml;
2. Geometric Mean ≤ 110 cfu/100ml.

The ambient coastal water quality for the receiving waterbody was derived from available EPA ambient monitoring data (2014-2015). The EPA ambient monitoring sampling location is shown in *Figure 2-1* with summary seasonal data presented in *Table 2-3*. The EPA data is taken from the monitoring station MY120 Bartragh (1st Nav Buoy / Tall Green Perch) which is located approx. 2.4km southeast of the Primary Discharge Point SW001.

The Primary Discharge Point SW001 is located within coastal waters and therefore under the Surface Water Regulations (SI272/2009) (as amended), Dissolved Inorganic Nitrogen (DIN) is the relevant Environmental Quality Standard (EQS). In addition to the ambient monitoring results included in *Table 2-3* for the DIN EQS, ambient concentrations for other parameters such as BOD and Orthophosphate (PO_4) which are not regulatory standards within coastal waters have also been included for reference.

The EQS for DIN is dependent on the salinity of the water. As outlined in Table 2-2 for 'Good' status, if salinity is 0psu (freshwater) then the DIN EQS is 2.6mg/l and if salinity is 34.5psu then the DIN EQS is 0.25mg/l. For 'High' status, if salinity is 0psu then the EQS is 1.0mg/l and if the salinity is 34.5psu then the DIN EQS is 0.17mg/l. Linear Interpolation can be used to find the 'Good' and 'High' status for different salinities. According to the EPA monitoring data (2014-2015), the salinity of Killala Bay coastal waterbody is 26.8psu. Using linear interpolation, the 'Good' status DIN EQS for 26.8psu is calculated to be 0.747mg/l and the DIN EQS for 'High' status is calculated to be 0.355mg/l.

[1] Based upon a 95-percentile evaluation

[2] Based upon a 90-percentile evaluation

Table 2-2: EQSs for the Receiving Water of Killala Bay

Parameter	Receiving Water EQSs	
	Good Status	High Status
DIN (mg N /l)	≤2.6 (0psu) - ≤0.25 (34.5psu) (Based on median)	≤1.0 (0psu) - ≤0.17 (34.5psu) (Based on median)

All values for DIN in *Table 2-3* for the monitoring location are less than 0.355mg/l and as such conform with ''High Status''.

Table 2-3: Available EPA Ambient Monitoring Data- Killala Bay

Date	Monitoring Station	Salinity (PSU)	BOD (mg/l)	DO (% saturation)	DIN (mg/l)	TON	NH_3	PO_4
29/05/2014	MY120	27.41			0.035	0.02	0.015	0.0025
29/05/2014	MY120	31		112.8	0.027	0.005	0.022	0.0025
30/06/2014	MY120		0.5	112.2	0.015	0.005	0.01	0.02
13/08/2014	MY120		0.5		0.04	0.01	0.03	0.005
30/06/2015	MY120	22.5	2	109	0.067	0.026	0.041	0.0025
10/08/2015	MY120	31.5	0.5	96	0.074	0.016	0.058	0.012
10/08/2015	MY120	16.3	0.5	95	0.145	0.082	0.063	0.011

Figure 2-1: EPA Monitoring Locations

Additionally, as included in the 2022 Annual Environmental Report (AER) for Killala there were two sets of ambient monitoring results for monitoring station MY140 (shown in Figure 2-1) which is located approximately 1.5km northwest of the Primary Discharge Point SW001.

All values for DIN[3] in *Table 2-4* for this monitoring location are less than 0.747mg/l and as such conform with ''Good Status''.

Table 2-4: Available EPA Ambient Monitoring Data- Killala Bay

Date	Station	BOD (mg/l)	TON as N (mg/l)	DO (% saturation)	OrthoP as PO4-P (mg/l)	NH_3 As N (mg/l)	E. Coli (cfu/100ml)	Intestinal Entreococci (cfu/100ml)
30/11/2022	MY140	<2	<0.1	105	0.039	0.033	10	21
06/12/2022	MY140	<2	<0.1	94.3	<0.01	0.423	26	5

3 AA Screening

A Stage 1 Screening for Appropriate Assessment was completed in respect to the Killala WW Agglomeration discharges. The AA Screening concluded that in accordance with Article 6(3) of the Habitats Directive, the Killala WW Agglomeration Primary Discharge Point SW001 and Dual SWO/EO's SW002 & SW003 are not likely to have significant effects in view of the European Sites conservation objectives and Stage 2 of the Appropriate Assessment process (Natura Impact Statement) is not required. The AA Screening Report is attached as **Attachment D.2-3 - AA Screening Report.**

4 Natura Impact Statement

NIS not required.

5 Water Quality Modelling Assessment Summary

5.1 Introduction

In 2013, a hydrodynamic and water quality model assessment was carried out to identify a suitable location within Killala Bay for a potential marine outfall to discharge treated waste effluent from the Killala Village Sewerage scheme. For that assessment, a 2-dimensional depth averaged hydrodynamic and transport dispersion model of Killala Bay, and the greater Moy Estuary was developed. This numerical model utilised the TELEMAC hydrodynamic and dispersion modelling software suite and is a finite element variable grid model allowing refinement where necessary for accurate modelling.

For the purposes of the updated water quality modelling assessment, the above model was used to investigate the bacteriological impact of a secondary treated sewage effluent on water quality within Killala Bay and on the nearby designated shellfish waters and bathing waters (discussed further in Sections 7 and 8). The modelled discharge point corresponds with the Primary Discharge Point SW001 located at Irish National grid coordinates 124144E, 331285N. This detailed modelling Report is contained in **Attachment D.2.4 - Marine Modelling Report.**

[3] DIN Value computed by summating values of TON and NH_3

Figure 5-1: Existing Primary Discharge Point SW001 off Bartragh Island Killala Bay

The design parameters for this water quality modelling assessment are set out in Table 5-1 and Table 5-2 below.

Table 5-1: Design Loading from Killala WWTP

Parameter	Design Load
Biological Load (PE)	2,300[4]
Dry Weather Flow (DWF) (m^3/d)/(l/s)[5]	517.5 / 5.99
Average Hydraulic Discharge (m^3/d)/(l/s)[6]	647 / 7.49

Table 5-2: Modelled Final Effluent Concentrations readily achievable by Secondary Treatment

Parameter	Design Load
E.coli cfu/100ml[7]	1.0E+05
Intestinal enterococci cfu/100ml[7]	2.5E+04

5.2 Water Quality Simulations

The following simulations were performed for a constant discharge rate of 7.49l/s at the Primary Discharge Point SW001 (E124144, N331285).

[4] The ultimate design capacity of the Killala WWTP
[5] DWF Figure based DWF = 0.175*PE+0.05PE in accordance with IW-TEC-700- 99-02 Inlet works & Stormwater Treatment (wastewater)
[6] Assumed to be 1.25 x DWF
[7] Bacteria concentrations agreed with Uisce Éireann as typical concentrations following secondary treatment

1. *E.coli* under summer coastal t_{90} die-off rate of 12 hours for an 88-day simulation (For assessing Bathing Water Compliance and Summer Shellfish Waters Compliance);
2. Intestinal Enterococci under summer coastal t_{90} die-off rate of 24 hours for an 88-day simulation period from 1st March 2023 to 28th May 2023 (for assessing bathing water compliance);
3. *E.coli* under winter coastal t_{90} die-off rate of 24 hours for an 88-day simulation period from 1st March 2023 to 28th May 2023 (for assessing Winter Shellfish Waters Compliance).

Eight reference sites (Figure 5-2) including the Primary Discharge Point SW001 were selected within the study area where a time series of computed bacteriological concentrations were output for detailed statistical analysis. The simulations were performed for a full lunar cycle of 28 days which ensured that equilibrium conditions were attained in order to assess the spring-neap variation and the long-term build-up of the respective water quality parameters.

