ATTACHMENT D.1:

MAP 8 - RECEIVING WATERS DESIGNATIONS

Mullaghanish to Musheramore Mountains SPA

The Gearagh SAC

The Gearagh SPA

The Gearagh pNHA

Lough Gal pNHA

Glashgarriff River pNHA

Shournagh Valley pNHA

Blarney Castle Woods pNHA

Blarney Lake pNHA

Lee Valley pNHA

Ballincollig Cave pNHA

Boylegrove Wood pNHA

Carrigdrohid Lake Waterbody

Inniscarra Lake Waterbody

L2758 R579 Grenagh L2 Donoughmore Ryvane Cross L2773 N20 R582 R579 R619 Matehy Aghabullogue R579 R582 County Cork Tower R579 Cloghroe N22 N22 R618 Macroom R584 R618 Dripsey R618 Coachford R618 R618 R579 Lee Valley pNHA R618 Ballincollig Regional Park Ballincollig R619 Ovens 3 N22 2 2 Ballincollig Cave pNHA N22 1 N22 Aherla L2218 L4603 Kilmurry Crookstown L2004 R585 R590 L4603 L2218 L2230 R585 L2011 R590 Crossbarry R589 L2008 R589 L2233 L2234 N71

N W E S

NOTES:

LEGEND

- AGGLOMERATION BOUDARY
- Operational Discharges
- SAC
- SPA
- PNHA
- SALMONID WATERS AS PER SAMONID REGULATIONS (S.I. 293 / 1988)

WFD WATERBODY STATUS (2016-2021) (ref.- catchments.ie)

- HIGH
- GOOD
- MODERATE
- POOR
- BAD

Location	Easting	Northing
SW001	145231	72297
SW005	145257	72497
SW006	145231	72297
SW007	145231	72297

SIGNED:

PRINT NAME:

POSITION:

DATE:

FOR UISCE ÉIREANN

Rev	Date	Description	Drn	Chk	App

LICENCE APPLICATION

CLIENT:

Uisce Éireann Irish Water

UISCE ÉIREANN
Colvill House,
24-26 Talbot Street,
Dublin 1
Tel. 1890 278 278 Web. www.water.ie

PROJECT:

COACHFORD
WASTE WATER DISCHARGE
LICENCE APPLICATION

TITLE:

MAP 8
RECIEVING WATER
DESIGNATIONS

SCALE 1:90,000

DRAWN J.Bhoy

DATE 11/12/2023

ATTACHMENT D.1

-

ATTACHMENT D.2:

ASSESSMENT OF IMPACT ON RECEIVING WATERS

ATTACHMENT D.2.1:

IMPACT ASSESSMENT REPORT
DECEMBER 2023

ATTACHMENT D.2.1: IMPACT ASSESSMENT REPORT, DECEMBER 2023

1. Introduction

This Report provides a summary of the Impact Assessments prepared to determine the impact of the discharges from the Coachford agglomeration on the receiving Inniscarra Lake Reservoir waterbody, and also addresses the criteria as outlined in **Section D.2** of the EPA guidance document.

2. Water Environment

The new Coachford WwTP discharges into the Inniscarra Reservoir (IE_SW_19_138) at 145231E, 72297N. The Inniscarra Reservoir is within the Lee, Cork Harbour, and Youghal Bay Catchment (Hydrometric Area 19). This catchment includes the area drained by the River Lee and all streams entering tidal water in Cork Harbour and Youghal Bay and between Knockaverry and Templebreedy Battery, Co. Cork, draining a total area of 2,153 km².

The draft 3rd cycle Catchment Report (2021) for this hydrometric area, determined that for river waterbodies excess nutrients remain the most prevalent issue, along with morphology, organic pollution, and hydrology. Pressures identified affecting the greatest number of waterbodies within Hydrometric Area 19 include hydromorphology, followed by agriculture, urban run-off, urban wastewater, domestic waste water, forestry, mines and quarries and industry. Coachford WwTP has not been listed as a significant pressure in At Risk waterbodies in the 2nd or draft 3rd cycle catchment assessment. The Inniscarra Reservoir is not listed as an area for action under the 3rd cycle.

The WFD status of the Inniscarra Reservoir is Good. There are no identified significant pressures for the Inniscarra Reservoir.

The Lee (Cork_090) which is fed by the Inniscarra Reservoir *ca.* 11km downstream of the operational discharges has a Good WFD status.

At RS19L030600 (NGR 157242E, 71016N), *ca*. 14km downstream of the discharge location in the Lee (Cork_090) waterbody the Q-value is 4 which corresponds to a '*Good'* biological river water quality.

Downstream of the WwTP primary discharge location *ca.* 1.3km, ambient monitoring is tested at LS190022800800020 (NGR 146156E, 71656N).

Recent downstream ambient monitoring data for the Inniscarra Reservoir (January 2022-October 2023) is shown in the table below.

Table D.2.1 - Ambient Monitoring – downstream monitoring results[1] (Data January 2022 – October 2023 [2] : Source: catchments.ie)

Parameter	pH	BOD	Ortho-P	Ammonia (N)	DO	TSS	Temp	Total Phosphorous
	pH unit	mg/l	mg/l	mg/l	% Sat	mg/l	°C	mg/l
Number of Samples	22	6	22	22	23	6	22	23
Max result	7.9	5.00	0.040	0.140	103.9	66.0	20.80	0.090
Min result	7.0	1.50	0.004	0.010	92.00	3.0	7.10	0.014
Average result	**7.53**	**2.27**	**0.010**	**0.047**	**99.03**	**20.17**	**13.43**	**0.029**

Parameter	pH	BOD	Ortho-P	Ammonia (N)	DO	TSS	Temp	Total Phosphorous
	pH unit	mg/l	mg/l	mg/l	% Sat	mg/l	°C	mg/l
*Mean EQS as per S.I. No. 77/2019 Good Status**	*6-9*			*≤0.065*				*≤0.025*
*95%ile EQS as per S.I. No. 77/2019 Good Status**	*6-9*			*≤0.140*				-
Overall compliance with relevant Mean EQS **Good Status ***	Yes			Yes				No
Overall compliance with relevant 95%ile EQS **Good Status ***	Yes			Yes				-

* EQS as per S.I. No. 77/2019
[1]Where data was reported as less than the limit of detection, 50% of the LOD was applied.
[2]Post commencement of operations of the new Coachford WwTP which was constructed as of Q4 2021

Based on recent water quality data for the Inniscarra Reservoir at the downstream ambient monitoring point from January 2022 – October 2023, the mean concentration for Ammonia is within the required EQSs for Good status (mean and 95%ile). However, the Total Phosphorous mean concentration is not compliant with relevant EQS for Good status (mean).

The Inniscarra Reservoir intersects the Lee River which is a WFD Designated Salmonid Waters under S.I. No. 293/1988. An ELV of 25 mg/l for Total Suspended Solids and Ammonia of 6.5mg/l have therefore been set in keeping with the protection required under the WFD for salmonid waters.

The River Lee, which drains Inniscarra Reservoir, is a *Margaritifera margaritifera* pearl mussel site. The National Parks and Wildlife Service (NPWS) were consulted with in relation to the status of the Freshwater Pearl Mussel (*Margaritifera margaritifera*) during the EPA's determination of the WWDL in 2015. It was concluded that "Good" WFD status is required to protect the Pearl Mussel. The completed new WwTP will satisfy all relevant regulatory requirements and the WwTP will be operated in line with the current EPA WWDL conditions. By applying the current EPA conditioned ELVs no significant impact on water quality in Inniscarra Reservoir as a result of the discharge from Coachford WwTP is anticipated (see **Attachment D.2.3**: Coachford Dispersion Model). Adhering to these limits will contribute towards the receiving water maintaining its "*Good*" current WFD status. This will ensure the protection of any downstream Freshwater Pearl Mussel populations.

There are no designated shellfish waters or bathing water located in the downstream vicinity of the operational discharges.

There are two drinking water abstraction points downstream of the operational discharges. These include 04000PUB1001 for the Lee Road Water Treatment Plant and 0500PUB3401 for the Inniscarra Water Treatment Plant. The 0400PUB1001 abstraction point is *ca.* 9.3km downstream of the primary discharge location and 0500PUB3401 is located *ca*. 9.7km downstream. Refer to **Section 5** below for further details.

The nearest pNHA/NHA hydrologically connected to the operational discharges is the Lee Valley pNHA (Site Code: 000094), located *ca*. 11.8km downstream of the agglomeration. However as noted above, it is considered that the operation of the WwTP and the operational discharges will not have a detrimental impact on the water quality of the Inniscarra/Lee Reservoir, or downstream Lee Valley.

There are no European sites immediately downstream of the operational discharges. The Cork Harbour SPA is *ca*. 30.2km downstream of the discharge location *via* the River Lee. The Great Island Channel SAC is *ca*. 34.8km downstream *via* the River Lee.

As per the Modelling Report and AA Screening prepared to support this application, it is considered that the water quality conditions in Inniscarra Reservoir will not be impacted as a whole, and the Good WFD status conditions downstream of the reservoir will be maintained, and therefore there is no likelihood of significant effects on the downstream designated habitats of Great Island Channel SAC, or the supporting wetland habitats of Cork Harbour SPA.

The Gearagh SPA (Site Code: 004109) and The Gearagh SAC (Site Code:000108) are the closest European sites to the Coachford agglomerations operational discharge location. These sites are located *ca*. 16.9km and 15.6km upstream of the agglomeration, respectively (*via* the River Lee (incl. Inniscarra and Carrigadrohid Reservoirs)).

The overall conservation objective for otter is to maintain their current favourable conservation condition in The Gearagh SAC. Given their wide foraging ranges, *ex-situ* otter associated with the SAC may rely to some extent on fish stocks in the Inniscarra reservoir, however given the level of treatment and compliance of the SWO's, the operation of the discharges from the agglomeration will not have any direct impact on the diversity, abundance or biomass of fish species and no direct/indirect effects to otter are predicted.

Ex-situ qualifying duck species associated with The Gearagh SPA, and also the Cork Harbour SPA, could use the Inniscarra reservoir occasionally, as there is likely to be interchange between these SPA populations and the reservoir is located between these two sites. The reservoir in the vicinity of the discharge however does not provide optimal habitat for large numbers these species due to the lack of shallow and semi-natural habitats. Furthermore, as for otter above, given the level of treatment and the compliance of the SWO's, the operation of the discharges from the agglomeration would not have any impact on the diversity, abundance, or biomass of foraging resources for these species and no direct/indirect effects to *ex-situ* qualifying interests are predicted.

Refer to **Section 4** below and **Attachment D.2.2** for a copy of the AA Screening Report for further details on the receiving environment.

Based on the above, it is considered that the operational discharges from the Coachford agglomeration will have no significant effects on the receiving aquatic environment, alone or in combination with other plans and projects.

3. Water Quality Dispersion Model

A Water Quality Dispersion Model Report, which has been prepared by Dr. Zeinab Bedri (TU Dublin) on behalf of UÉ, presents the findings of a desktop modelling study conducted to determine the distance (m) downstream of the effluent discharge from the new Coachford WwTP where the relevant EQSs for Ammonia (as N) and Total Phosphorus (as P), as set out in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (now S.I. No. 288 of 2022), will be met in Inniscarra Reservoir, using the proposed discharge effluent standards/ELVs and the WwTP 10-year design horizon p.e. of 1,400.

An assimilative capacity model analogous to the NUI Galway (NUIG) model was developed based on the advection/diffusion equations and was used to predict concentrations of two main water quality parameters (Ammonia and Total Phosphorus (TP)) in the receiving water (Inniscarra Reservoir lake) at a location downstream of the effluent discharge point.

This model was used to simulate a number of future discharge scenarios based on a 10-year horizon of 1,400 p.e. Simulations were performed to predict concentrations of TP and Ammonia in Inniscarra Reservoir corresponding to a future predicted effluent loading from the WwTP under a range of conditions (*e.g.,* varying ambient flow conditions, varying background levels of TP and Ammonia in the receiving water) in order to determine the distance downstream of the effluent discharge at which the relevant TP and Ammonia EQSs will be met.

For the Future Discharge Scenario, model inputs to reflect the upgraded Coachford design capacity of 1,400 p.e. (based on a 10-year design horizon) were used. For the purpose of the future discharge model, an average daily effluent discharge of 393.75 m^3/d was used. The average effluent flow is taken as 1.25*DWF. The DWF was estimated based on the p.e. of 1,400 and an assumed design flow per capita of 225 litres/day. The future discharge scenario was used to predict i) the width of the plume and (ii) the distance from of the emission point at which the EQS concentrations of TP and Ammonia were achieved.

