

# IRISH WATER SIGNIFICANT URBAN WASTE WATER PRESSURES ASSESSMENT

Blacklion Agglomeration - Technical Report (D0498-01)

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Sole significant pressures  
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## Contents

<b>1</b>	<b>STEP 1 – INTRODUCTION &amp; DATA COLLECTION</b> .....	<b>1</b>
1.1	Assessment Approach .....	2
1.2	Blacklion agglomeration .....	3
1.3	Data Collection .....	4
1.4	Data Quality .....	6
1.4.1	Overview .....	6
1.4.2	Ambient Data – General.....	6
1.4.3	Suitability of ambient monitoring locations.....	6
1.4.4	Effluent data check.....	7
1.4.5	Step Change Detection .....	8
1.4.6	Primary Discharge Data – Outlier Detection .....	8
<b>2</b>	<b>STEP 2 - EXISTING ASSESSMENTS</b> .....	<b>10</b>
2.1	SWO Assessments .....	11
2.1.1	SWO Assessments in Discharge Authorisation Reports .....	11
2.2	Environmental Assessment.....	11
2.2.1	Appropriate Assessment Screening Report.....	11
2.2.2	Appropriate Assessment - Natura Impact Statement .....	12
<b>3</b>	<b>STEP 3 - CONCEPTUALISATION OF THE CATCHMENT</b> .....	<b>14</b>
3.1	Catchment Description .....	14
3.2	Subcatchment Hydrology .....	14
3.3	Subcatchment Land Use .....	14
3.4	Subcatchment WFD Protected Areas .....	16
3.5	Subcatchment Conceptualisation .....	16
3.6	Catchment Storyboard .....	16
<b>4</b>	<b>STEP 4 - LOAD QUANTIFICATION</b> .....	<b>21</b>
4.1	Methodology.....	21
4.1.1	Effluent Load Estimation .....	21
4.1.2	Ambient Load Estimation .....	22
4.2	Ambient Data .....	23
4.3	Results and Findings.....	23
<b>5</b>	<b>STEP 5 - AMBIENT MONITORING</b> .....	<b>24</b>
5.1	Overview .....	24
5.2	Methodology.....	25
5.2.1	Data analysis.....	25
5.3	Summary of Ambient and WFD Monitoring Data .....	25
5.3.1	Review of WFD App Risk Assessment Information .....	25
5.4	Physico-chemical Data - Time Series Analysis.....	26
5.4.1	BOD.....	26
5.4.2	Ammonia .....	26
5.4.3	Total Phosphorus .....	27
5.5	Biological Monitoring .....	28
<b>6</b>	<b>STEP 6 - AGGLOMERATION ASSESSMENT</b> .....	<b>30</b>
6.1	Reason for Inclusion in the Priority Action List (PAL) .....	30
6.2	Compliance .....	30

6.2.1	Capacity .....	30
6.2.2	ELV Compliance Assessment.....	30
6.2.3	Proposed Improvement Measures for Agglomeration .....	32
<b>7</b>	<b>STEP 7 – TROPHIC ASSESSMENT.....</b>	<b>34</b>
7.1	Methodology.....	34
7.2	Results .....	35
<b>8</b>	<b>STEP 8 - FURTHER DETAILED ASSESSMENT .....</b>	<b>38</b>
<b>9</b>	<b>STEP 9 - OVERALL CONCLUSIONS AND DETERMINATIONS .....</b>	<b>40</b>