The simulations were run independently of ambient background concentrations and represent the potential increase in concentrations.

Site 1 is the Primary Discharge Point SW001, Site 2 is the Ross Beach bathing water reference site, Site 3 is the Enniscrone Beach bathing water reference site and sites 5 and 6 are the west and east boundary locations to the designated shellfish waters area. Sites 4, 7 and 8 are located within the tidal channels to inner Killala Bay and to the Moy Estuary.

In order to assess the impact on the shellfish and bathing waters, the simulation results were post-processed to produce percentile concentration contours within Killala Bay. This was performed for the final 60 days of the 88-day simulation period. The median, geometric mean, 90-percentile, 95-percentile and 97-percentile were calculated.

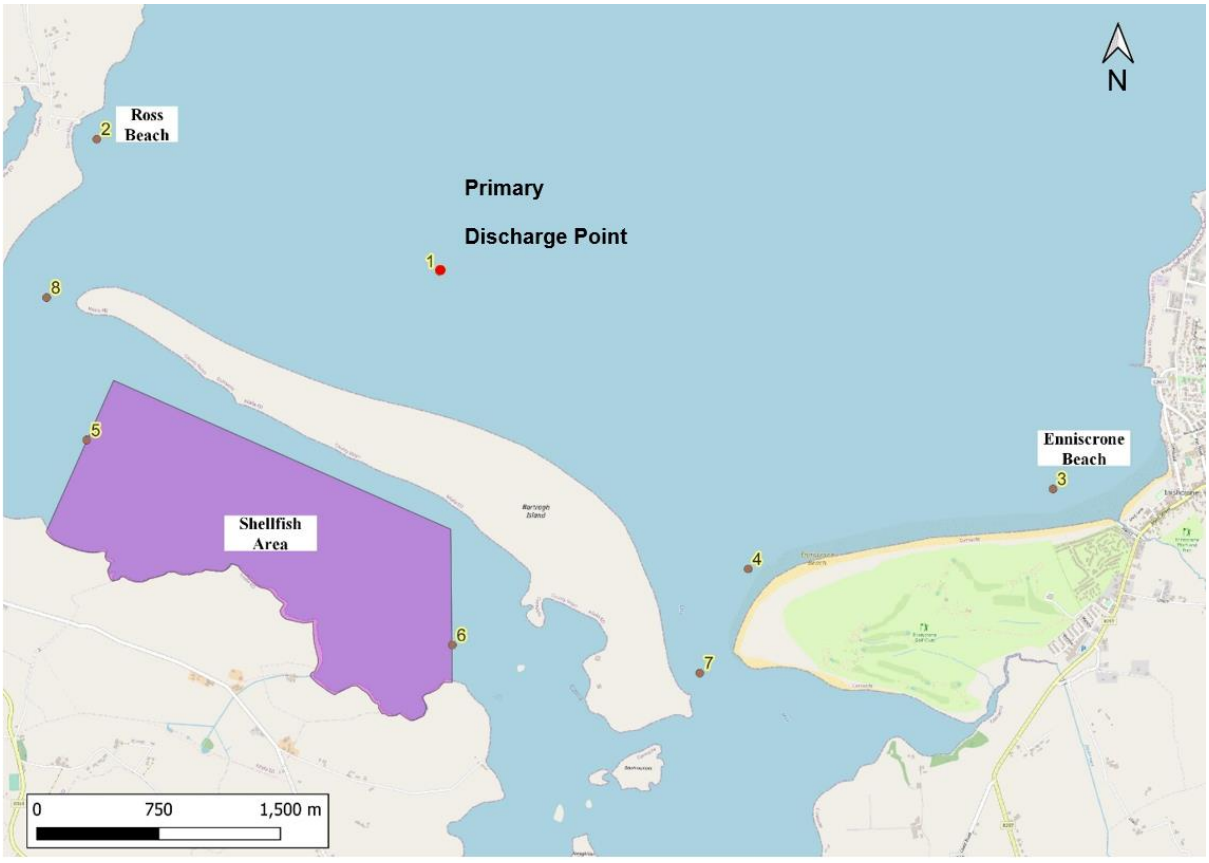

Figure 5-2: Primary Discharge Point SW001off Bartragh Island Killala Bay

5.2.1.1 *Simulation 1 - Summer E. Coli Results (For assessing Bathing Water Compliance and Summer Shellfish Waters Compliance)*

This model simulation examined summer die off rates for *E.coli* concentration of 12 hours for the Primary Treated Effluent Discharge SW001. The geometric mean, 95 and 97-percentile concentration contour plots are presented in Figures 5-3 to 5-5 for a 60-day simulation period after a warm-up period of 28 days to ensure equilibrium concentrations have been attained.

The results clearly show that within approximately 50m of the Primary Discharge Point SW001 excellent bathing water standards (for E. Coli) would be achieved. At the designated bathing water areas of Ross Beach and Enniscrone Beach, the predicted concentration increase attributable to the Primary Discharge Point SW001 will be less than 1 cfu/100ml and therefore the impact is low (accounting for <1% of the total E. Coli Excellent Limit) and consequently the discharge is considered not significant in respect to impact on status. The target standards for shellfish would be met at the Primary Discharge Point SW001 itself and negligible effect is predicted within the designated shellfish area.

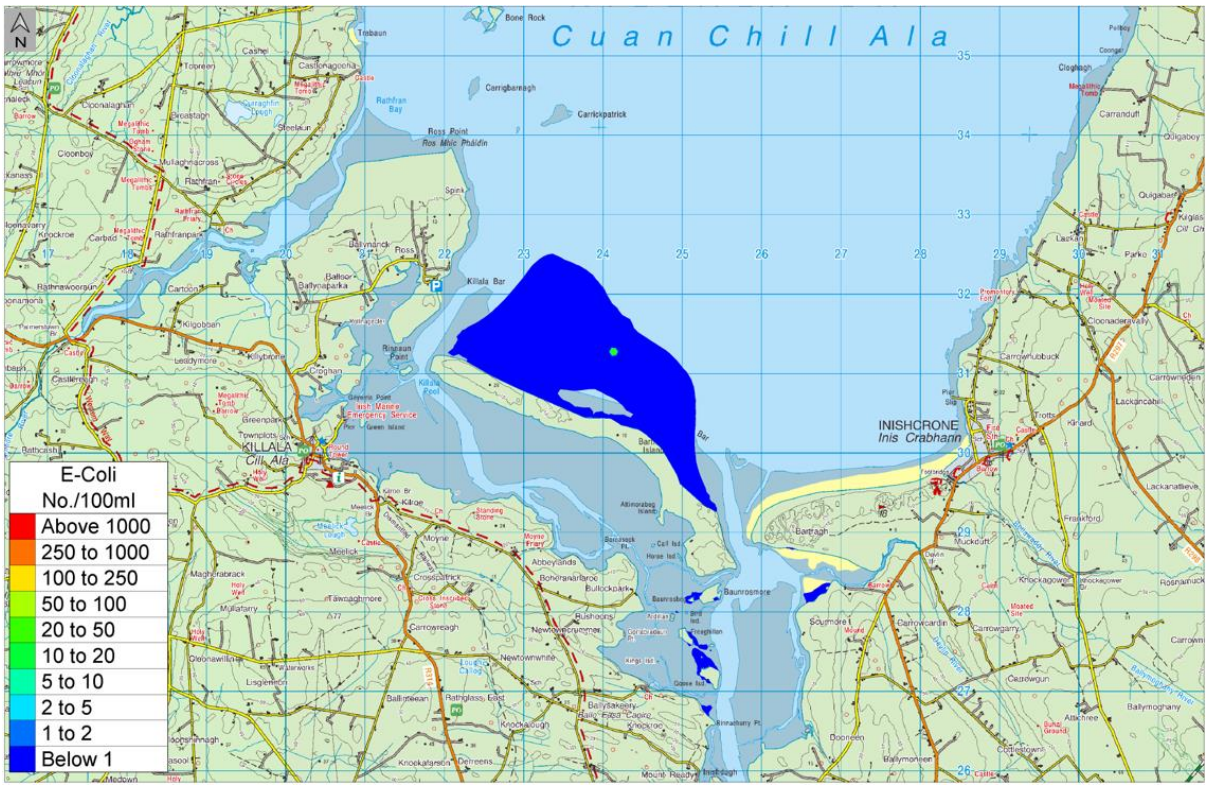

Figure 5-3: Geometric mean E.coli concentrations – Summer die-off rate assessment based on 60-day period