Model Results

TP

The mean background concentration for TP (period 2019-2022) was 0.024mg/l and therefore approximately equal to the mean EQS Standard of TP (0.025 mg/). Therefore, it was not possible to perform a simulation in which the background concentration of TP was set to the mean observed value of 0.024 mg/l, and consequently only a notionally clean approach was used in which the background concentration of TP was set to 0.002 mg/l (corresponding to one-fifth of the EQS concentration for High Status, based on mean concentrations).

The results of the TP model show that the mean EQS for Good Status was met at a distance 21m downstream of the primary discharge point, a distance that is significantly below the defined mixing length of 662m. The results indicate that the TP mean EQS for Good Status is achieved within the periphery of the mixing zone. The results also shows that the estimated plume width was 2.6m, approximately 1% of the lake width at the discharge location. The area of the plume, approximated as an oval, was 0.004% of the total area of Inniscarra Lake.

Ammonia

The mean background concentration for Ammonia, 0.045g/l, is less than the mean EQS for Ammonia (0.065 mg/). Therefore, a background concentration based on two approaches were adopted: (i) a notionally clean approach in which the background concentration of Ammonia was set to 0.008 mg/l (corresponding to one-fifth of the EQS concentration for High Status, based on mean concentrations), and (ii) a mean background concentration of 0.045 mg/l.

Simulations Results based on a Mean Ambient Flow Conditions:

The results show that for the proposed effluent discharge standard/ELV of 6.5 mg/l and using the notionally clean approach, the mean EQS for Ammonia was met at a distance of 45m downstream of the primary effluent point.

Based on the mean background concentration, the mean EQS for Ammonia was met at 303m downstream of the primary discharge point. These results indicate that the distance at which the EQS is met increased with the increase in background concentration, and therefore highlights the effect of the ambient/background concentration on the assimilative capacity of the receiving water body (Inniscarra Reservoir). Nevertheless, both distances were below the defined mixing length of 662m indicating that the Ammonia mean EQS for Good Status was achieved within the periphery of the mixing zone under both the notionally clean background concentration and the average measured background concentration.

The estimated plume width for the notionally clean approach was 5.6m, whereas for the scenario based on the average measured background concentration, the estimated width was 15.9m. Consequently, the plume footprint for the notionally clean approach, estimated as the ratio of the plume area to the total lake area (%), was 0.02%, a percentage that is significantly less than the footprint resulting from the scenario in which the background concentration is based on the average measured concentration (0.31%).

Simulations Results based on the 95th percentile Ambient Flow Conditions.

The results show that for the proposed effluent discharge standard/ELV of 6.5 mg/l and using the notionally clean approach, the 95th percentile EQS for Ammonia was met at a distance 247m downstream of the primary effluent discharge point. Based on the mean background concentration, the 95th percentile EQS for Ammonia is met at a distance of 477m downstream of the primary effluent point. Both distances are below the defined mixing length of 662m indicating that the Ammonia 95%ile EQS for Good Status is achieved within the periphery of the mixing zone under both the notionally clean background concentration and the average measured background concentration.

The estimated plume width for the notionally clean approach under the 95%ile flow conditions, was 25.5m, whereas for the scenario based on the average measured background concentration, the estimated width was 35.4m. The plume footprint for the notionally clean approach, estimated as the ratio of the plume area to the total lake area (%), was 0.41%, a percentage that is significantly less than the footprint resulting from the scenario in which the background concentration was based on the average measured concentration (1.1%).

Summary

Model predictions indicate that the mean EQS for TP (Good Status) will be met at a distance of 21m downstream of the primary discharge point (within the periphery of the mixing

zone), and therefore the proposed effluent discharge standard/ELV of 1.2 mg/l for TP is compatible with the achievement of the WFD objectives.

The predictions also indicate that both mean and 95th percentile EQS for Ammonia (Good Status) will be met within the periphery of the mixing zone and therefore the proposed effluent discharge standard/ELV of 6.5 mg/l for Ammonia will also be compatible with the achievement of the WFD objectives.

It can therefore be concluded, based on a TP effluent standard/ELV of 1.2mg/l and an Ammonia effluent standard/ELV of 6.5 mg/l, that Inniscarra Lake will have the capacity to accommodate the proposed discharge from the new Coachford WwTP without causing a breach in relevant standards set out in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (now S.I. No. 288 of 2022), and that the proposed discharge is compatible with the achievement of the WFD objectives.

Refer to **Attachment D.2.3** for a copy of the Coachford Dispersion Model.

4. Appropriate Assessment Screening

An Appropriate Assessment (AA) Screening Report was prepared in December 2023 to accompany this WWDL review application. This Report will enable the EPA as competent authority to conduct an Appropriate Assessment (AA) Screening Determination, for the purposes of the European Union (Waste Water Discharge) Regulations 2007 to 2020.

The Appropriate Assessment (AA) Screening of the operational discharges assessed whether the discharge activity, alone or in combination with other plans and projects, are likely to have significant effects on a European Site(s) in view of best scientific knowledge and the conservation objectives of the site(s).

On the basis of the information set out in the AA Screening, and documentation referenced therein, the likelihood of significant effects to Cork Harbour SPA, Great Island Channel SAC, The Gearagh SAC and The Gearagh SPA, and any other European Sites, can be excluded, and a Stage Two Appropriate Assessment is not required.

Refer to **Attachment D.2.2:** AA Screening, December 2023.

5. Drinking Water Risk Assessment Report

As note above there are two drinking water abstraction points downstream of the operational discharges. These include 04000PUB1001 for the Lee Road Water Treatment Plant and 0500PUB3401 for the Inniscarra Water Treatment Plant. The 0400PUB1001 abstraction point is ca. 9.3km downstream of the primary discharge location and 0500PUB3401 is located ca. 9.7km downstream. Based on the Drinking Water Risk Assessment completed to inform this licence review the overall risk from the Coachford agglomeration operational discharges can be classified as *'Low Risk'*. Drinking water quality is unlikely to be impacted during normal and abnormal operational conditions. This has been based on the high level of dilution in the receiving waterbody, the level of treatment and unintended discharges prevention measures at the new WwTP, the design and operation of the overflows, and the distance to the downstream abstraction points.

Based on the results of this desk top study, it can be determined that no further Drinking Water Risk Assessment analysis of the discharge is required.

Refer to **Attachment D.2.5:** Drinking Water Risk Assessment Report, December 2023.

6. Priority Substance Assessment Report

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge (SW001) has been carried out to inform this WWDL application. Estimated data from the PRTR reporting tool was used to inform this desktop assessment. The assessment considered the primary discharge 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 after dilution 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 effluent discharge to the Inniscarra Reservoir, 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).

Based on the results of this desk top study, it can be determined that no for further analysis of the discharge, based on the Guidance on the Screening for Priority Substances for Waste Water Discharge Licences issued by the EPA, is required.

This Report is contained in **Attachment D.2.4**: Priority Substance Assessment Report, November, 2023.

7. Environmental Impact Assessment

An Environmental Impact Assessment (EIA) Screening Report (December 2023) has been prepared to form an opinion as to whether or not the operational activities from the Coachford agglomeration (*i.e.,* the operational discharges from the Coachford agglomeration in so far as they relate to the risk of environmental pollution of the receiving waters, the Inniscarra Reservoir, should be subject to Environmental Impact Assessment (EIA) and if so, whether an Environmental Impact Assessment Report (EIAR) should be prepared in respect of it.

Based on the information as contained in the EIA Screening Report (refer to **Attachment B.5**), it is Uisce Éireann's opinion that there is no significant and realistic doubt in regard to the likelihood of significant effects on the environment arising from the operational discharges from the Coachford agglomeration in so far as they relate to the risk of environmental pollution of the receiving waters) and it is considered that an EIA is not required for the authorisation to which this application relates by virtue of its nature, size and location.

8. Shellfish Waters

There are no designated shellfish waters located in the downstream in the vicinity of the discharges.

9. Bathing Waters

There are no designated bathing waters on any of the receiving waters downstream of the WwTP.

10. River Flow Estimation

Not Applicable as a lake.

11. Combined Approach

The Waste Water Discharge Authorisation under 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.

The design of the WwTP is less than 2,000 p.e. and is therefore in line with Article 7 of the directive, "*Member States shall ensure that, by 31 December 2005, urban waste water entering collecting systems shall before discharge be subject to appropriate treatment as defined in Article 2 (9)". Article 2(9) states that " 'appropriate treatment' means 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*".

The proposed effluent standards for the new WwTP shall give effect to the principle of the Combined Approach as defined in Waste Water Discharge (Authorisation) Regulations, 2007 to 2020 in that they accommodate the Urban Waste Water Regulations and the relevant status/designations of the receiving waterbody, the Inniscarra Reservoir.

12. Compliance with Relevant National or EU Legislation

As per **Attachment B.6**, the Coachford WwTW have been designed to ensure that the emissions from the agglomeration will comply with, and will not result in the contravention of, EU Legislation and National Regulations.

The proposed effluent discharge standards (*i.e.,* BOD 25mg/l, Total Suspended Solids 25mg/l, Total Ammonia 6.5mg/l and Total Phosphorous 1.2mg/l), the design of the overflows and the upgrades to the WwTP network, will ensure that the operational discharges from the agglomeration (i) will not cause negative impacts to the Inniscarra Reservoir and its water quality, (ii) contribute towards maintaining the "*Good"* WFD status in accordance with the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. No. 77 of 2019) and (iii) will ensure that there is no environmental likely risk posed to the receiving water environment as a result of the discharges from the agglomeration.

Based on the above, the new WwTP will have a positive impact in terms of reduction in the levels of nutrients being discharged into the Inniscarra Reservoir. The discharge activities will not cause a deterioration in the chemical status in the relevant receiving waterbody and will not compromise the achievement of the objectives and EQSs established for any water dependant species and natural habitats, or any other designations.

13. Data Sources

The following data sources were used to complete this application.

- Online data available on held by the NPWS, the EPA, NIEA and Uisce Éireann:
    - www.npws.ie
    - epawebapp.epa.ie
    - gis.epa.ie/EPAMaps
    - https://gis.daera-ni.gov.uk/arcgis/apps/webappviewer/
    - catchments.ie
- GIS data for European site boundaries obtained in digital format online from European Environmental Agency
- Uisce Éireann/Cork County Council Monitoring & Sampling Data

14. Mixing zone or transitional areas of exceedance

Not applicable.

15. Dilutions and retention times for lakes

Based on the 95%ile Lake Flow (2.82 m^3/s) measured at the Inniscarra Hydrometric Gauges ESB Station Number: 19094 (*ca*. 10.8km downstream stream of primary discharge) and the Coachford WwTP DWF (315 m^3/d), there are 773.5 dilutions estimated immediately in the proximity of the discharge point (SW001).

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

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

17. Groundwater Details

Not applicable. No discharge to ground waters.

18. High Status Waterbodies

No High-Status waterbodies are downstream of the operational discharges.

19. Fresh Water Pearl Mussels

Refer to **Section 2** above. The River Lee, which drains Inniscarra Reservoir, is a *Margaritifera margaritifera* pearl mussel site. The new WwTP will satisfy all relevant regulatory requirements and will be operated in line with the current EPA WWDL conditions. By applying the current EPA conditioned ELVs no significant impact on water quality in Inniscarra Reservoir as a result of the discharges from Coachford WwTP is anticipated (see **Attachment D.2.3**: Coachford Dispersion Model Report).

Adhering to these limits will contribute towards the receiving water maintaining its "*Good*" current WFD status. This will ensure the protection of any downstream Freshwater Pearl Mussel populations.

20. Impacts on Transboundary / Territory of other States

The operational discharges to which this application relates will not result in transboundary impacts or impacts on the territory of other states.

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

Not applicable. Discharge is not to coastal water.

ATTACHMENT D.2.3:

DISPERSION MODELLING REPORT DECEMBER 2023

Dispersion Model of Wastewater Discharges from Coachford WwTP - Assessment of the Assimilative Capacity of Inniscarra Lake

Prepared by: Dr. Zeinab Bedri

Lecturer, School of Transport and Civil Engineering, TU Dublin City Campus

08th December 2023

1. Introduction

This report presents the findings of a desktop modelling study conducted by Dr. Zeinab Bedri (TU Dublin) on behalf of Uisce Éireann to inform the Coachford Waste Water Discharge Licence (WWDL) Review Application to the EPA.