## Tables

Table 1.1:	Overview of the Blacklion agglomeration, Co. Cavan .....	3
Table 1.2:	Effluent loading check for measured parameters at Blacklion agglomeration .....	7
Table 1.3:	Outlier detection summary .....	9
Table 2.1:	Existing Assessments for the Blacklion agglomeration.....	10
Table 2.2:	Information available from the SWO Programme .....	11
Table 2.3:	Appropriate Assessment Screening Report Summary.....	12
Table 2.4:	Natura Impact Statement Summary .....	13
Table 4.1:	Production per capita figures for BOD, ammonia & total P .....	22
Table 4.2:	Treatment reduction factors .....	22
Table 5.1:	Ambient monitoring stations and available data.....	26
Table 5.2:	Biological monitoring summary .....	28
Table 6.1:	Reasons for inclusion of Blacklion on PAL.....	30
Table 6.2:	ELVs for Blacklion WWDA licence .....	31
Table 6.3:	Summary of compliance for Blacklion agglomeration 2016-2018.....	31
Table 7.1:	OECD fixed boundary system for Lake Trophic Classes based on annual maximum chlorophyll concentration in mg/m <sup>3</sup> .....	34
Table 7.2:	Impact of discharge on Lower Lough Macnean based on existing loading from the WWTP.....	36
Table 8.1:	Further detailed assessment categories .....	38
Table 8.2:	Summary of data issues.....	38
Table 9.1:	Overall conclusions and determinations.....	40

## Figures

Figure 1.1: Steps included in the methodology .....	3
Figure 1.2: Blacklion agglomeration overview map.....	5
Figure 1.3: Python user interface .....	8
Figure 3.1: Map of subcatchments within Macnean loughs connector_SC_010 subcatchment and Blacklion agglomeration .....	15
Figure 3.2: Near surface pathway susceptibility (phosphates) in Macnean Loughs Connector_SC_010 subcatchment .....	18
Figure 3.3: Subcatchment storyboard .....	19
Figure 5.1: Monitoring station location map for Blacklion agglomeration.....	24
Figure 9.1: Blacklion effluent BOD concentrations step change detection .....	57
Figure 9.2: Blacklion effluent ammonia concentrations step change detection .....	58
Figure 9.3: Blacklion effluent Orthophosphate concentrations step change detection .....	59
Figure 9.4: Blacklion Effluent Outlier Detection for BOD concentrations .....	60
Figure 9.5: Blacklion Outlier Detection for Ammonia concentrations .....	61
Figure 9.6: Blacklion Effluent Outlier Detection for Orthophosphate concentrations .....	62

## Appendices

Appendix A Data Collection Summary
Appendix B Data Quality Checks
Appendix C Load Quantification Calculation
Appendix D Ambient Monitoring Summary
Appendix E Mass Balance Calculations

## Abbreviations

- AA – Appropriate Assessment
- AER – Annual Environmental Report
- BOD – Biological Oxygen Demand
- CI – Compliance Investigation
- CIWEM – Chartered Institute for Water and Environmental Management
- COD – Chemical Oxygen Demand
- CSMU – Catchment Science and Management Unit
- DAP – Drainage Area Programme
- D/S - Downstream
- DWWTS – Domestic Waste Water Treatment Systems
- DWF – Dry Weather Flow
- ELV – Emissions Limit Value
- EO – Emergency Overflow
- EPA – Environmental Protection Agency
- EQS – Environmental Quality Standard
- HA – Hydrometric Area
- ICM – Integrated Catchment Management
- NCAP – National Certificate of Authorisation
- NHA – Natural Heritage Area
- NIS – Natura Impact Statement
- OEE – Office of Environmental Enforcement
- OSPAR – Oslo & Paris Convention for Protection of the Marine Environment of the North-East Atlantic
- PAL – Priority Action List
- PE – Population Equivalent
- pNHA – Proposed Natural Heritage Area
- RBMP – River Basin Management Plan
- SAC – Special Area of Conservation
- SPA – Special Protection Area
- SSRS – Small Stream Risk Score
- SWO – Stormwater Overflow
- TSS – Total Suspended Solids
- U/S - Upstream
- UWWTD – Urban Waste Water Treatment Directive
- WFD – Water Framework Directive – Directive 2000/06/EC establishing a framework for Community action in the field of water
- WWDA – Waste Water Discharge Authorisation
- WWTP – Waste Water Treatment Plant