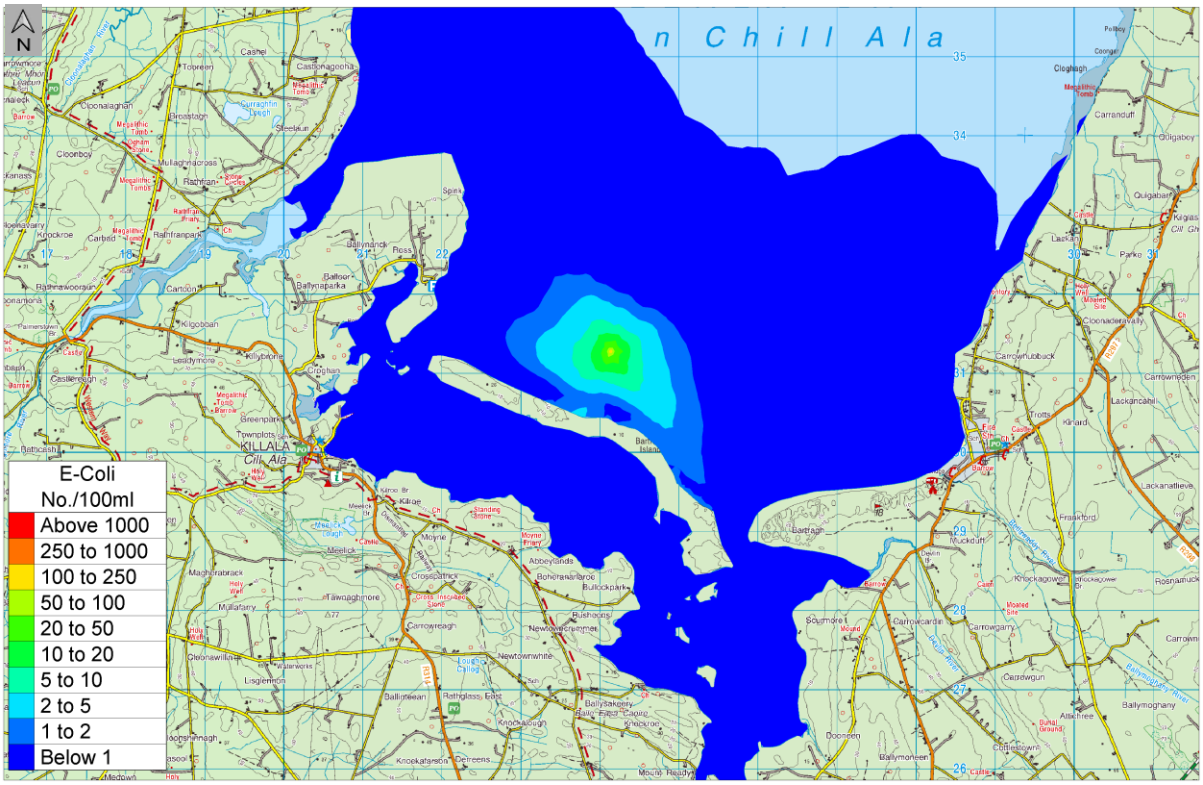

Figure 5-4: 95-percentile E.coli concentrations – Summer die-off rate assessment based on 60-day period

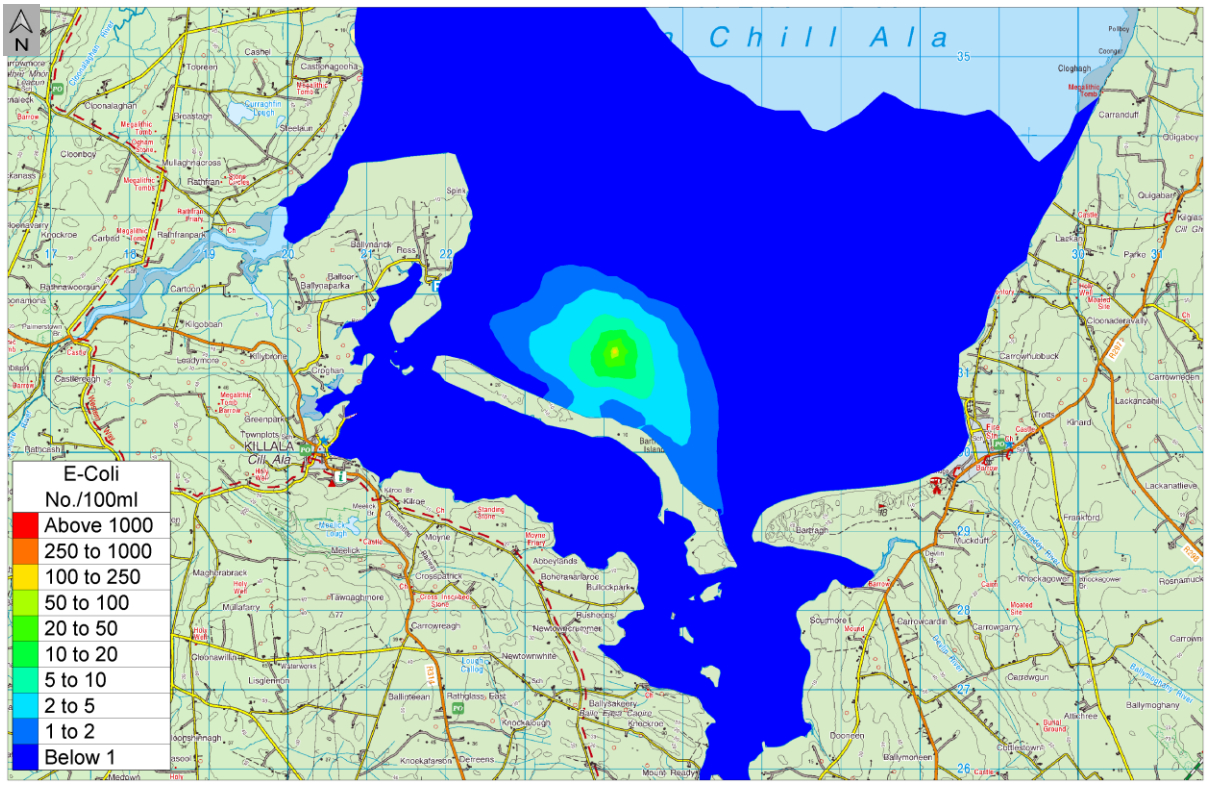

Figure 5-5: 97-percentile E.coli concentrations – Summer die-off rate assessment based on 60-day period

5.2.1.2 Simulation 2 - Summer Intestinal Enterococci Results (for assessing bathing water compliance)

This model simulation examined summer die off rates for Intestinal Enterococci concentration of 24 hours for the treated effluent discharge SW001. The geometric mean, 95 and 97-percentile concentration contour plots are presented in Figures 5-6, 5-7 & 5-8 for a 60-day simulation period after a warmup period of 28 days to ensure equilibrium concentrations have been attained.