The study aims to determine the downstream distance (in metres) from the effluent discharge point of the new Coachford Waste Water Treatment Plant (WwTP) where the relevant Environmental Quality Standard (EQSs) for Ammonia (as N) and Total Phosphorus (as P), as outlined in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (now S.I. No. 288 of 2022), will be met in Inniscarra Lake, Co. Cork.

This assessment is based on the currently licenced discharge Emission Limit Values (ELVs) under WWDL Licence Register Number: D0427-01 (i.e., the effluent discharge standards proposed under the WWDL application review), and the proposed primary discharge based on a 10-year design horizon load of 1,400 p.e.

The report provides the following information:

- Characterisation of flow and water quality of the receiving waters
- Description of the Water Framework Directive (WFD) status of receiving and downstream waterbodies
- Description of the assimilative model
- Model application to the study area and results
- Overall conclusion

2. Background

Wastewater from the Coachford agglomeration is treated at a new WwTP at NGR 146003E, 073146N. Prior to the construction of the new WwTP, Coachford village was served by a sewerage collection system which transferred flows to a single crossflow primary settling tank. This settling tank also served as a septic tank which was consistently overloaded and with limited aeration, providing minimal to no effective treatment.

Construction of new WwTP (1,600 p.e., 30-year design horizon & 1,400 p.e. 10-year design horizon) and associated upgrade works were completed during the last quarter of 2021 in order to ensure compliance with Condition 1.7 of the WWDL – Licence Register Number:

D0427-01 issued by the EPA in accordance with the Waste Water Discharge (Authorisation) Regulations (S.I. No. 684 of 2007) on the 4th of December 2015 [1]. Schedule A1 of the licence includes the following ELV's which are being implemented at the new Coachford WwTP (see **Table 1**).

Table 1: Coachford Current Emission Limit Values (ELVs) /Proposed Effluent Discharge Standards of WWDL Review

Parameter	ELV	Units
pH	6-9	pH units
BOD, 5 days with Inhibition (Carbonaceous BOD)	25	mg/l
COD-Cr	125	mg/l
Suspended Solids	25	mg/l
Ammonia-Total (as N)	6.5	mg/l
Total Phosphorus (as P)	1.2	mg/l

The European Communities Environmental Objectives (Surface Water) Regulations, 2009 as amended (now S.I. No. 288 of 2022) has set environmental quality objectives for lakes for Ammonia and Total Phosphorus (TP) but not for Biochemical Oxygen Demand (BOD). BOD is not a physicochemical parameter used to measure lake quality. However, the ELVs of 25 mg/l for BOD (and 125mg/l for COD) were set in order to achieve compliance with the Urban Wastewater Treatment Directive 91/271/EEC (UWWTD).

During their determination of D0427-01, the EPA examined the impact of the above tabled ELVs on the water quality of the receiving water using an assimilative capacity model developed by NUI Galway. This model used an average effluent discharge rate of 178 m^3/day reflecting a predicted capacity of 990 p.e. at that time. The new WwTP has a design capacity of 1,600 p.e (30-year design horizon) and a 10-year design horizon load of 1,400 p.e. The current total agglomeration collected load is 665 p.e (see the 2022 Annual Environmental Report [2]).

Given the increase in p.e. since the determination of D0427-01 in 2015, it is necessary to predict the impact of the increased effluent loading from the new Coachford WWTP on the receiving water in order to inform this WWDL review application. An assimilative capacity model analogous to the NUI Galway (NUIG) model was developed in this study based on the advection/diffusion equations by Fischer *et al*. [3]. The developed model was used to predict concentrations of two main water quality parameters (Ammonia and Total Phosphorus (TP)) in the receiving water (Inniscarra lake) at a location downstream of the effluent discharge point.

The performance of the developed model was first assessed using observed data sets. Here the model was used to simulate effluent loadings measured on selected dates during the years 2021 and 2022. Then the simulated concentrations of Ammonia and TP at a location downstream of the primary discharge point (Site 2 in **Figure 1**) was compared with the measured concentrations at the same location. Following the assessment of its performance, the model was then used to simulate a number of future discharge scenarios based on the

10-year horizon p.e. of 1,400. Here simulations were performed to predict concentrations of TP and Ammonia in Inniscarra Lake corresponding to 10-year horizon predicted effluent loading from the WwTP under a range of conditions (*e.g.*, varying ambient flow conditions, varying background levels of TP and Ammonia in the receiving water) in order to determine the distance downstream of the effluent discharge at which the relevant TP and Ammonia EQSs will be met.

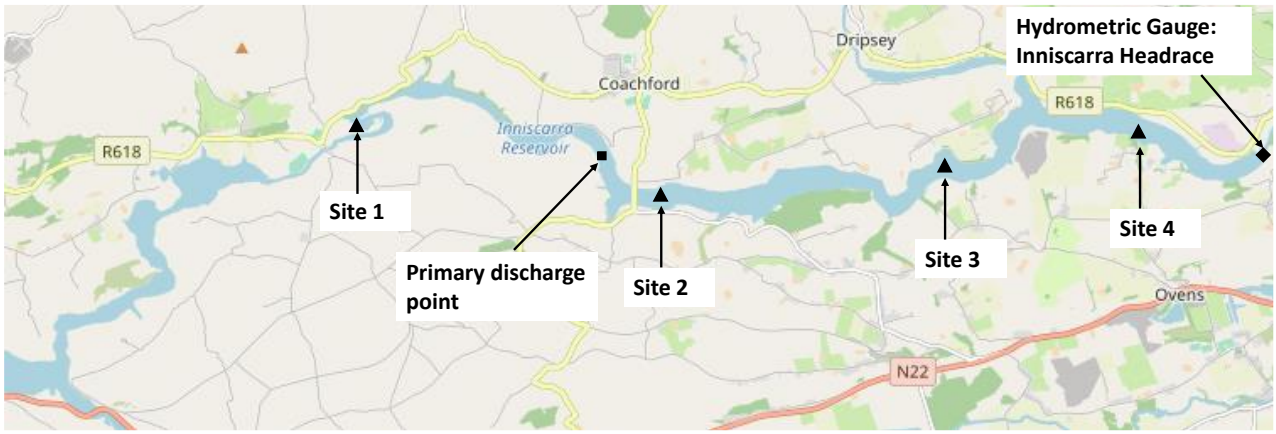

Figure 1: Study area – showing WwTP primary discharge location, Ambient Monitoring Locations, and the ESB hydrometric Station at Inniscarra Dam Headrace

3. Characterisation of Flow and water quality of Inniscarra Lake

This section discusses the flow regime in Inniscarra Lake as well as the lake water quality status. In **Section 3.1**, characterisation of the flow regime in the lake is provided and **Section 3.2** below offers an analysis of the available water quality data recorded at four monitoring stations (both upstream and downstream of the Coachford WwTP primary discharge point). Furthermore, the effluent loading from Coachford WwTP into Inniscarra Lake were reviewed.

It is important to highlight here that the functioning and significance of any Storm Water Overflows/Emergency Overflows and their impacts on the receiving environment are outside the scope of this study and therefore have not been dealt with herein.

3.1 Characterisation of flow regime

In order to characterise the flow regime in Inniscarra lake, hydrometric data for Inniscarra dam headrace station was requested from the Electricity Supply Board (ESB). An hourly time series of estimated flow at the Inniscarra dam headrace (**Figure 1**) was provided for a 10-year period (January 2012 – August 2022). The flow estimates are based on water level readings from staff gauges that form part of the ESB hydrometric network. An assessment of the data at Inniscarra dam headrace indicated a mean flow of 29.81 m^3/s and a 95^{th} percentile flow of 2.82 m^3/s.

3.2 Lake water quality

At the time the EPA were assessing the licence in 2015, the status of Inniscarra Lake under the Waterbody WFD Assessment (2013-2018) was '*Moderate*' [1]. According to the most recent Lake WFD assessment (reporting period 2016-2021), the water quality Status has

improved to '*Good*' [4]. The assessment of the Lee River (downstream of Inniscarra Reservoir has also shown an improvement in the River WFD Status from '*Moderate*' (2013-2018) to '*Good*' (2016-2021).

A number of ambient monitoring stations are situated both upstream and downstream of the Coachford WwTP primary discharge point (see **Figure 1**). These are managed by the EPA under the Water Framework Directive – Rivers and Lakes Water Body monitoring programme [5]. For the purpose of this study, water quality data from monitoring station "*Site 1*", located approximately 4 km upstream of Coachford WwTP primary discharge point, "*Site 3*" and "*Site 4*" (located approximately 5.8 and 9 Km respectively downstream of the discharge location) were averaged to establish background levels of TP and Ammonia. The water quality data from "*Site 2*", located approximately 1.4 km downstream of the primary discharge point, was used for the purpose of assessing the lake water quality downstream of the effluent discharge point.

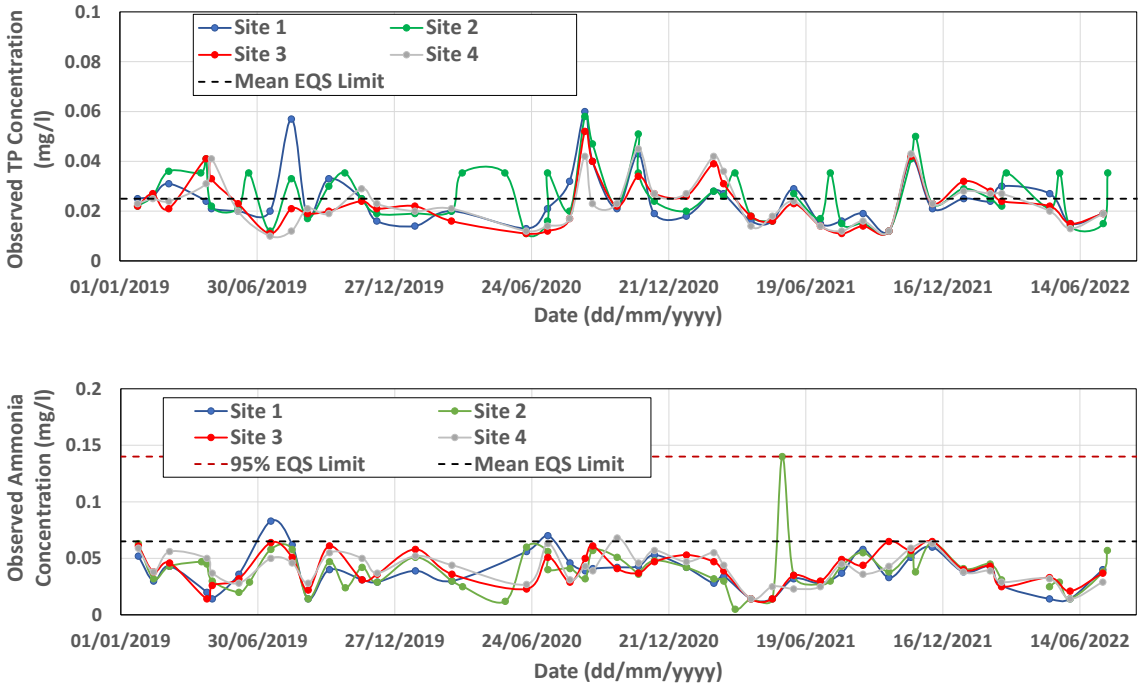

Figure 2: Results of EPA ambient Monitoring at Locations: Site 1, Site 2, Site 3 and Site 4 over the period 2019-2022

Figure 2 above shows concentrations of Ammonia and TP measured at Site 1, Site 2, Site 3, Site 4 over the period 2019-2022 [5]. The results show that many samples at all four sites have exceeded the TP EQS of 0.025 mg/l for "*Good*" Status. The sampling results of Ammonia has shown that a small number of samples at the four sites have exceeded the mean EQS of 0.065 mg/l for '*Good*' Status (**Figure 2**). Data also shows that most measurements of Ammonia concentration at the four sites are well below the 95th percentile EQS of 0.14 mg/l.

The results in **Table 2** below indicate that the mean and median of TP concentration at all monitoring sites are below or equal the mean TP EQS of 0.025 mg/l for Good Status except for the mean concentration at "*Site 2*" (*i.e.,* 0.027mg/l). The mean, median and 95th percentile

concentrations at all four monitoring sites are below the mean Ammonia EQS of 0.065 mg/l for Good Status.