## Glossary

- **Agglomeration** – An area where the population and / or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point.
- **Aquifer** – Water-bearing sand, gravel or rock layer yielding usable water quantities.
- **Catchment** – A catchment area is a hydrological unit. Any precipitation that falls into a catchment area will eventually end up in the same river water body if it does not evaporate. Catchments are separated from each other by watersheds.
- **Chemical status** – Chemical status is a quality index used by the Water Framework Directive. For surface waters, the default objective is Good chemical status, which means no concentrations of priority substances exceed the relevant EQS established.
- **Coastal water** – Surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.
- **Diffuse Pollution** – Pollution which originates from various activities, and which cannot be traced to one single source. It originates from a spatially extensive land use e.g. agriculture, industry, residential.
- **Discharge** – The release of polluting substances directly or indirectly into water bodies as defined under Article 2 (i) of Water Framework Directive 2000/06/EC.
- **Ecological status** – Ecological status is a biodiversity index developed and used by the Water Framework Directive. Good ecological status is the WFD default objective in all water bodies and is defined as a slight variation from undisturbed conditions. Elements that make up ecological status included biological elements e.g. fish, macro-invertebrates, macrophytes and supporting elements e.g. physico-chemical monitoring and hydromorphology.
- **Groundwater** – All the water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
- **Investigative monitoring point** – This is required where the reason for any exceedances is unknown; where surveillance monitoring indicates that the objectives set under Article 4 for a body of water are not likely to be achieved and operational monitoring has not already been established, in order to ascertain the causes of a water body or water bodies failing to achieve the environmental objectives; or to ascertain the magnitude and impacts of accidental pollution; and shall inform the establishment of a programme of measures for the achievement of the environmental objectives and specific measures necessary to remedy the effects of accidental pollution.
- **Lake** – A body of standing inland surface water.
- **Population Equivalent** – The organic biodegradable load having a five-day biochemical oxygen (BOD-5) demand of 60g of oxygen per day.
- **LI Aquifer** - Bedrock which is Moderately Productive only in Local Zones
- **Operational monitoring point** – Monitoring that aims to establish the status of waterbodies identified at being ‘at risk’ of failing to meet their environmental objectives; and assess any changes in the status of such bodies resulting from the programmes of measures.
- **Parameter** – Parameters that are indicative of the quality elements listed in Annex V of the Water Framework Directive that will be used in monitoring and classification of ecological status.
- **PI Aquifer** - Bedrock which is Generally Unproductive except for Local Zones

- **Point Source Pollution** – Pollution arising from a discrete source e.g. the discharge from a sewage treatment works.
- **Pu Aquifer** – Bedrock which is generally unproductive
- **Q values** – Irish EPA index of water quality based on aquatic conditions.
- **River** – River means a body of inland water flowing for the most part on the surface of the land but which may flow underground for part of its course.
- **Significant pressure** – In terms of WFD, a pressure that on its own or in combination with other pressures, would be liable to cause a failure to achieve the environmental objectives set out under Article 4.
- **Sole significant pressure** – In terms of WFD, a pressure that on its own would be liable to cause a failure to achieve the environmental objectives set out under Article 4.
- **Storm Water Overflow (SWO)** – In Ireland, the majority of urban areas are drained by combined sewer systems, which convey wastewater and stormwater in a single pipe. During rainfall events the capacity of the combined sewer system may be exceeded. A stormwater overflow (SWO) is a structure designed to divert excess flows from the sewer network, either directly or via a storm sewer system, to the receiving water.
- **Subcatchment** – A subcatchment area is a fundamental hydrological unit that is used to model the runoff from a given area of land.
- **Surveillance monitoring point** – Monitoring that aims to allow assessment of long-term changes in natural conditions; the efficient and effective design of future monitoring programmes; validation of the impact assessment procedure detailed in Annex II of the Directive; and the assessment of long term changes resulting from human activity.
- **Transitional water body** – Water bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows.
- **Water body** – The basic compliance and management unit for the Water Framework Directive into which all rivers, lakes, ground, transitional and coastal waters are divided

# 1 STEP 1 – INTRODUCTION & DATA COLLECTION

The Environmental Protection Agency (EPA) Catchment Science and Management Unit (CSMU) identified ‘significant pressures’ during initial characterisation activities undertaken as part of the development of the River Basin Management Plan (RBMP) 2018-2021<sup>1</sup>.