The results clearly show that within (approximately 10m) of the Primary Discharge Point SW001, excellent bathing water standards (for Intestinal Enterococci) would be achieved. At the designated bathing water areas of Ross Beach and Enniscrone Beach, the predicted concentration increase attributable to the Primary Discharge Point SW001 will be less than 1 cfu/100ml and therefore the impact is low (accounting for <1% of the total Intestinal Enterococci Excellent Limit) and consequently the discharge is considered not significant in respect to impact on status.

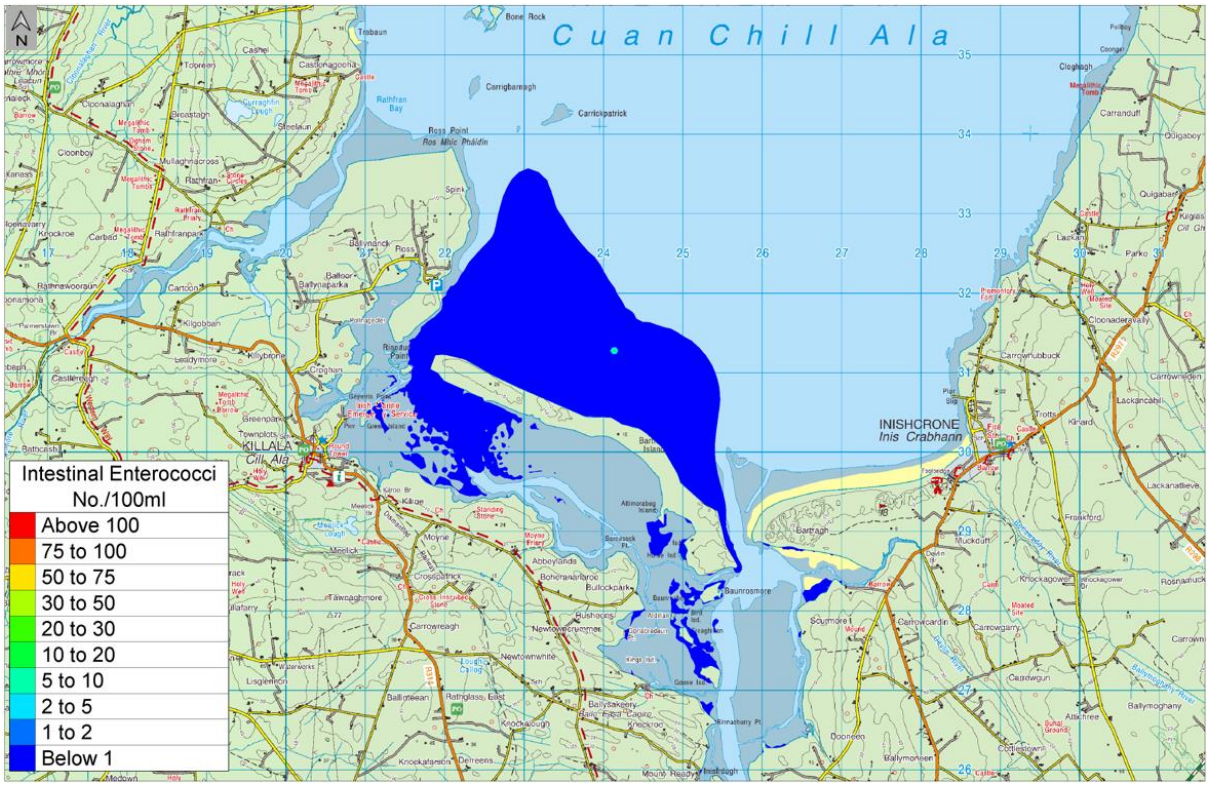

Figure 5-6: Geometric Mean Intestinal Enterococci concentrations – Summer die-off rate assessment based on 60-day period.

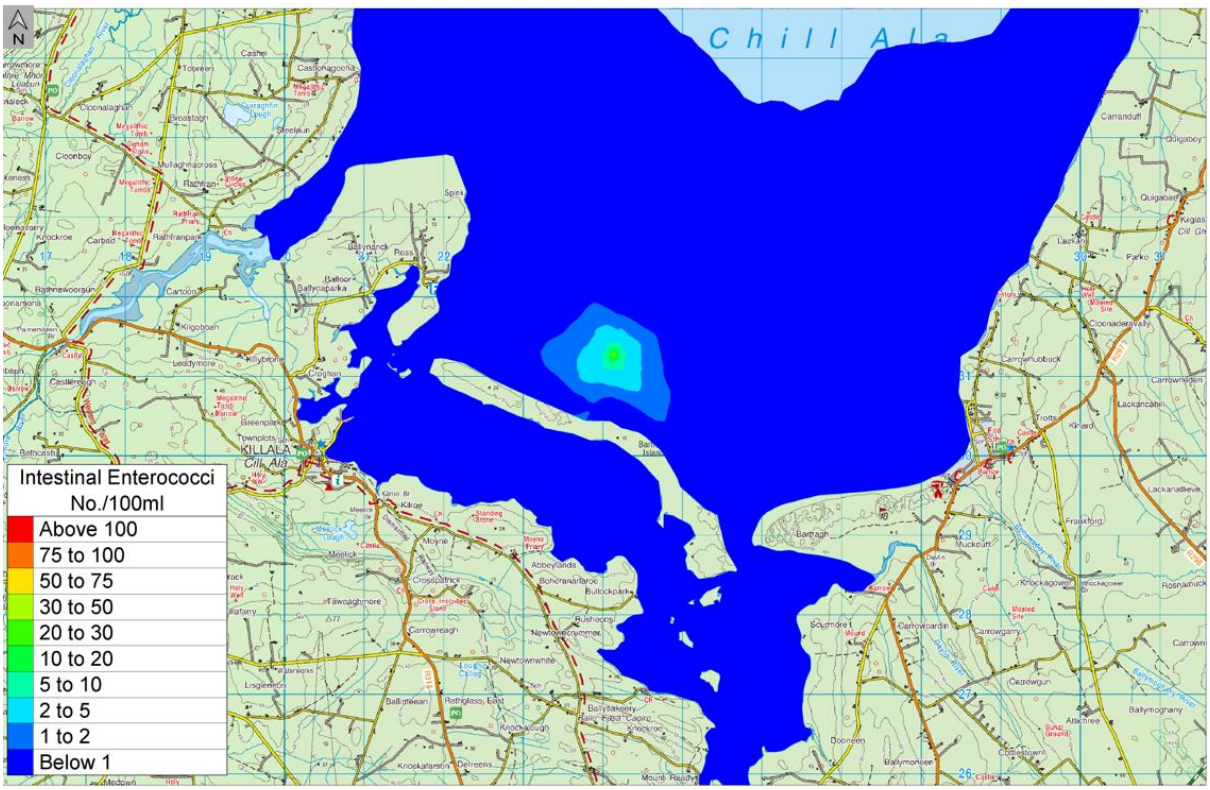

Figure 5-7: 95-percentile Intestinal Enterococci concentrations – Summer die-off rate assessment based on 60-day period.