Table 2: Summary of Results of Ambient Monitoring at over the period 2019-2022

Site	Total Phosphorus (TP)			Ammonia concentration (mg/l)		
	Mean (mg/l)	Median (mg/l)	95%ile (mg/l)	Mean (mg/l)	Median (mg/l)	95%ile (mg/l)
Site 1	0.025	0.021	0.013	0.038	0.039	0.014
Site 2	0.027	0.025	0.012	0.04	0.038	0.014
Site 3	0.024	0.022	0.011	0.04	0.04	0.014
Site 4	0.023	0.023	0.012	0.042	0.043	0.023

3.3 Effluent discharges

Coachford WwTP discharges to Inniscarra Lake at NGR 145231E, 72297N (**Figure 1**). The primary discharge is subject to the ELV's as set out in EPA Wastewater Discharge Licence D0427-01 and summarised in **Table 1**.

In **Table 3** below, the annual mean concentrations of BOD, COD, SS, Ammonia and TP (the main effluent water quality parameters) for the period 2019-2022 are shown. For 2019 and 2020 the annual mean concentrations exceeded the ELVs set in **Table 1**. **Table 3** shows that the mean concentrations of all parameters in 2021 and 2022 have complied with the ELV limits set in the WWDL. The exceedance of the annual mean concentrations to the ELVs in the years 2019 and 2020 can be attributed to the lack of adequate wastewater treatment prior to the construction of the new WwTP. However, the effluent water quality has significantly improved following the completion of the new WwTP (as demonstrated by the mean annual concentrations in 2021 and 2022).

Table 3: Coachford Effluent water quality monitoring - Annual mean concentrations ([2],[6], [7], [8]).

Year	BOD (mg/l)	COD (mg/l)	SS (mg/l)	Ammonia (as N) (mg/l)	TP (as P) (mg/l)
2022	3.52	20	10	0.231	0.397
2021	4.15	17	11	1.9	0.104
2020*	50.08	142.98	42.75	14.8	2.0
2019*	65.03	135	38.83	11.57	1.83

**Prior to new WwTP*

4. Assimilative Capacity Model

4.1 Introduction

Compliance with EQSs, as required by Directive 2008/105/EC [9] is an essential consideration, when deciding appropriate regimes for wastewater and effluent treatment. Discharge control regimes are normally designed to ensure that a Contaminant of Concern (CoC) in the receiving water does not exceed the EQS. If, however, the concentration in the effluent is greater than the EQS there will be a "*permissible"* zone of EQS exceedance, "*mixing zone*", in the vicinity of the point of discharge.

The Technical Guidelines for the Identification of Mixing Zones, pursuant to Art. 4(4) of the Directive 2008/105/EC [10] adopts an approach in which dimensions of the "*mixing zone"* (permissible zone of EQS exceedance) must be estimated to judge whether the concentration of CoC in an effluent discharge is acceptable. Such an assessment usually requires the use of a simple model (e.g., the Discharge Test Tool) that computes the size of the mixing zone and determines the distance downstream of the discharge location at which the relevant EQSs for the CoCs are met.

The contaminants of concern in this study are TP and Ammonia. The following section describes the "*Discharge Test Tool*", which was used to: (i) estimate the dimensions of the mixing zone, and (ii) determine the distance downstream of the primary discharge location of Coachford WwTP at which the EQSs of Ammonia and TP will be met.

4.2 Discharge Test Tool

The Discharge Test Tool was prepared as part of the Technical Guidelines for the Identification of Mixing Zones [10] to assist Member States in assessing the acceptability of mixing zones resulting from discharges into surface waters. The tool is based on the Fischer Equations [3] which calculates the dilution of an effluent as a function of distance from the discharge point. The tool provides a simple approximation of the dimension of the mixing zone based on the dimensions of the water body , and the concentration of the CoC based on information about the discharge and receiving water body (see **Figure 3**).

The Discharge Test Tool [11] was developed and validated by comparing its runs with observed data to ensure that the system does not under-predict effects. The simplifications that this tool considers for the water body imply that the concentrations are overestimated, so that discharges that meet the standards according to the tool will not require a more detailed investigation.

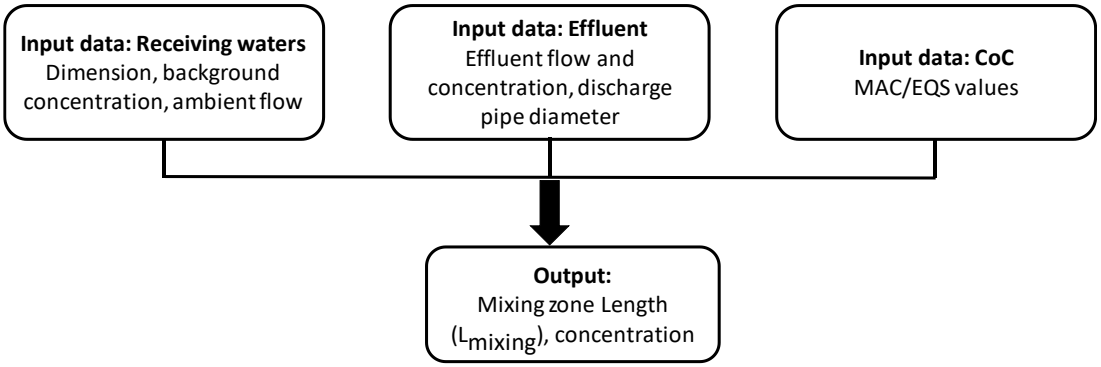

Figure 3: Illustration of Discharge Test tool used in Mixing Zone Assessment

However, due to its simplicity, the Discharge Test tool may fail to capture a number of factors that influence mixing in a lake environment [10]. Some of these are discussed below:

- In lakes, the net flow of rivers and streams into the lake can be very small resulting in relatively poor mixing characteristics. On the other hand, local wind driven flows can stimulate mixing. Wind-induced mixing is not accounted for in the Discharge Test tool.
- Factors such as partition between suspended particulate matters and the water phase, degradation, evaporation etc. are not accounted for in the Discharge Test tool.

The above-discussed factors imply that the concentrations are overestimated and hence result in conservative predictions by the Discharge Test Tool.

In the current study, the dimensions of Inniscarra Lake (length, average width, and surface area), obtained from WWDL Inspectors Report [1], catchments.ie [5] and Google Earth [13]), were used to estimate the length of the mixing zone. This length (662m for Inniscarra lake) represents the distance downstream of the primary discharge point beyond which the Environmental Quality Standards (EQS) for Total Phosphorus (TP) and Ammonia should not be exceeded.

Following this, the performance of the Discharge Test Tool was assessed using site specific data from Inniscarra Lake. Also, future discharge scenarios were simulated to determine the distance at which the relevant EQSs will be met. Lake dimensions (average width, length, and surface area) were used to estimate the mixing length.

5. Model Application

The below sections describe model development and simulated scenarios using the Discharge Test tool. First, input data for the model was compiled from various sources including the Wastewater Discharge Licence Inspector's report (D0427-01)[1], D0427-01 Annual Evaluation reports [2],[6], Coachford WwTP Detailed Design Report [12], Google Earth [13], EPA maps [14] and EPA water quality monitoring data[5], as well as the ESB hydrometric network [15].

The compiled data was used to develop the following model scenarios:

(i) *Assessment of Model Performance*, representing discharge conditions of the existing wastewater treatment plant. Here effluent loadings on selected dates in 2021 and 2022 were simulated and the resulting concentrations of TP and Ammonia in Inniscarra Lake were compared with measured data for the purpose of model assessment, and

(ii) (ii) *Future discharge scenarios* based on the predicted population equivalent of 1,400 (10-year horizon). Here simulations were performed to predict concentrations of TP and Ammonia in Inniscarra Lake corresponding to the future predicted average daily effluent flowrate from the WwTP under a range of conditions (*e.g.,* varying ambient flow conditions in the lake).

5.1 Assessment of Model Performance

The model was developed using collected data on selected dates over the period October 2021 – July 2022. The inputs to the model included: (i) Effluent loading (effluent discharge and concentrations of TP and Ammonia) from Coachford WwTP on selected dates (see **Table 4**). These were obtained from Uisce Éireann [2],[6], (ii) Ambient water flow on the selected dates was obtained from the daily flow record provided by the ESB hydrometric network [15], (iii) Ambient concentrations of TP and Ammonia in Inniscarra Lake– these were obtained from EPA water quality monitoring programme [5]. The background concentrations were estimated by averaging TP and Ammonia concentrations at Site 1, Site 3, and Site 4. Measured concentrations of TP and Ammonia at Site 2 were used for the purpose of model assessment.

Another input to the model constitutes the lake dimensions (average width, depth, length, and surface area). These were obtained from the WWDL Inspectors Report [1] and confirmed by measurements taken from Google Earth [13]. Finally, the diameter of outfall pipe (450 mm) was obtained from the Coachford WwTP Detailed Design Report [12].

Table 4: Assimilative Capacity Model of Inniscarra Lake – Assessment Model: Model inputs

Date	Effluent			Ambient Flow in lake (m^3/s)
	TP conc (mg/l)	Ammonia Conc (mg/l)	Flow (m^3/d)	
06/10/2021	0.12	3.1	134	38.47
10/11/2021	0.06	0.2	477	32.21
09/03/2022	0.27	0.2	866	44.34
18/05/2022	2.19	0.5	253	9.1
20/07/2022	0.63	0.6	129	3.14

Measurements of TP and Ammonia at Site 2 (located *ca*. 1.4 km downstream of the primary discharge point (**Figure 1**)) were taken on the dates shown in **Table 4** above. The model was run to replicate the conditions (effluent loading, ambient flow, and background concentration) on the dates shown in **Table 4**. Model outputs, TP and Ammonia concentrations at a distance 1.4 km from the primary discharge point, were compared with measured TP and Ammonia concentrations at Site 2 (See **Table 5** below).

Table 5: Assessment model: Model outputs Vs measurements at Site 2

Date	Measured concentrations Site 2		Simulated concentrations 1400m d/s of discharge point	
	TP (mg/l)	Ammonia (mg/l)	TP (mg/l)	Ammonia (mg/l)
06/10/2021	0.012	0.038	0.012	0.034
10/11/2021	0.050	0.038	0.041	0.0512
09/03/2022	0.035	0.014	0.0303	0.0262
18/05/2022	0.035	0.029	0.0298	0.0155
20/07/2022	0.035	0.057	0.018	0.042

Results of the dispersion model (**Table 5**) showed very good agreement to TP measurements at Site 2 (**Figure 5**). To assess the accuracy of fit between simulated and measured TP concentrations, the Root Mean Square of Errors (RMSE) was calculated. The RMSE between the measured and simulated concentrations of TP at Site 2 was 0.0094 mg/l. A low RMSE (close to 0.0) signifies an accurate fit between simulated and measured concentrations. It can be noted, however, that the model has slightly underestimated measured TP concentrations on some dates in **Table 5**.

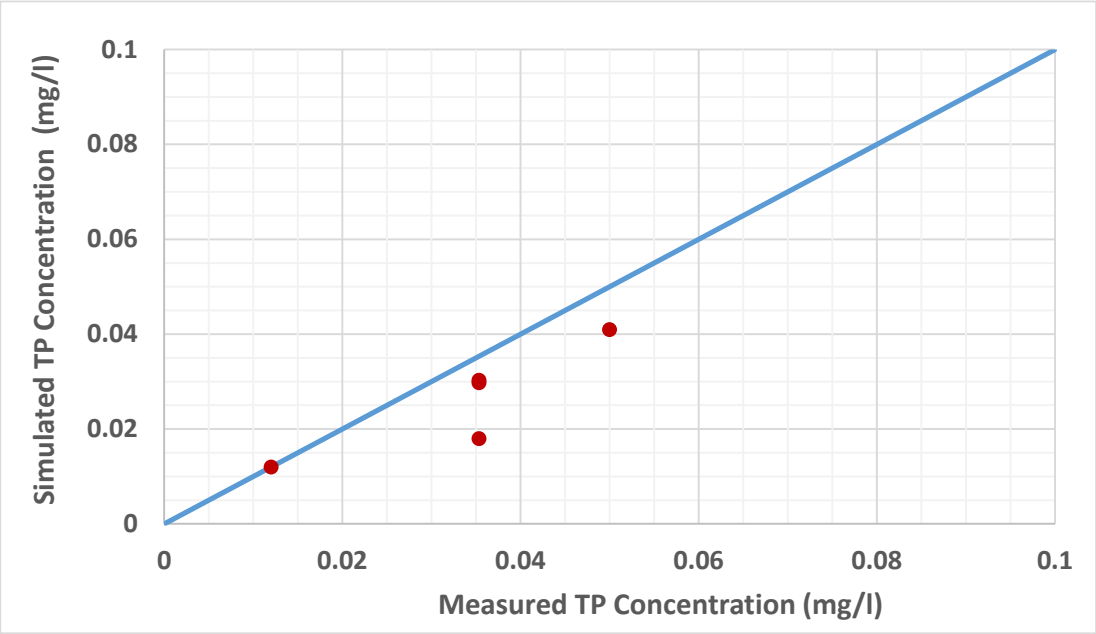

Figure 5: Comparison of measured and simulated concentrations of TP – Assessment model