During this initial characterisation process, significant pressures were considered to be pressures that are causing, or are likely to cause, receiving water issues. The official Water Framework Directive<sup>2</sup> (WFD) definition of significant pressures are ‘...those pressures which, either alone, or in combination with other pressures prevent or put ‘at risk’ the achievement of WFD Article 4(1) Environmental Objectives including the achievement of ‘good’ status, the non-deterioration of status, the avoidance of a significant and sustained upward trend in pollution of groundwater, and the achievement of objectives in WFD protected areas’.

The urban waste water significant pressure category encompasses both waste water treatment plants (WWTPs) and waste water networks (Storm Water Overflows (SWOs) and Emergency Overflows (EOs)). Where only one significant pressure category is affecting a water body, it is referred to as a ‘sole’ significant pressure.

The EPA CSMU identified 63 urban waste water agglomerations as sole significant pressures on a total of 67 river, lake, transitional and coastal water bodies. For each of the urban waste water significant pressures, the EPA CSMU identified what element has been determined to be causing issues i.e. the WWTP, Storm Water Overflows (SWOs), Emergency Overflows (EO) or a combination of these. The EPA Office of Environmental Enforcement (OEE) has raised Compliance Investigations (CIs) in relation to the urban waste water sole significant pressures. These CIs include requirements to examine the WWTPs and SWOs in terms of their potential to impact on receiving water body objectives. In addition, 57 of the sole significant urban waste water pressures have been added to the Priority Action List (PAL) by EPA OEE.

The objectives of the Significant Urban Waste Water Pressures Assessment Project are to:

- collect, collate, summarise and synthesise information in relation to the nature and magnitude of the urban waste water pressures, the pathways to receiving waters from all discharges including SWOs, and the impact on the receiving water environment;
- determine whether or not each of these pressures is significantly impacting water body status or risk, either alone or in combination with other pressure categories;
- quantify any improvements necessary to eliminate the impact of sole significant pressure agglomerations on water body status and/or risk;
- address all of the issues highlighted in the EPA’s online Water Framework Directive Application (WFD App) and in Compliances Investigations (CIs) opened for these pressures.

Outputs from the Significant Urban Waste Water Pressures Assessment Project include:

- Technical reports for each agglomeration describing in detail all of the assessment work undertaken and the conclusions and determinations made;

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<sup>1</sup> Department of Housing, Planning and Local Government, River Basin Management Plan for Ireland 2018-2021

<sup>2</sup> European Commission, *Common Implementation Strategy for the Water Framework Directive*, 2003

- Summary outcome reports for each agglomeration summarising the outcome of the assessments;
- An overall summary spreadsheet.

This document is the technical report in relation to the Blacklion agglomeration (D0498-01).

## 1.1 Assessment Approach

Figure 1.1 outlines the steps involved in the assessment of the sole significant pressure agglomerations.