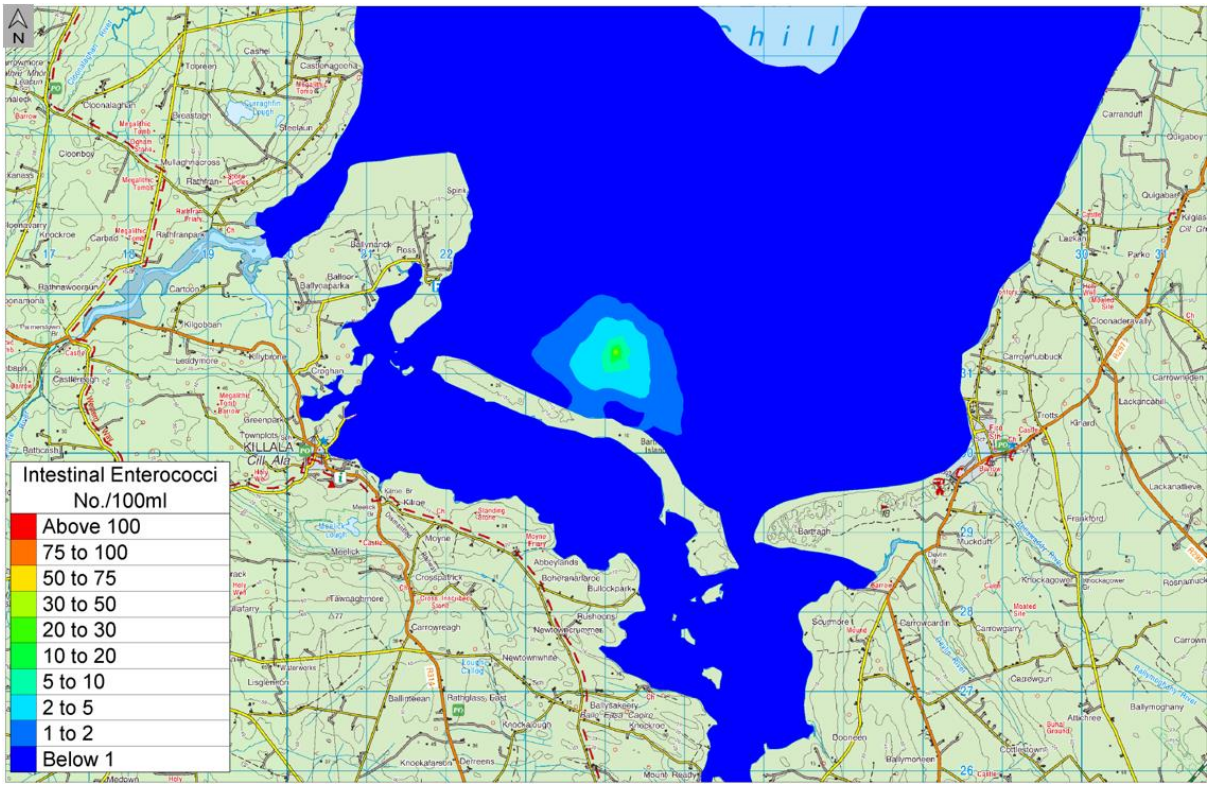

Figure 5-8: 97-percentile Intestinal Enterococci concentrations – Summer die-off rate assessment based on 60-day period.

5.2.1.3 Simulation 3. - Winter E. Coli Results (for assessing Winter Shellfish Waters Compliance)

This model simulation examined winter average die-off rates for *E.coli* concentrations of 24 hours for the Primary Discharge Point SW001. The geometric mean, 95 and 97-percentile concentration contour plots are presented in Figures 5-9 to 5-11 for a 60-day simulation period after a warm-up period of 28 days to ensure equilibrium concentrations have been attained.

The results clearly show that within (approximately 100m) of the Primary Discharge Point SW001, excellent bathing water standards (for E. Coli) would be achieved. At the bathing water designated areas of Ross Beach and Enniscrone Beach, the predicted concentration increase attributable to the Primary Discharge Point SW001 will be less than 1 cfu/100ml and therefore the impact is low (accounting for <1% of the total E. Coli Excellent Limit) and consequently the discharge is considered not significant in respect to impact on status[8]. The target standards for shellfish outlined in Section 2 would be met at the Primary Discharge Point SW001 itself and negligible effect is predicted within the designated shellfish area.

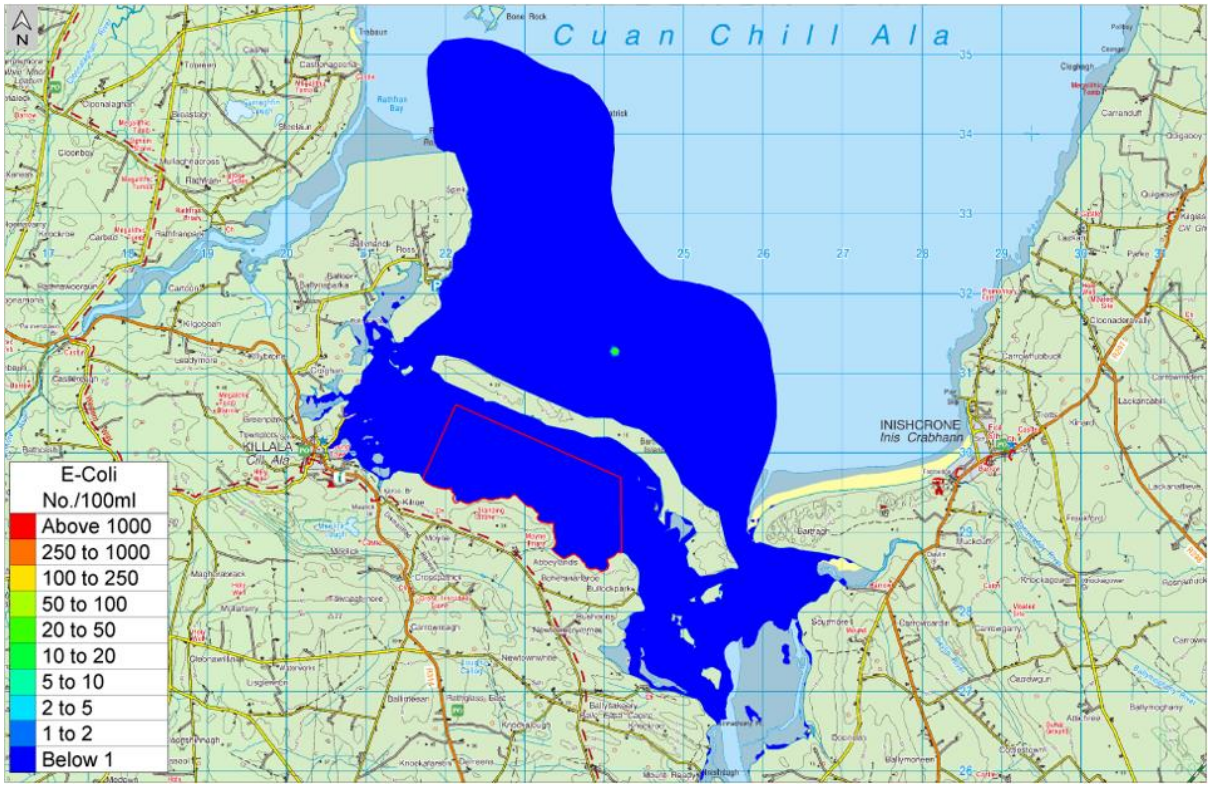

Figure 5-9: Geometric mean E.coli concentrations – Winter die-off rate assessment based on 60-day period

[8] It is noted that this modelling simulation is outside of the designated bathing season.