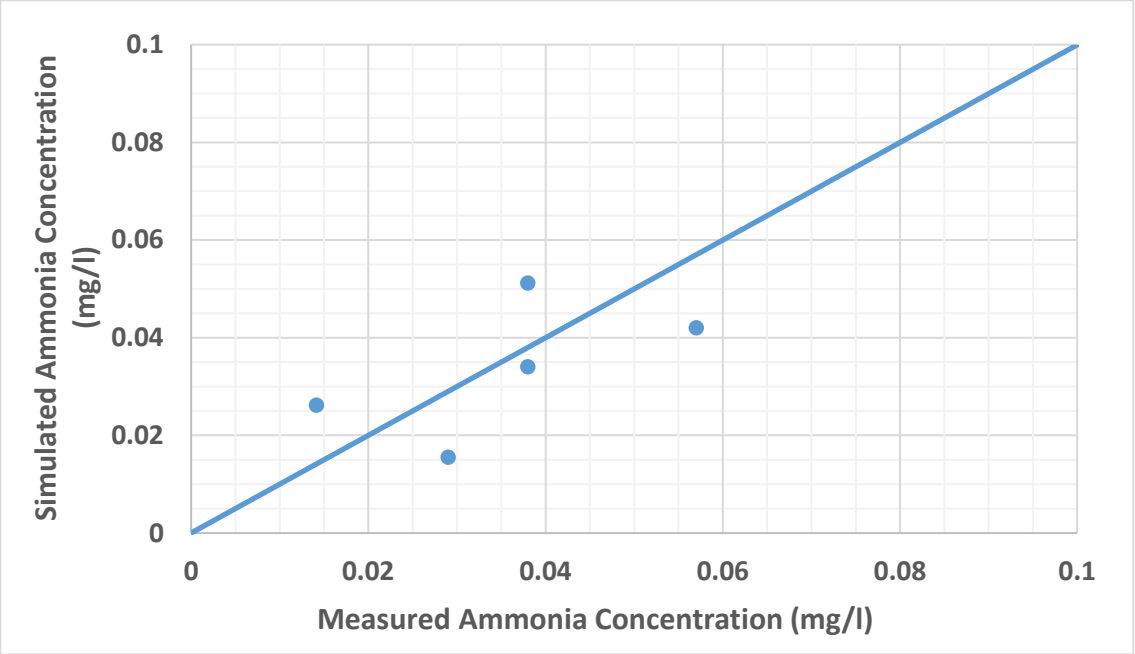

Figure 6: Comparison of measured and simulated concentrations of Ammonia – Assessment model

Results of the Ammonia model also demonstrated a good agreement between simulated and measured concentrations at Site 2 (**Figure 6**). The calculated RMSE between the simulated and measured Ammonia concentrations at Site 2 was 0.012 mg/l. Similar to the results of TP model, this also indicates a good fit between simulated and measured Ammonia concentrations. However, there are some outliers; the Ammonia model has both under- and overestimated measured concentrations.

Overall, the results of the above assessment show good agreement between measured and simulated TP and Ammonia at Site 2. Considering the satisfactory modelling results presented above, the model can serve as a valuable tool for predicting the impact of WwTP discharges into Inniscarra Lake.

5.2 Future Discharge Model

Since the completion of the new Coachford WwTP in Q4 2021, the plant has the capacity to cater for a population equivalent of 1,400 corresponding to a 10-year design horizon. For the purpose of the future discharge model, an average daily effluent discharge of 393.75 m^3/d was used. The average effluent flow was estimated as 1.25 times the Dry Weather Flow (DWF), the latter calculated based on the future design p.e. of 1,400 and an assumed design wastewater flow per capita of 225 litres/day [12],[16].

Simulations were performed to predict concentrations of TP and Ammonia in Inniscarra Lake corresponding to the future predicted average daily flowrate of 393.75 m^3/d under varying ambient flow conditions and background concentrations of TP and Ammonia. The model was used to predict: (i) the width of the plume and (ii) the distance from of the primary discharge point at which the EQS concentrations of TP and Ammonia were achieved. These predicted

distances were then compared to the length of the mixing zone (662m) that was estimated using the Discharge Test Tool (See **Section 4.2**).

Using the width and length of the plume, the surface area of the plume was estimated as an oval. Subsequently, this plume area was divided by the surface area of the lake (4.89 km^2) to derive an estimate of the plume footprint, expressed as a percentage of the total lake area.

5.2.1 Model inputs

The main inputs to the future discharge model (**Table 6**) include:

(i) Effluent loading of TP and Ammonia: the effluent loading was estimated based on the predicted average daily effluent flowrate of 393.75 m^3/d and concentrations of TP and Ammonia. The concentration of TP and Ammonia in the future effluent discharges was set to the currently licenced (WWDL D0427-01) primary discharge ELVs for TP (1.2 mg/l) and Ammonia of 6.5 mg/l (**Table 6**).

(ii) Ambient flow in Inniscarra Lake: The ambient flow was obtained from the flow data record at Inniscarra Lake Headrace (2012-2022). Two values were used in the simulations: a mean flow of 29.81 m^3/s and a 95^{th} percentile flow of 2.82 m^3/s [15].

(iii) Background concentrations of TP and Ammonia: for the purpose of the simulations, two approaches were adopted; (i) a notionally clean approach in which the concentrations were set to values that correspond to $1/5^{th}$ of the EQS concentration for High Status (based on mean concentrations), and (ii) mean background concentrations of TP and Ammonia in which the observed concentrations of TP and Ammonia taken over the years 2019 – 2022 at Site 1, Site 3, and Site 4 were averaged in order to establish mean background levels.

Table 6: Future discharge Simulations – Model Scenarios

Input	Value	Comment/Source
Average discharge (m^3/d)	393.75	Estimated as 1.25 DWF of the projected PE of 1,400
Ambient Flow (lake Inniscarra) (m^3/s)	29.81 (mean), 2.82(95%ile)	Average and 95^{th} percentile flow at Inniscarra Lake [15].
Background concentration: Notionally Clean approach (mg/l)	0.002 (TP) 0.008 (Ammonia)	Assuming a notionally clean lake, concentration estimated as 1/5 of the EQS for High Status (based on mean concentrations)
Background concentration: Observed mean concentrations (mg/l)	0.024 (TP) 0.045 (Ammonia)	observed concentrations of TP and Ammonia at Site 1, Site 3, and Site 4 were averaged over the period 2019-2022 in order to establish mean background levels.
Effluent concentration TP (mg/l)	1.2	Currently licenced (WWDL D0427-01) primary discharge ELV for TP [1]

Input	Value	Comment/Source
Effluent concentration Ammonia (mg/l)	6.5	Currently licenced (WWDL D0427-01) primary discharge ELV for Ammonia of 6.5 mg/l [1].
EQS for TP (mg/l)	0.025	S.I No. 77 of 2019 (for good status) based on mean concentrations
EQS for Ammonia (mg/l)	0.065, 0.14	S.I No. 77 of 2019 (for good status) based on mean and 95th percentile concentrations respectively

Using the above-described model inputs, simulations of the future discharge scenarios were performed. The model was used to predict the distance from the primary discharge point at which the EQS concentrations of TP (see **Section 5.2.2**) and Ammonia (see **Section 5.2.3**) were achieved.

5.2.2 Model Results– Distance downstream at which the Mean TP EQS was met

The mean background concentration for TP in **Table 6** above was 0.024mg/l and therefore approximately equal to the mean EQS Standard of TP (0.025 mg/). Therefore, it was not possible to perform a simulation in which the background concentration of TP was set to the mean observed value of 0.024 mg/l and consequently only a notionally clean approach was used in which the background concentration of TP was set to 0.002 mg/l (corresponding to one-fifth of the EQS concentration for High Status, based on mean concentrations). The results of the TP model (**Table 7**) show that the mean EQS for Good Status was met at a distance 21m downstream of the primary discharge point, a distance that is significantly below the defined mixing length of 662m. The results indicate that the TP mean EQS for Good Status is achieved within the periphery of the mixing zone. **Table 7** below also shows that the estimated plume width was 2.6m, approximately 1% of the lake width at the discharge location. The area of the plume, approximated as an oval, was 0.004% of the total area of Inniscarra Lake.

Table 7: TP model – Distance D/S of the discharge location (m) at which the Mean TP EQS for Good Status is met

Ambient Flow (m^3/s)	Discharge ELV (mg/l)	EQS (mean) mg/l	Background concentration (mg/l)	Distance at which mean EQS is met (m)	Plume width (m)	Plume area (m^2)	Plume footprint (% of the lake area)
29.81 (mean)	*1.2*	0.025	0.002 (notionally clean)	21	2.6	171.5	0.004

5.2.3 Model Results– Distance Downstream at which the Ammonia Mean and 95%ile EQSs were met

The mean background concentration for Ammonia, 0.045g/l, is less than the mean EQS for Ammonia (0.065 mg/). Therefore, as a background concentration the two approaches

(described in **Section 5.2.1**) were adopted: (i) a notionally clean approach in which the background concentration of Ammonia was set to 0.008 mg/l (corresponding to one-fifth of the EQS concentration for High Status, based on mean concentrations), and (ii) a mean background concentration of 0.045 mg/l (**Table 6**).

Table 8 below display the results of the Ammonia model under the two background concentrations discussed above. The simulations were based on a mean river flow of 29.81 m^3/s. The results show that for the currently licenced ELV of 6.5 mg/l and using the notionally clean approach, the mean EQS for Ammonia was met at a distance of 45m downstream of the primary effluent point. Based on the mean background concentration, the mean EQS for Ammonia was met at 303 m downstream of the primary discharge point. These results indicate that the distance at which the EQS is met increased with the increase in background concentration and therefore highlights the effect of the ambient/background concentration on the assimilative capacity of the receiving water body (Inniscarra Lake). Nevertheless, both distances in **Table 8** were below the defined mixing length of 662m indicating that the Ammonia mean EQS for Good Status was achieved within the periphery of the mixing zone under both the notionally clean background concentration and the average measured background concentration. The estimated plume width for the notionally clean approach was 5.6 meters (**Table 8**), whereas for the scenario based on the average measured background concentration, the estimated width was 15.9 meters. Consequently, the plume footprint for the notionally clean approach, estimated as the ratio of the plume area to the total lake area (%), was 0.02%, a percentage that is significantly less than the footprint resulting from the scenario in which the background concentration is based on the average measured concentration (0.31%).

Table 8: Ammonia model – Distance D/S of the discharge location (m) at which the Ammonia Mean EQS for Good Status is met.

Ambient Flow (m^3/s)	Discharge ELV (mg/l)	Mean EQS mg/l	Background concentration (mg/l)	Distance at which mean EQS is met (m)	Plume width (m)	Plume Area (m^2)	Plume footprint (% of the lake area)
29.81 (mean)	6.5	0.065	0.008 (notionally clean)	45	5.6	791.7	0.02
			0.045 (average measured)	303	15.9	15,135	0.31

The results in **Table 9** below correspond to the Ammonia model simulations in which 95th percentile ambient flow conditions were applied. These were compared against the 95th percentile EQS for Good Status. The background concentrations were set to a notionally clean concentration of 0.008 mg/l, and an average measured background concentration of 0.045 mg/l. The results show that for the currently licenced ELV of 6.5 mg/l and using the notionally clean approach, the 95th percentile EQS for Ammonia was met at a distance 247m downstream of the primary effluent discharge point. Based on the mean background

concentration, the 95th percentile EQS for Ammonia is met at a distance of 477 m downstream of the primary effluent point. Both distances in **Table 9** are below the defined mixing length of 662m indicating that the Ammonia 95%ile EQS for Good Status is achieved within the periphery of the mixing zone under both the notionally clean background concentration and the average measured background concentration.

Table 9: Distance D/S of the discharge location (m) at which the Ammonia 95th percentile EQS for Good Status is met.