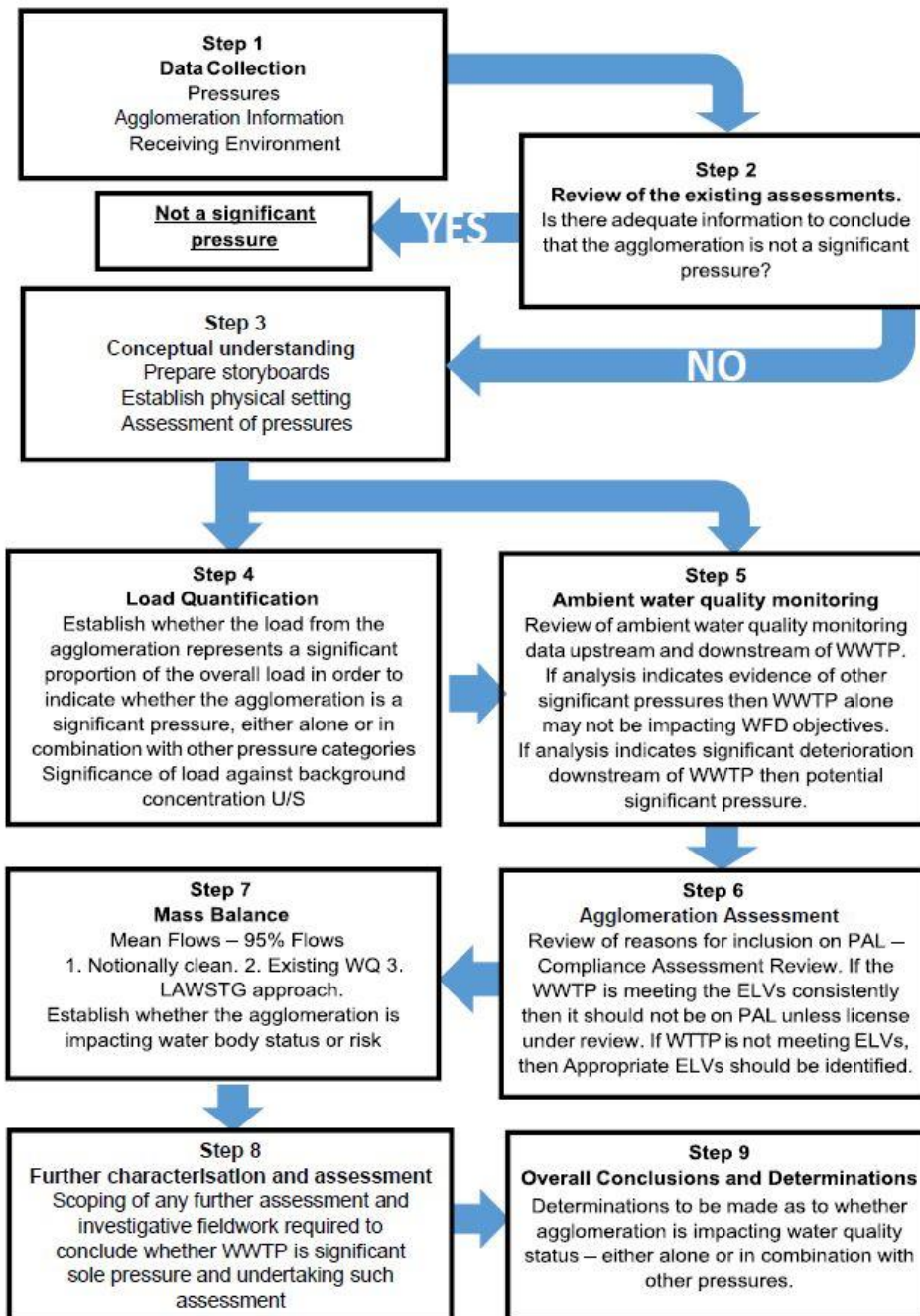


Figure 1.1: Steps included in the methodology

## 1.2 Blacklion agglomeration

Table 1.1 provides an overview of the Blacklion agglomeration, the receiving water environment, and the reason(s) for identification as a sole significant pressure by the EPA CSMU during initial characterisation. Figure 1.2 provides an overview map of the area surrounding the Blacklion agglomeration.