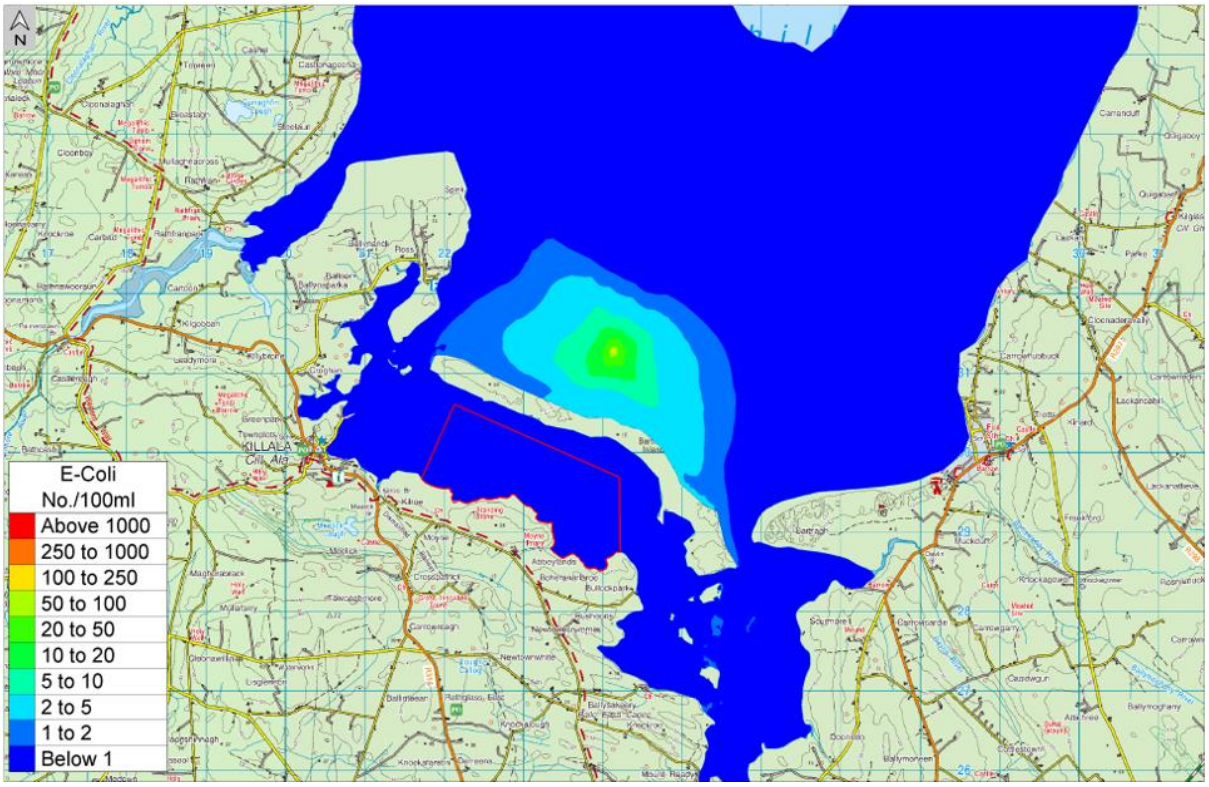

Figure 5-10: 95-percentile E.coli concentrations – Winter die-off rate assessment based on 60-day period

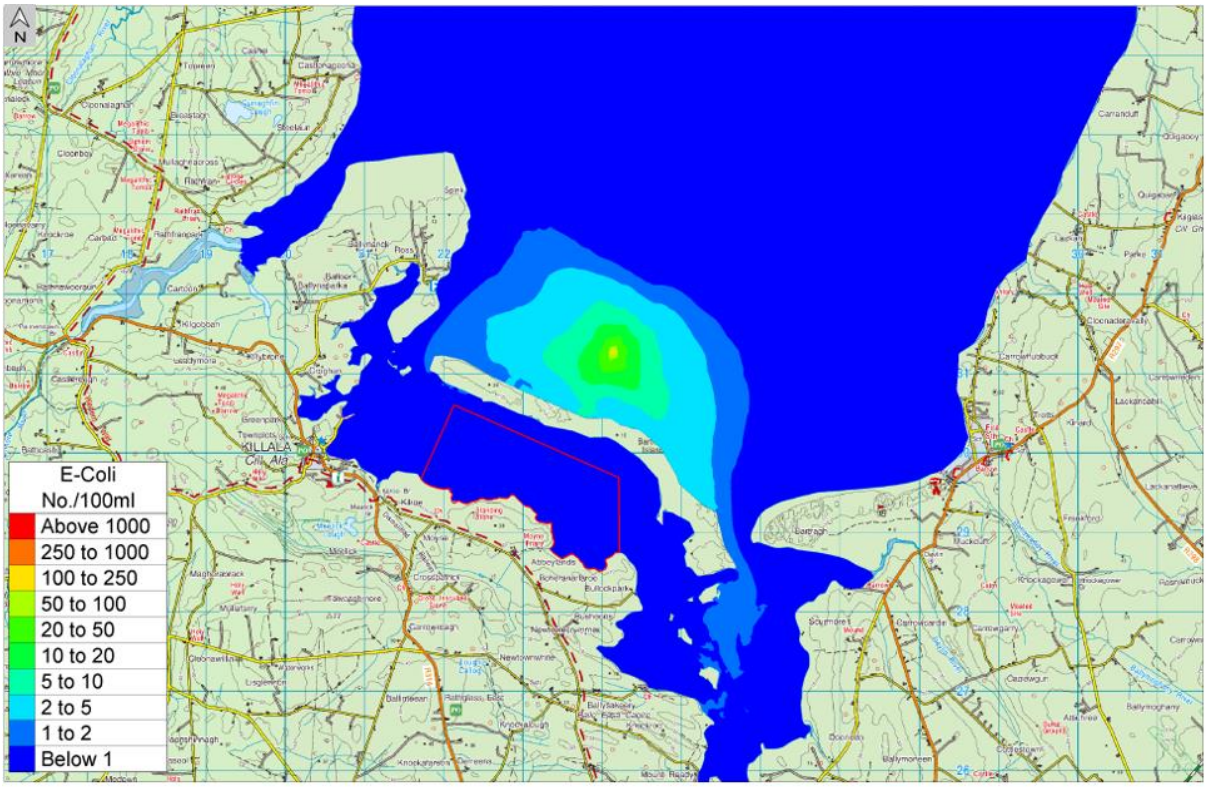

Figure 5-11: 97-percentile E.coli concentrations – Winter die-off rate assessment based on 60-day period

5.3 Conclusions

Bacteriological dispersion simulations were conducted for the secondary treated effluent standard discharging at the ultimate design capacity flows of the Killala WWTP via the Primary Discharge Point SW001 located 875m north of Bartragh Island. The simulations demonstrated excellent mixing characteristics which do not impact negatively on the designated bathing waters at Ross Beach and Enniscrone Beach during the designated bathing water season or the designated shellfish waters located in the inner Killala Bay area south of Bartragh Island throughout the year.

Consequently, the simulation results demonstrate that the requirement for UV treatment at Killala WWTP is not warranted, with respect to potential bacteriological impact of the Final Discharge Point SW001 on bathing and shellfish waters and that the secondary treated effluent discharging at the Primary Discharge Point SW001 satisfies water quality requirements in accordance with the Bathing Waters Quality Regulations (S.I. no. 79/2008) for 'Excellent' bathing water classification and does not impact negatively on the designated shellfish waters of Killala Bay.

6 Priority Substance Assessment

A Desk Top Priority Substance Assessment has been prepared to inform this WWDL Review Application. This assessment is based only on loads to the WWTP and was carried out in accordance with the Guidance on the Screening for Priority Substances for Waste Water Discharge Licences, issued by the EPA.

Estimated data from the PRTR reporting tool was used to inform this desktop assessment. The assessment considered the Primary Discharge SW001 relevant to Environmental Quality Standards (EQS) for priority substances in surface waters, as set out in the European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended (now S.I No. 77 of 2019).