Ambient Flow (m^3/s)	Discharge ELV (mg/l)	Mean EQS mg/l	Background concentration (mg/l)	Distance at which mean EQS is met (m)	Plume width (m)	Plume area (m^2)	Plume footprint (% of the lake area)
2.82 (95%ile)	6.5	0.14	0.008 (notionally clean)	247	25.5	19,787	0.41
			0.045 (average measured)	477	35.4	53,048	1.1

Similar to the results in **Table 8**, the results in **Table 9** indicate that the distance (downstream of the discharge point) at which the EQS is met increased with the increase in background concentration. This is because a higher background concentration limits the dilution/assimilative capacity of the receiving water body. Also similar to the results in **Table 8,** the estimated plume width for the notionally clean approach under the 95%ile flow conditions, was 25.5 meters, whereas for the scenario based on the average measured background concentration, the estimated width was 35.4 meters. The plume footprint for the notionally clean approach, estimated as the ratio of the plume area to the total lake area (%), was 0.41%, a percentage that is significantly less than the footprint resulting from the scenario in which the background concentration was based on the average measured concentration (1.1%).

6. Conclusion

A modelling study was conducted to assess the impact of the effluent discharge from the new Coachford WwTP (1,400 p.e, 10-year horizon), based on the proposed effluent discharges standards under this licence review (i.e., currently licenced discharge TP and Ammonia ELVs under WWDL Licence Register Number: D0427-01), on the water quality of Inniscarra Lake, and to specifically determine the distance downstream of the effluent discharge where the relevant TP and Ammonia EQS as set out in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (S.I No. 288 of 2022) will be met.

The model predictions indicate that the mean EQS for TP (Good Status) will be met under the proposed effluent standard/ELV of 1.2 mg/l for TP at a distance of 21m downstream of the discharge location.

The predictions also indicate that the mean and 95th percentile EQS for Ammonia (Good Status) will be met under the proposed effluent standard/ELV for Ammonia of 6.5 mg/l at a distance of 45m and 247m respectively (under the scenario in which a notionally clean background concentration was adopted), and 303m and 477m (under the scenario in which an average background concentration was used). All predicted distances are well below the defined mixing zone of 662m indicating that the Water Framework Directive Objectives will be met under the proposed effluent standards/ELVs for TP and Ammonia.

The results also indicate that the plume footprint was less than 1% in most simulations. Also, the maximum predicted plume width was 35.4 m (approximately 13 % of the lake width in the vicinity of the discharge outfall).

The results highlight the effect of the background concentrations on the assimilation of the effluent where a higher background concentration limits the dilution/assimilative capacity of the receiving water body.

7. Summary Conclusion

A modelling study was conducted to assess the impact of the effluent discharges from the new Coachford WwTP on the water quality of Inniscarra Lake. The main objective of the study was to investigate the assimilative capacity of Inniscarra Lake to accommodate the proposed primary discharge from the new 1400 p.e. WWTP based on the proposed effluent discharge standards/ELVs (as per the currently licensed (WWDL D0427-01) primary discharge ELVs) (**Table 1**) without causing a breach in relevant standards set out in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (S.I No. 288 of 2022) and ultimately to ensure that the currently licensed discharge ELVs are compatible with the achievement of the WFD objectives.

Model predictions indicate that the mean EQS for TP (Good Status) will be met at a distance of 21m downstream of the primary discharge point (within the periphery of the mixing zone) and therefore the proposed discharge standard/ ELV of 1.2 mg/l for TP is compatible with the achievement of the WFD objectives. The predictions also indicate that both mean and 95th percentile EQS for Ammonia (Good Status) will be met within the periphery of the mixing zone and therefore the proposed discharge standard/ ELV of 6.5 mg/l for Ammonia will also be compliant the objectives of the WFD.

It can therefore be concluded, based on a TP discharge standard/ELV of 1.2mg/l and an Ammonia discharge standard/ELV of 6.5 mg/l that Inniscarra Lake will have the capacity to accommodate the proposed discharge from the new Coachford WwTP without causing a breach in relevant standards set out in the European Communities Environmental Objectives (Surface Water) Regulations, 2009, as amended (now S.I. No. 288 of 2022), and that the proposed discharge is compatible with achievement of the WFD objectives.

8. References

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ATTACHMENT D.2.4:

PRIORITY SUBSTANCE ASSESSMENT REPORT NOVEMBER 2023

Priority Substances Assessment

Agglomeration Name:	**Coachford**
Licence Register No.	**D0427 Licence Review**

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1 Introduction

This report has been prepared for the Coachford agglomeration, in County Cork, to inform a Waste Water Discharge Licence Review Application for D0427-01.

A new Waste Water Treatment Plant (WwTP) was built in 2021 at the site of the existing septic tank which was overloaded (NGR 146003E, 73146N) (30-year design – 1,600 p.e; 10-year design horizon – 1,400 p.e.). The new WwTP provides secondary treatment to the Coachford agglomeration. Treated effluent discharges at NGR 145231E, 72297N into the Inniscarra Reservoir.

The Coachford agglomeration generates largely domestic wastewater. This desk top study has been undertaken to determine the necessity, if any, for further analysis of the discharge based on the *Guidance on the Screening for Priority Substances for Waste Water Discharge Licences*, issued by the EPA. Relevant inputs to the Coachford WwTP and estimates for the emissions from the discharge point have been considered in the preparation of this report.

2 Desktop Study

2.1 Assessment of Analysis Required

A. Review of all industrial inputs into WWTP

A review of all inputs into the WwTP was conducted using online mapping and the EPA's IPC and IEL, and licenced waste facilities information in order to determine if influent of non-domestic nature was being received by the Coachford WwTP. As per the EPA, IPC, IEL, and Waste Facility database and a review of the EPA's online mapping software there are currently no industrial premises within the agglomeration. The wastewater influent from the Coachford agglomeration is largely domestic in nature, with the majority of non-domestic sources from commercial facilities (*i.e.,* hairdressers, grocers, schools).

All planning applications over the past 5 years within the Coachford agglomeration were reviewed in order to determine if non-domestic discharges were being sent to the WwTP. The majority of planning applications were also largely domestic.

The UÉ Technical Assessment Manual Sectoral Profile Data was reviewed to determine the potentially dangerous substances which could be released to sewer from industrial inputs.

There is one trade effluent licence under Section 16 of the Water Pollution Act 1977 (amended 1990) within the agglomeration. (WP(S)-11-03) for a Commercial Trade Effluent Licence (40 p.e.).

It is considered that the Priority Substances which are possibly being emitted to sewer have been well represented in this partial characterisation of the wastewater (**Table 2.1**).

Upon review of the types of businesses, amenities, and educational facilities in Coachford, **Table 2.1** provides an indicative list of non-domestic discharge types to the WwTP and details potential dangerous/priority substance.

Table 2.1 – List of Non-Domestic Discharge Types to WwTP and Details of Potential Dangerous/Priority Substance

Type of Industry within the Agglomeration	Potential Source of Dangerous / Priority Substances (Yes / No)	Dangerous / Priority Substances Monitoring Undertaken (Yes / No)	List of Potential Dangerous Substances Based on Industry Type (Source: *Technical Assessment Manual - Sectoral Profile Data*)
Garage and Filling Station	Yes		Benzene Di (2-ethylhexyl) phthalate (DEHP) Lead and its compounds Naphthalene Nickel and its compounds Cadmium and its compounds Mercury and its compounds Chromium (III) Copper Toluene Xylenes (Total) Zinc
Hairdressers	Yes		Nickel and its compounds Cadmium and its compounds
Schools & Universities	Yes		Dichloromethane Lead and its compounds Nickel and its compounds Trichloromethane

B. Discharge monitoring

No primary discharge monitoring for the possible presence of Specific Pollutants, Priority and Priority Hazardous Substances as outlined in Table 10, 11 and 12 of European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended is available for this agglomeration.

C. Downstream monitoring location's participation in relevant monitoring programme

There is recent no priority substances monitoring data for the downstream ambient monitoring location, Inniscarra Reservoir.

D. Participation in PRTR reporting

Estimated data from the PRTR reporting tool was required for this desktop assessment as measured data was unavailable for all parameters in Appendix 1.

The Coachford agglomeration pertains to a WwTP of <10,000 p.e., No saline intrusion, Secondary Treatment - Activated Sludge, Phosphorus Removal Only - Biological/Chemical/Wetland.

2.2 Review Outcome of Desktop Study

Following the desktop study, all parameters in Appendix 1 have been assessed to establish any potential impact on the receiving waters. Priority substance measured concentrations in the primary

discharge were not available for any parameters, as such estimated concentrations were assessed. This desktop study is considered to provide partial characterisation of the wastewater.

3 Assessment of Significance and Recommendations

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge has been carried out. The assessment considers the primary discharge 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).

Based on the estimated data, no parameters were identified as potentially being higher than the required EQS.

Does the assessment use the Desk Top Study Method or Screening Analysis to determine if the discharge contains the parameters in Appendix 1 of the EPA guidance	Desk Top Study
Does the assessment include a review of licensed / authorised inputs to the works?	Yes
Does the assessment include a review of other (unauthorised) inputs to the works?	Yes
Does the report include an assessment of the significance of the results where a listed material is present in the discharge? (e.g. impact on the relevant EQS standard for the receiving water)	Yes
Does the assessment identify that priority substances may be impacting the receiving water?	No
Does the Improvement Programme for the agglomeration include the elimination / reduction of all priority substances identified as having an impact on receiving water quality?	No

4 Conclusion

An assessment of the potential for impacts on receiving waters from priority substances in the primary discharge has been carried out to inform this WWDL review application. Estimated data from the PRTR reporting tool was used to inform this desktop assessment. The assessment considered the primary discharge relevant to Environmental Quality Standards (EQS) for priority substances in surface waters, as set out in the Surface Waters Regulations (S.I No. 77 of 2019).

After dilution, it can be concluded that none of the substances listed in the Specific Pollutants, Priority and Priority Hazardous Substances, are likely to be present in the effluent discharge to the Inniscarra Reservoir, at concentrations above the standards in S.I No. 77 of 2019.

Based on the results of this desk top study, it can be determined that **no for further analysis** of the discharge, based on the *Guidance on the Screening for Priority Substances for Waste Water Discharge Licences*, issued by the EPA, is required.

Appendix 1 – Screening of Parameters for Priority Substances

AA: Annual Average
MAC: Maximum Allowable Concentration
EQS: Environmental Quality Standards
Dilution factor in receiving water: 773.5 dilutions estimated immediately in the proximity of the discharge point (based on the Inniscarra Reservoir 95%ile flow 2.82 m^3/s (Inniscarra Hydrometric Gauge Station Number: 19094) & DWF – $315m^3/d$ (1,400 p.e)

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l)[1]	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
1	Benzene	VOCs	10	8	0.0168	PRTR Electronic Toolset	N/A	No	No
2	Carbon tetrachloride	VOCs	12	12	0	PRTR Electronic Toolset	N/A	No	No
3	1,2-Dichloroethane	VOCs	10	10	0	PRTR Electronic Toolset	N/A	No	No
4	Dichloromethane	VOCs	20	20	0.0455	PRTR Electronic Toolset	N/A	No	No
5	Tetrachloroethylene	VOCs	10	10	0.0591	PRTR Electronic Toolset	N/A	No	No
6	Trichloroethylene	VOCs	10	10	0	PRTR Electronic Toolset	N/A	No	No
7	Trichlorobenzenes	VOCs	0.4	0.4	0	PRTR Electronic Toolset	N/A	No	No
8	Trichloromethane	VOCs	2.5	2.5	0	PRTR Electronic Toolset	N/A	No	No
9	Xylenes (all isomers)	VOCs	10	10	0.1160	PRTR Electronic Toolset	N/A	No	No

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l)[1]	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
10	Ethyl Benzene	VOCs	n/a	n/a	0.01659	PRTR Electronic Toolset	N/A	N/A	N/A
11	Toluene	VOCs	10	10	0.4933	PRTR Electronic Toolset	N/A	No	No
12	Naphthlene[1]	PAHs	2	2	0.0040	PRTR Electronic Toolset	N/A	No	No
13	Fluoranthene[1]	PAHs	0.0063	0.0063	0.0023	PRTR Electronic Toolset	N/A	No	No
14	Benzo[k]fluoranthene[2]	PAHs	MAC of 0.017	MAC of 0.017	0.0020	PRTR Electronic Toolset	N/A	No	No
15	Benzo[ghi]perylene[2]	PAHs	MAC of 8.2×10^{-3}	MAC of 8.2×10^{-4}	0.0020	PRTR Electronic Toolset	N/A	Yes	No
16	Indeno[1,2,3-c,d]pyrene[2]	PAHs			0.0022	PRTR Electronic Toolset	N/A	No	No
17	Benzo[b]fluoranthene[2]	PAHs	MAC of 0.017	MAC of 0.017	0.0020	PRTR Electronic Toolset	N/A	No	No
18	Benzo[a]pyrene	PAHs	1.7×10^{-4}	1.7×10^{-4}	0.0020	PRTR Electronic Toolset	N/A	Yes	No
19	Di(2-ethylhexyl)phthalate (DEHP)	Plasticiser	1.3	1.3	0.9173	PRTR Electronic Toolset	N/A	No	No
20	Isodrin[3]	Pesticides	∑=0.01	∑=0.005	0	PRTR Electronic Toolset	N/A	No	No

[1] The EQS for these substances shall take effect from 22 December 2015

[2] No indicative parameter is provided for this group of substances

[3] ∑ of Aldrin, Dieldrin, Endrin and Isodrin.