Table 1.1: Overview of the Blacklion agglomeration, Co. Cavan

<b>Agglomeration name</b> Blacklion		<b>Authorisation code</b> D0498-01	
<b>Design PE</b>	1,025	<b>2019 collected PE</b>	509
<b>Treatment level</b>	Primary, Secondary, Nutrient removal and Tertiary treatment (reed bed polishing)	<b>2018 compliant</b>	No
<b>Discharges</b>	Primary: 1 no. (TPEFF0200D0498SW001)) Storm Water Overflows: 1no. (unnamed)		
<b>EPA Priority Action List (PAL)</b>	Yes (see Section 6 for more details)	<b>EPA Compliance Investigation (CI)</b>	Yes (see Section 6 for more details)
<b>WWTP upgrade project (completion date)</b>	No	<b>IW Programme(s)</b>	SWO Programme IWSS Programme
<b>Water bodies where agglomeration is a significant pressure</b>			
<b>WB Name (code):</b>	2010-2015 monitoring period: Lower Lough Macnean (IE_NW_36_445) "Bad' ecological status – fish being the driving element "at risk' 2013-2018 monitoring period: "bad' ecological status		
<b>WFD App pressure and impact details:</b>			
<b>Pressure category</b>	sub-WWTP		
<b>Impacts</b>	Nutrient pollution Organic pollution		

## 1.3 Data Collection

There were a large number of datasets available, both internally within Irish Water and from other sources, in relation to the agglomeration and the receiving water environment.

The data collected was registered in a dedicated project register and is summarised in Appendix A of this report. An indication of the relevance of the data to the Blacklion agglomeration assessment has been provided.