It was concluded that none of the substances listed in the Specific Pollutants, Priority and Priority Hazardous Substances as outlined in the Surface Water Regulations, are likely to be present in the WWTP discharge at concentrations above the specified standards as per European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended (now S.I No. 77 of 2019).

This Report is contained in **Attachment D.2.2 - Priority Substances Assessment**

7 Shellfish Waters

As previously noted in Section 2 above, the Killala Bay designated Shellfish Waters (*Figure 7-1*) are located 1.4km southwest of the Primary Discharge Point SW001, south of Bartragh Island. Bartragh Island acts as a barrier between the designated shellfish waters and the Primary Discharge Point SW001. This reduces the potential impact of the WWTP Primary Discharge on the water quality at the shellfish waters.

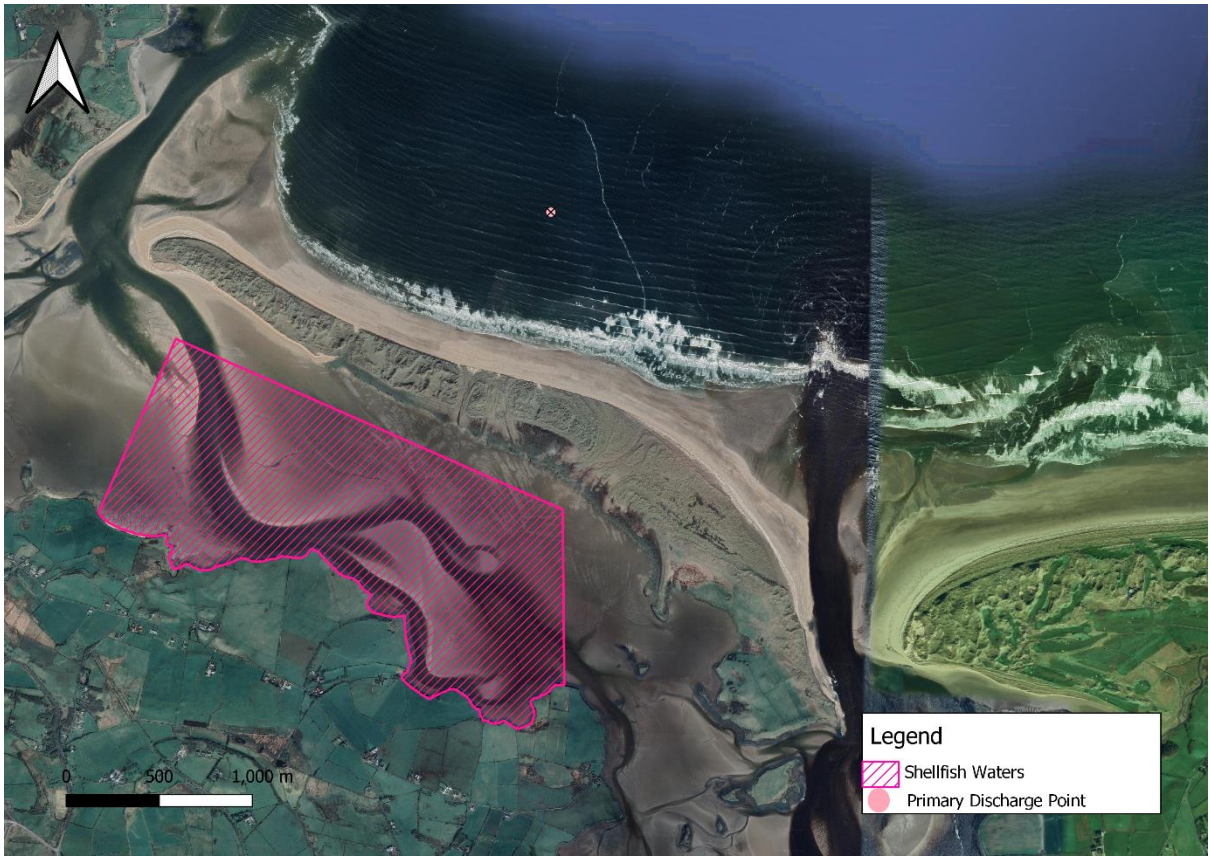

Figure 7-1: Designated Shellfish Waters

The in-water proxy EQS values outlined in Section 2 were used to assess whether the Primary Discharge Point SW001 is impacting Designated Shellfish Waters

The water quality modelling outlined in Section 5 above demonstrated the target standards for shellfish outlined in Section 2 would be met at the Primary Discharge Point SW001 itself and negligible effect is predicted within the designated shellfish area.

Additionally the Quality of Shellfish Waters Regulations specify that a discharge affecting shellfish waters must not cause the suspended solids content to increase by more than 30% of the background level. Based on the excellent mixing characteristics demonstrated at the Primary Discharge Point SW001 by the water quality modelling contained in Attachment D.2.4 - Marine Modelling Report and the suspended solids levels associated with a secondary treated effluent standard, it is considered that the Primary Discharge Point SW001 will not meaningfully impact the suspended solids content at the Killala Bay Shellfish Waters.

8 Bathing Waters

The nearest designated Bathing Waters are Ross Beach (2.2km west of Primary Discharge Point SW001) and Enniscrone beach (4.1km east of Primary Discharge Point SW001).

The bathing water quality at Ross Beach and Enniscrone Beach are classified as ‘Excellent’ and ‘Good’ quality respectively, in accordance with the Bathing Waters Quality Regulations (S.I. no. 79/2008) based upon an evaluation of environmental microbiological monitoring results for the previous four bathing seasons. Tables 8-1 below outlines the performance standards for the classification of bathing waters.

Table 8-1: Performance standards for the classification of bathing water quality (SI No. 79/ 2008).

Parameter	Excellent	Good	Sufficient
Intestinal enterococci	≤ 100cfu/100ml[9]	≤ 200cfu/100ml[9]	≤ 185cfu/100ml[10]
Escherichia coliforms *E. coli*	≤ 250cfu/100ml[9]	≤ 500cfu/100ml[9]	≤ 500cfu/100ml[Error! Bookmark not defined.]

The water quality modelling outlined in Section 5 above demonstrated that the predicted E. Coli and Intestinal Enterococci concentration increase attributable to the ultimate design discharge at the Primary Discharge Point SW001 will be less than 1 cfu/100ml for the relevant 95%ile statistical scenario at both the Ross Beach and Enniscrone Beach. Therefore the impact is low (accounting for <1% of the total E. Coli and Intestinal Enterococci Excellent Limits) and not considered significant in respect to impact on status.

9 Combined Approach

The European Union (Waste Water Discharge) Regulations 2007 to 2020, specify that a 'Combined Approach' in relation to licensing of waste water works must be taken, whereby the emission limits for the discharge are established on the basis of the stricter of either or both, the limits and controls required under the Urban Waste Water Treatment Regulations, 2001, as amended, and the limits determined under statute or Directive for the purpose of achieving the environmental objectives established for surface waters, groundwater or protected areas for the water body into which the discharge is made.

Under the Urban Waste Water Treatment Regulations, discharges to coastal waters form agglomerations less than 10,000 PE. were required to provide appropriate treatment (treatment of urban waste water by any process and/or disposal system which after discharge allows the receiving waters to meet the relevant quality objectives and the relevant provisions of this and other Community Directives) by 31st December 2005.