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l)[1]	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
21	Dieldrin[3]	Pesticides			0	PRTR Electronic Toolset	N/A	No	No
22	Diuron	Pesticides	0.2	0.2	0.0264	PRTR Electronic Toolset	N/A	No	No
23	Isoproturon	Pesticides	0.3	0.3	0.0075	PRTR Electronic Toolset	N/A	No	No
24	Atrazine	Pesticides	0.6	0.6	0.0105	PRTR Electronic Toolset	N/A	No	No
25	Simazine	Pesticides	1	1	0.0141	PRTR Electronic Toolset	N/A	No	No
26	Glyphosate	Pesticides	60	-	1.5327	PRTR Electronic Toolset	N/A	No	No
27	Mecoprop	Pesticides	n/a	n/a	0.1070	PRTR Electronic Toolset	N/A	N/A	N/A
28	2,4-D	Pesticides	n/a	n/a	0.0510	PRTR Electronic Toolset	N/A	N/A	N/A
29	MCPA	Pesticides	n/a	n/a	0.0886	PRTR Electronic Toolset	N/A	N/A	N/A
30	Linuron	Pesticides	0.7	0.7	0	PRTR Electronic Toolset	N/A	No	No
31	Dichlobenil	Pesticides	n/a	n/a	0.0043	PRTR Electronic Toolset	N/A	N/A	N/A
32	2,6-Dichlorobenzamide	Pesticides	n/a	n/a	0.0805	PRTR Electronic Toolset	N/A	N/A	N/A
33	PCBs	PCBs	n/a	n/a	0	PRTR Electronic Toolset	N/A	N/A	N/A

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l)[1]	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
34	Phenols (as Total C)	Phenols	8	8	0.9098	PRTR Electronic Toolset	N/A	No	No
35	Lead	Metals	1.2	1.3	3.0394	PRTR Electronic Toolset	N/A	Yes	No
36	Arsenic	Metals	25	20	0.5667	PRTR Electronic Toolset	N/A	No	No
37	Copper	Metals	5 or **30**[2]	5	3.0000	PRTR Electronic Toolset	N/A	No	No
38	Zinc	Metals	8 or 50 or **100**[3]	40	49.360	PRTR Electronic Toolset	N/A	No	No
39	Cadmium	Metals	0.08 or 0.09 or 0.15 or 0.25[4]	0.2	0.2667	PRTR Electronic Toolset	N/A	Yes	No
40	Mercury	Metals	MAC of 0.07	MAC of 0.07	0	PRTR Electronic Toolset	N/A	No	No
41	Chromium VI	Metals	3.4	0.6	0.8000	PRTR Electronic Toolset	N/A	No	No
42	Selenium	Metals	n/a	n/a	0	PRTR Electronic Toolset	N/A	N/A	N/A
43	Antimony	Metals	n/a	n/a	0.1545	PRTR Electronic Toolset	N/A	N/A	N/A
44	Molybdenum	Metals	n/a	n/a	0	PRTR Electronic Toolset	N/A	N/A	N/A
45	Tin	Metals	n/a	n/a	0.1444	PRTR Electronic Toolset	N/A	N/A	N/A

No.	Compound	Group of compounds	AA-EQS Inland SW (µg/l)	AA-EQS Other SW (µg/l)	Estimated Conc. (µg/l)[1]	Data Source	Sample Date (if applicable)	Effluent Concentration above AA concentration (Yes/No)	Effluent Concentration above AA concentration after dilution (Yes/No)
46	Barium	Metals	n/a	n/a	13.244	PRTR Electronic Toolset	N/A	N/A	N/A
47	Boron	Metals	n/a	n/a	61.111	PRTR Electronic Toolset	N/A	N/A	N/A
48	Cobalt	Metals	n/a	n/a	0.1758	PRTR Electronic Toolset	N/A	N/A	N/A
49	Vanadium	Metals	n/a	n/a	2.7273	PRTR Electronic Toolset	N/A	N/A	N/A
50	Nickel	Metals	4	8.6	4.2576	PRTR Electronic Toolset	N/A	No	No
51	Fluoride	General	500	1,500	235.00	PRTR Electronic Toolset	N/A	No	No
52	Chloride	General	n/a	n/a	54120.0	PRTR Electronic Toolset	N/A	N/A	N/A
53	TOC	General	n/a	n/a	9219.78	PRTR Electronic Toolset	N/A	N/A	N/A
54	Cyanide	General	10	10	2.9318	PRTR Electronic Toolset	N/A	No	No
	Conductivity	General	n/a	n/a	-	PRTR Electronic Toolset	N/A	N/A	N/A
	Hardness (mg/l $CaCO_3$)	General	n/a	n/a	201750.0	PRTR Electronic Toolset	N/A	N/A	N/A
	pH	General	n/a	n/a	-	PRTR Electronic Toolset	N/A	N/A	N/A

Notes:

1. Where measured values are available these should be used instead of estimated values from PRTR tool.
2. In the case of copper, the value 5 applies where the water hardness measured in mg/l $CaCO_3$ is less than or equal to 100; the value 30 applies where the water hardness exceeds 100 mg/l $CaCO_3$. Estimated $CaCO_3$ value > 100 where no sampling data available (based on PRTR tool)
3. In the case of Zinc, the standard shall be 8 µg/l for water hardness with annual average values less than or equal to 10 mg/l $CaCO_3$, 50 µg/l for water hardness greater than 10 mg/l $CaCO_3$ and less than or equal to 100 mg/l $CaCO_3$ and 100 µg/l elsewhere. Estimated $CaCO_3$ value > 100 where no sampling data available.
4. For Cadmium and its compounds, the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40 mg $CaCO_3$/l, Class 2: 40 to <50 mg $CaCO_3$/l, Class 3: 50 to <100 mg $CaCO_3$/l, Class 4: 100 to <200 mg $CaCO_3$/l and Class 5: >200 mg $CaCO_3$/l)

ATTACHMENT D.2.4:

DRINKING WATER RISK ASSESSMENT REPORT DECEMBER 2023

Drinking Water Risk Assessment

Agglomeration Name:	**Coachford**
Licence Register No.	**D0427-01 Licence Review**

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1 Introduction

This report has been prepared for the Coachford agglomeration, in County Cork, to inform a Waste Water Discharge Licence Review Application for D0427-01 and assesses the potential risk from the Coachford operational discharges (SW001, SW005, SW006 and SW007) on 2 no. downstream drinking water abstractions (*i.e.*, 04000PUB1001 for the Lee Road Water Treatment Plant and 0500PUB3401 for the Inniscarra Water Treatment Plant).

The risk from the operational discharges from the agglomeration has been assessed in this report under four separate headings with an overall risk ranking applied in conclusion.

(1) Level of treatment and capacity of WwTP
(2) Discharge compliance and level of dilution
(3) Receiving waters / abstraction water quality
(4) Impact of discharges during normal and abnormal operation

2 Background

Coachford is a village approximately 22 km from Cork City and 12 km from Macroom. It is located North of the River Lee on the R618. The agglomeration was served by an overloaded septic tank of 402 Population Equivalent (p.e.) design capacity. As of 2022, the collected load of the agglomeration (peak week) was 665 p.e.

In January 2010, planning permission was applied for by Cork County Council under Part 8 of the Planning and Development Regulations for the construction of a 1,600 p.e. Waste Water Treatment Pant (WwTP) (30-year horizon) at Coachford, Co. Cork. The application was approved in May 2010 with conditions and the scheme progressed under this planning permission (Note: 10-year design horizon of plant is 1,400 p.e.).

The Coachford upgrade works, which were completed in Q4 2021, included the demolition and decommissioning of the existing septic tank, the construction of a new WwTP to provide secondary treatment with P removal, along with the construction of new concrete gravity sewers and an outfall pipe. These upgrade works were completed in order to ensure compliance with condition 1.7 of the Waste Water discharge Licence (WWDL): D0427-01, issued by the EPA in accordance with the Waste Water Discharge (Authorisation) Regulations (S.I. No. 684 of 2007) (now S.I. No. 214 of 2020) issued on the 4th of December 2015.

3 Tabular Details of Agglomeration and Drinking Water Abstractions

3.1 Wastewater Treatment Plant Details

The Coachford WwTP details are summarised in **Table 3.1** below.

Table 3.1 – Wastewater Treatment Plant

1	Type of treatment (primary, secondary, tertiary)	Secondary Treatment with P removal
2	Hydraulic Capacity – Design / As Constructed (dry weather flow) (m^3/day)	1,400 p.e. – 315m^3/d
3	Hydraulic Capacity – Design / As Constructed (peak flow) (m^3/day)	1,400 p.e. – 945 m^3/d
4	Hydraulic Capacity – Current loading (m^3/day)	661 m^3/d (Source: 2022 AER)
5	Hydraulic Capacity – Remaining (m3/year)	1,400 p.e. – 284 m^3/d
6	Organic Capacity - Design / As Constructed (PE)	1,400 p.e. (10-year design horizon)
7	Organic Capacity - Current loading (PE)	665 p.e. (Source: 2022 AER)
8	Organic Capacity – Remaining (PE)	1,400 p.e. – 735 p.e.
9	Will the capacity be exceeded in the next three years? (Yes / No)	No
10	Are ELV's compliant with licence ? (Yes / No)	No in 2022. There was 1 no. Total Phosphorus condition 2 exceedance in May 2022. Yes in 2023. It should be noted that since the 2022 non-compliance in Total Phosphorus up to the preparation of this report on the 11th December 2023, the WwTP has been compliant with the ELV's set in the current WWDL
11	If answer to No. 11 above is **Yes**, list parameters not in compliance	Total Phosphorus (see above)

3.2 Discharges from the Agglomeration

A list discharges from the agglomeration is summarised in **Table 3.2** below.

Table 3.2 – List of Discharges from the Agglomeration

Discharge	Type of Discharge	Receiving Waters	Level of Dilution (DWF vs 95 percentile river flow)	Easting	Northing	Frequency of Discharge (if known)	Compliant Discharge (Yes / No)
Licenced Discharges							
TPEFF0500D0427SW001	Primary	Inniscarra Reservoir IE_SW_19_138	773.5*	145231	72297	Continuous	See **Table 3.1** above
TPEFF0500D0427SW002	Storm Water Overflow	River Lee LEE (CORK)_080 IE_SW_19L030600	Decommissioned	145955	73162	Decommissioned	Decommissioned
TPEFF0500D0427SW003	Storm Water Overflow	River Lee LEE (CORK)_080 IE_SW_19L030600	Decommissioned	145947	73165	Decommissioned	Decommissioned
None	Storm Water Overflow	River Lee LEE (CORK)_080 IE_SW_19L030600	Decommissioned	146002	73155	Decommissioned	Decommissioned
SW005 – New SWO	Storm Water Overflow	Inniscarra Reservoir IE_SW_19_138	Unknown	145257	72497	Unknown	Yes**
SW006 – New Dual Function Overflow	Emergency Overflow & Storm Water Overflow ***	Inniscarra Reservoir IE_SW_19_138	Unknown	145231	72297	Unknown	Yes**

Discharge	Type of Discharge	Receiving Waters	Level of Dilution (DWF vs 95 percentile river flow)	Easting	Northing	Frequency of Discharge (if known)	Compliant Discharge (Yes / No)
SW007 - New SWO	Storm Water Overflow	Inniscarra Reservoir IE_SW_19_138	Unknown	145231	72297	Unknown	Yes*

Note* Calculated based on the 95%ile Lake Flow (2.82 m^3/s) measured at the Inniscarra Hydrometric Gauges ESB Station Number: 19094 *(ca.* 10.8km downstream stream of primary discharge) and the Coachford WwTP DWF (315 m^3/d), there are 773.5 dilutions estimated immediately in the proximity of the discharge point (SW001).
Note** - Compliant with DoEHLG criteria set out in *'Procedures and Criteria in Relation to Storm Water Overflows'.*
Note*** - SW006 is a Dual Function Overflow (*i.e.,* an overflow which can act as a Storm Water Overflow (SWO) or as an Emergency Overflow (EO) depending on the event).