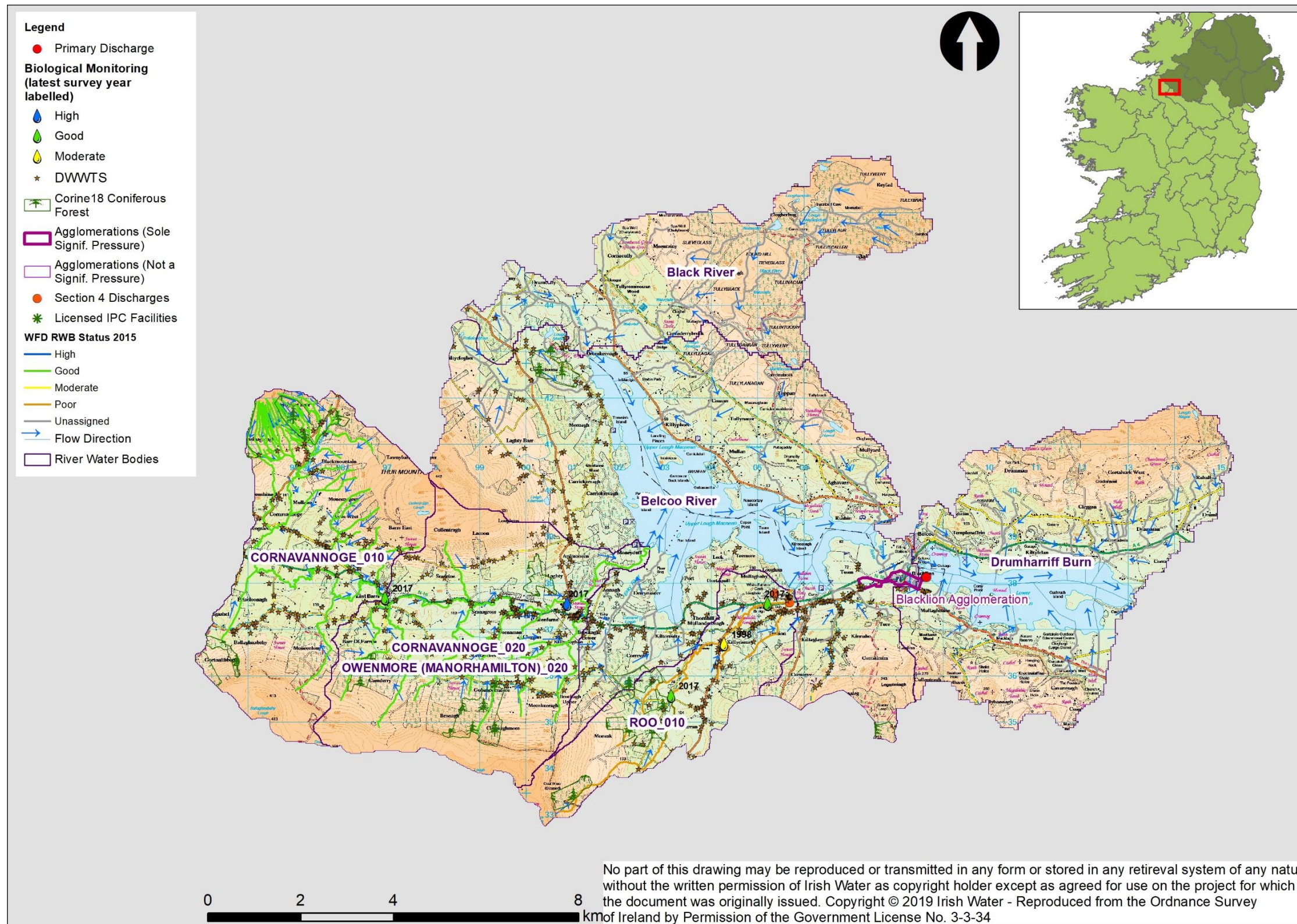


Figure 1.2: Blacklion agglomeration overview map

## 1.4 Data Quality

### 1.4.1 Overview

As outlined in the Assessment Approach (Figure 1.1), Steps 4 to 6 involve a series of calculations which use data from numerous datasets. The data is listed in Appendix A. Data availability and quality checks have therefore been carried out to ensure that data is fit for purpose and can be used in the relevant calculations.

### 1.4.2 Ambient Data – General

Available monitoring data from the WFD monitoring programme, compliance assessments and investigative monitoring was obtained from EPA, Local Authorities and Irish Water including:

- Ambient biological and physico-chemical monitoring results for both upstream and downstream monitoring points for all agglomerations;
- Ambient monitoring station locations;
- WFD App information on water body status, drivers, risk status, updated ambient and effluent monitoring datasets, and pressures information.

Note ambient water quality data for water bodies receiving primary discharges was downloaded from the WFD App and has already undergone review and cleansing by the EPA. Data checks typically involved are outlined in Appendix B.

### 1.4.3 Suitability of ambient monitoring locations

Further characterisation of the stretch of water body between the upstream and downstream monitoring points allows for the identification of other potential pressures in the area, and determination of whether these may be significant pressures. In the case of Blacklion there is only one monitoring point located in Lough Macnean that is used as the downstream monitoring point for the discharge.

Based on the available pressure information, there are a number of point source pressures to the Belcoo River upstream of the Blacklion primary discharge including Belcoo WWTP, Belcoo Bridge pumping station which has a storm water overflow and emergency overflow, which all discharge to the Belcoo River and ultimately Lough Macnean. Potential additional pressures identified include part of Blacklion and Belcoo town which would be a source of diffuse urban pressure, agricultural lands and DWWTS in an area of high pollution impact potential for surface pathways for phosphates. There is the potential for unlicensed discharges to be present. There are numerous single dwellings with the village and environs that are outside of the agglomeration boundary and not connected to the sewer network and wastewater treatment plant.

EU Member States may designate mixing zones adjacent to points of discharge where concentrations of one or more substances may exceed a relevant EQS within such mixing zones if they do not affect the compliance of the rest of the body of surface water with those standards.

Monitoring station locations however should ensure samples are representative of the overall water body, and other European environment agencies (such as SEPA, NIEA and Environment Agency England)

apply a high level principle that monitoring stations should not be within 100m of a discharge point to ensure water quality samples are taken outside of the mixing zone.