As demonstrated in Section 8 above, the Primary Discharge SW001 has no significant impact on the bathing water quality at the relevant designated bathing waters of Ross Beach and Enniscrone Beach and as such is considered in compliance with the Bathing Waters Quality Regulations (S.I. no. 79/2008). Additionally, as detailed further in Section 2 above, the discharge to coastal waters is providing appropriate treatment per the Urban Waste Water Treatment Regulations to ensure ongoing compliance with the objectives of the WFD for Killala Bay.

10 Compliance with Relevant National or EU Legislation

As noted in **Attachment B.6. - *Compliance with EU Directives & National Regulations***, where national or EU legislation is relevant, the Primary Discharge SW001 is in compliance with its requirements, with reference to details of such included in **Attachment *A.1 - Non-Technical Summary***.

11 Cumulative and In Combination Effects

The Screening for Appropriate Assessment addresses 'In-combination Effects'. It was concluded that there is no potential for cumulative impacts when the Primary Discharge SW001 is considered in conjunction with Mayo County Council Development Plan (2014-2020), and that this project will not compromise the qualifying interests of any European site and will not have any significant impact on the species or habitats for which they have been designated.

Refer to **Attachments D.2.2 – *AA Screening Report***

[9] Based upon a 95-percentile evaluation

[10] Based upon a 90-percentile evaluation

12 Mixing Zone or Transitional Areas of Exceedance

For any marine wastewater discharge, initial dilution is important in reducing the likelihood of a visible slick forming at the outfall and also serves to reduce the localised impact of pollutants around the point of discharge. The degree of initial dilution required to prevent an unacceptable aesthetic impact at a wastewater discharge is highly dependent on the level of treatment received by the wastewater prior to discharge. The Primary Discharge SW001 from Killala WWTP undergoes secondary treatment. The UÉ Marine Modelling Specification requirements for initial dilutions are 50 for secondary treatment effluent, based on mean effluent flow conditions and on 95th percentile low water levels and current velocities.

When assessing initial dilutions in coastal and transitional waterbodies, low tide is often when the minimum initial dilutions are expected as this is when both water levels and current velocities are at their lowest. It is felt that this assumption is reasonable for the Killala Primary Discharge SW001.

The Cederwall Equation (outlined below) was used to calculate the minimum initial dilutions assuming a zero ambient current velocity. Given the estimated water depth below mean low water spring level ,based on admiralty mapping, of 3.42m, the minimum initial dilutions calculated at the Primary Discharge Point SW001 was 111. This result indicates that discharging the ultimate design discharge flow from Killala WWTP should reasonably achieve the required 95%ile initial dilutions of greater than 50.

$$S = 0.54 \times Fr \times \left(\frac{0.38 \times z}{d \times Fr} + 0.68\right)^{5/3}$$

Where:

- S-Number of initial dilutions available
- Fr-Densimetric Froude number
- D-Port diameter (taken as 0.15m)
- Z-Depth of water available for dilution
- F-Average hourly flow rate of the discharge through discharge point (m3/h)

13 Dilutions and retention times for lakes

Not applicable. No discharges to lakes.

14 The impact of the discharges on any environmental media other than those into which emissions are to be made

Not applicable. No other relevant media into which the emissions are to be made.

15 Groundwater details

Not applicable. No discharge to groundwater.

16 High Status waterbodies

No High-Status waterbodies are downstream of Primary Discharge Point SW001.

17 Fresh Water Pearl Mussels

Not applicable. No Fresh Water Pearl Mussels within the region of the Primary Discharge Point SW001.

18 For wastewater treatment plants with coastal discharges, provide evidence that the end of the discharge pipe is below the mean spring tide low water line

The end of the discharge pipe is below the mean spring tide low water line. *Table 18-1* shows the tidal levels at Killala:

Table 18-1: Tides at Killala

Tide	*Killala Level (mOD)*
Mean High Water Spring (MHWS)	1.82
Mean Low Water Spring (MLWS)	-1.58
Mean High Water Neap (MHWN)	0.72
Mean Low Water Neap (MLWN)	-0.68

A bathymetry survey of Killala Bay demonstrated that the seabed level at the Primary Discharge Point SW001 is located at an approximate level of -5m OD (Malin Head) and as such has significant cover at the mean spring low water tidal level.

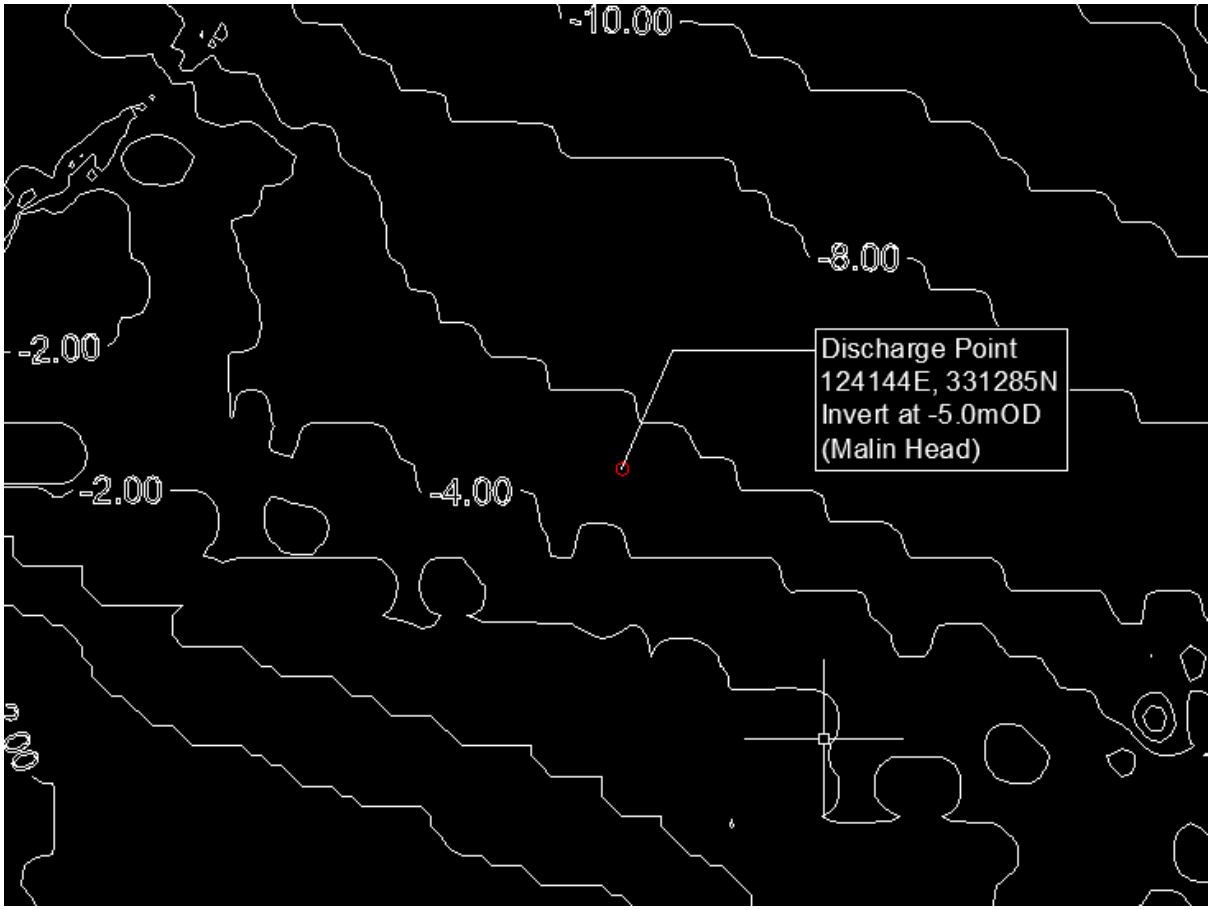

Figure 18-1: Bathymetry Survey Killala Bay