Table 2.3 – List of Downstream Drinking Water Abstractions

Abstraction Code	Agglomeration Served	Abstraction Volume (m^3/day)	Distance Downstream (m)	Discharge Point	Type of Treatment	Easting	Northing
Scheme Code: 0400PUB1001	Cork City Water Supply	31,598 m^3/d (population served: 87,291)	*ca.* 9,300m	SW001 SW005 SW006 SW007	Coagulation, flocculation, rapid gravity filtration, UV disinfection, chlorination, fluoridation, final water pH correction and sludge treatment	153489	72309
Scheme Code: 0500PUB3401	Cork Harbour and City	69,631 m^3/d (population served: 145,304)	*ca.* 9,700m	SW001 SW005 SW006 SW007	Coagulation, flocculation, clarification, filtration, final water pH correction, disinfection, fluoridation and sludge treatment	tbc*	tbc*

*The exact coordinates are to be verified by UÉ.

4 Risk Assessment

4.1 Level of Treatment and Capacity of WwTP

The construction of the new Coachford WwTP (NGR 146003E, 73146N) and associated works were completed in Q4 of 2021. The WwTP has a 30-year design capacity of 1,600 p.e. and a 10-year design capacity of 1,400 p.e. As of 2022, the collected load of the agglomeration (peak week) was 665 p.e.

The new WwTP provides secondary treatment with P removal.

As noted in **Table 3.1** above, the final treated effluent from the primary discharge point (SW001) was non-compliant with the Emission Limit Values (ELVs) in 2022. There was one Condition 2 exceedance of Total Phosphorus recorded May 2022 due to an issue with the dosing pumps. Corrective actions were implemented following the incident. Since this ELV breach, the primary discharge has been fully compliant with the ELVs set out in the current licence.

The closest drinking water abstraction point is for public supply 0400PUB1001 for the Lee WTP and is *ca*. 9.3km downstream of the primary discharge point, SW001. The drinking water abstraction point for public supply 0500PUB3401 for the Inniscarra WTP is located *ca*. 9.7km downstream of SW001.

Having regard to:

- The level of treatment at the new Coachford WwTP (*i.e*., secondary treatment with Phosphorus removal).
- The treatment capacity of the new WwTP (10-year design horizon 1400 p.e.).
- The primary discharge (SW001) has been compliant with the ELVs as per Schedule A of the WWDL (D0427-01) since May 2022;
- The discharge distance to the nearest abstraction point downstream of the discharges is greater than 5km;
- The significant dilution factor in receiving water: At 95%ile lake flow (2.82 m^3/s), there is *ca*. 773.5 dilutions estimated immediately in the proximity of the discharge point (SW001).

The level of risk is considered to be '***Low Risk'***.

4.2 Discharge Compliance and Level of Dilution

Schedule A of the current WWDL (D0427-01) sets out the ELVs for the primary discharge point SW001. As noted above the final effluent from the Primary Discharge Point was compliant with the ELVs, in 2022 and 2023 to date, apart from one exceedance of Total Phosphorus in May 2022 due to an issue with the dosing pumps. Corrective actions have been taken by UÉ and the Plant Operator to prevent a recurrence.

There have been no complaints of an environmental nature reported to the EPA relating to the Coachford operational discharges.

There have been no incidents reported relating to the Coachford WwTWs of an environmental nature since the 1 no. condition 2 Total Phosphorus ELV exceedance in May 2022.

All 3 SWO's (SW005, SW006, and SW007) have been designed and operate to meet DoEHLG criteria set out in "*Procedures and Criteria in Relation to Storm Water Overflows*".

As part of design measures of the upgraded WwTP completed in 2021, dial out alarms are available to the Plant Operator in the event of an emergency, and all alarms are linked to SCADA technology.

There is significant dilution in the receiving waters, estimated at *ca.* 773.5 dilutions immediately in the proximity of the discharge point (SW001).

Having regard to:

- The primary discharge (SW001) has been compliant with the ELVs as per Schedule A of the WWDL (D0427-01) since May 2022.
- The significant dilution factor in receiving water.
- The distances to the nearest abstraction points downstream of the discharges are greater than 5km.
- There have been no reported water quality issues identified at the downstream abstraction points which may be due to the Coachford WwTW operational discharges.
- There have been no reported complaints received regarding the Coachford WwTW operational discharges.

The level of risk is considered to be ***'Low Risk'*** considering the high level of dilution and compliance with the WWDL ELVs since May 2022.

4.3 Receiving waters / Abstracted Water Quality

The receiving water (Inniscarra Reservoir IE_SW_19_138) downstream of the primary discharge point has a '*Good*' Water Framework Directive Status (WFD) for the 2016-2021 period (Source: catchments.ie). The WFD Objective for the Inniscarra Reservoir is to maintain the *"Good"* waterbody status. The 3rd Cycle Draft Lee, Cork Harbour, and Youghal Bay Catchment Report (HA 19) the Coachford wastewater agglomeration is not identified as a significant pressure on the Inniscarra Reservoir waterbody.

The Coachford Dispersion Model (see **Attachment D.2.3** of the WWDL Review Application) prepared to inform the Coachford WWDL review highlights the effect of the ambient/background concentration on the assimilative capacity of the receiving water body (Inniscarra Reservoir) and confirms that the Coachford agglomeration is not a significant pressure on this waterbody.

In terms of risks from priority substances, an assessment of the potential for impacts on receiving waters from priority substances in the primary discharge (SW001) has been carried out to inform this WWDL application (see **Attachment D.2.4** of the WWDL Review Application). The priority substances assessment concluded that after dilution 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 effluent discharge to the Inniscarra Reservoir, 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) and it determined that no for further analysis of the

discharge, based on the Guidance on the Screening for Priority Substances for Waste Water Discharge Licences issued by the EPA, was/is required.

In terms of reported water quality issues/incidents, none have been identified/reported at the downstream abstraction points from either 04000PUB1001 for the Lee Road WTP and 0500PUB3401 for the Inniscarra WTP which may be due to the operational discharges from the Coachford WwTWs.

A summary of the Drinking Water Quality Results for water supplies 04000PUB1001 and 0500PUB3401 are provided in below in **Figure 4.1 – 4.4**.

Parameter	Unit	Tests Undertaken	Exceedances	Pending Review	% of Tests within Exceedance Limit
Bacteria and Protozoa		306	0	7	100%
Chemicals		283	0	0	100%
Metals		272	0	3	100%
Other		597	0	7	100%

Figure 4.1 – 2022 Drinking Water Quality Results for Cork City Water Supply 0400PUB1001

Parameter	Unit	Tests Undertaken	Exceedances	Pending Review	% of Tests within Exceedance Limit
Bacteria and Protozoa		288	0	4	100%
Chemicals		98	0	0	100%
Metals		167	0	0	100%
Other		428	0	4	100%

Figure 4.2 - 2023 Drinking Water Quality Results for Cork City Water Supply (results up to 08/12/2023) 0400PUB1001

Parameter	Unit	Tests Undertaken	Exceedances	Pending Review	% of Tests within Exceedance Limit
Bacteria and Protozoa		320	0	1	100%
Chemicals		383	2	0	99.48%
Metals		292	0	1	100%
Other		602	2	2	99.67%

Figure 4.3 - 2022 Drinking Water Quality Results for Cork Harbour and City Supply 0500PUB2401

Parameter	Unit	Tests Undertaken	Exceedances	Pending Review	% of Tests within Exceedance Limit
Bacteria and Protozoa		304	1	0	99.67%
Chemicals		357	0	0	100%
Metals		236	1	1	99.58%
Other		487	0	0	100%

Figure 4.4 - 2023 Drinking Water Quality Results for Cork Harbour and City Supply (results up to 08/12/2023) 0500PUB2401

The impact of the Coachford WwTP operational discharges on abstracted water quality can be classified as "***Low Risk***" on the basis of the receiving water quality and the drinking wate quality results.

4.4 Impact of Discharges During Normal and Abnormal Operations

The impact of discharges during normal and abnormal operations are considered to be low having regard to the measures in place to prevent unintended discharges and to respond to abnormal operations.

Periods of abnormal operation are considered to occur during plant / equipment breakdowns caused by direct *(i.e.*, mechanical breakdowns) or indirect impacts (*i.e.,* power outage). The impact on the receiving water is minimised by having a plant operator regularly on site.

The WwTWs at Coachford has been designed and incorporates the following key measures to prevent unintended discharges to the Inniscarra Reservoir:

- SWOs (SW005, SW006 and SW007) have been designed to meet the definition of 'Storm Water Overflow' as per Regulation 3 of the European Union (Waste Water Discharge) Regulations 2007 to 2020 and the criteria as set out in the DoEHLG '*Procedures and Criteria in Relation to Storm Water Overflows*', 1995.
- Provision of 120m^3 of storm storage provided at the WwTP.
- All alarms are linked to level measurement to alert to any spillage and are linked to SCADA with alarms sent to operators in the result of an emergency event.
- Uninterruptible Power Supply (UPS) backup for telemetry/plant controllers;
- An Emergency Response Plan and Procedures, Operation and Maintenance Procedures for all equipment will be in place and implemented by the appointed plant operator, as required;
- All operators will be fully familiar with all operational plans and procedures pertaining to the plant and network *etc*.
- Upon activation, the overflow volumes are recorded *via* flow meters.
- Daily Flow Reports from the WwTP are received by the Control Room *via* SCADA.
- At the Storm Water Tank, a standby pump will activate upon failure in order to pump Storm Water back to WwTP.
- SWOs are screened to 6mm.

- In the event of an emergency, a call out alarm system is in place in order to alert the contractor.
- FOG treatment is not included in the WwTP as fats, oils and greases were never an issue to the existing works. However, the design will give due consideration to a layout that will enable FOG equipment to be retro-fit at a later date if required.
- 30kVA mobile standby generator to be provided to WWTP, along with a connection point in the event of an interruption to the plants power supply.

Based on the above measures, the design capacity of the WwTP., the provision of secondary treatment with phosphorus removal, compliance with the WWDL ELVs since May 2022, the distance of the Coachford operational discharges (SW001, SW005, SW006, and SW007) to the drinking water abstractions (*i.e.,* greater than 5km), it is considered that the operational discharges from the Coachford agglomeration will have no significant effects on the receiving aquatic environment or downstream drinking water abstraction points (*i.e.,* 04000PUB1001 for the Lee Road WTP and 0500PUB3401 for the Inniscarra WTP).

The impact of the discharge during normal and abnormal operations is therefore considered to be '***Low Risk***'.

5 Overall Risk and Recommendations

Based on the Drinking Water Risk Assessment above the overall risk from the Coachford agglomeration operational discharges can be classified as '***Low Risk***'. Drinking water quality is unlikely to be impacted during normal and abnormal operational conditions. This has been based on the high level of dilution in the receiving waterbody, the level of treatment provided for at the new WwTP and its compliance with its current ELVs since May 2022, the measures at the new WwTP to prevent unintended discharges, the design and operation of the overflows, and the distance to the downstream abstraction points.

Based on the results of this desk top risk assessment, it can be determined that no further Drinking Water Risk Assessment analysis of the discharge is required.

Drinking Water Abstraction Point Risk Assessment Summary

	Checks to determine whether all relevant information is included in the Assessment.
Does the Drinking Water Abstraction Risk Assessment identify whether any of the discharges in Schedule A of the licence pose a risk to a drinking water abstraction	No risks identified due to design and operation of the operational discharges.
Does the assessment identify if any other discharge(s) from the works pose a risk to a drinking water abstraction (includes emergency overflows)	No
What is the overall risk ranking applied by the licensee	Low Risk
Does the risk assessment consider the impacts of normal operation	Yes

Does the risk assessment consider the impacts of abnormal operation (e.g. incidents /overflows)	Yes, and refer to the measures to prevent unintended discharges in **Section 4.4** above.
Does the risk assessment include control measures for each risk identified	Not applicable as Low Risk
Does the risk assessment consider operational control measures e.g? waste water incident notification to drinking water abstraction operator	Yes, an Emergency Response Plan is in place at the WwTP.
Does the risk assessment include infrastructural control measures	Yes, and refer to the measures to prevent unintended discharges in **Section 3.4** above.
Does the Improvement Programme for the agglomeration include control measures / corrective actions to eliminate / reduce priority substances identified as having an impact on receiving water quality?	Not applicable. Refer to **Attachment D.2.4** Priority Substance Assessment Report.