When considering Blacklion agglomeration the primary discharge point in relation to the downstream ambient monitoring location (LS360012313000160 - M\_5), the distance between the two points is approximately 45m. The water quality sampling may therefore be taking place within the mixing zone and would not be considered to be representative samples.

### 1.4.4 Effluent data check

A quality check of the available effluent data was undertaken using an adopted EPA methodology<sup>3</sup>. The load from the WWTP as reported in the 2017 AER ( $Load_{WWTP (AER)}$ ) was compared with estimated load based on the population equivalent ( $Load_{WWTP (PE)}$ ). Where values differ considerably (i.e. by more than ten times) the possible reason for this is reviewed, i.e. it may be that the WWTP is operating at a much higher treatment efficiency rate which differs from the assumed treatment standards for the particular level of treatment when estimating the effluent load from the PE. The quality check is calculated as follows:

When;

$$Load_{WWTP (PE)} * 0.1 < Load_{WWTP (AER)} < Load_{WWTP (PE)} * 10$$

$$Load_{WWTP} = Load_{WWTP (AER)}$$

$$\text{Otherwise } Load_{WWTP} = Load_{WWTP (PE)}$$

Where;

$$Load_{WWTP (AER)} = \text{Reported AER Effluent WWTP Load}$$

$$Load_{WWTP (PE)} = PE * \text{production rate}$$

Table 1.2 provides a summary of the assessment. The effluent loadings calculated for BOD, total N and total P recorded in the AER for Blacklion. The effluent loadings calculated from measured data, as recorded in the AER, are a reasonable representation of the loads to the plant, i.e. are within the range as specified above.

**Table 1.2: Effluent loading check for measured parameters at Blacklion agglomeration**

Parameter	Loading (kg/yr)		Representative
	Load WWTP (AER)	Load WWTP (PE)	
BOD	2,379	4,285	Yes
Total N	1,848	890	Yes
Total P	122	41	Yes

<sup>3</sup> Mockler E.M, Deakin J, Archbold M, Gill L, Daly D and Bruen M, *Sources of nitrogen and phosphorus emissions to Irish rivers and coastal waters: Estimates from a nutrient load apportionment framework*, Science of the Total Environment, 2016, Volumes 601-602, pp 326-339

### 1.4.5 Step Change Detection

Effluent data for Blacklion WWTP is available for the period 2015-2019, and it is recognised that there may have been operational improvements, operational issues or process changes during this time. A step change analysis was therefore undertaken to highlight any step changes.

The step change analysis was undertaken by calculating the rolling mean of the 7 previous data points and plotting the results as illustrated in graphs in Appendix B for effluent parameters BOD, ammonia, and Orthophosphate.

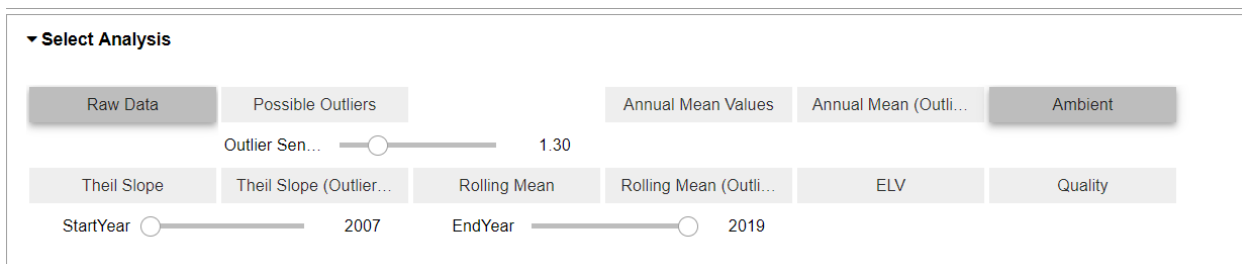
On review of the graphs, there is a general downward trend in BOD over the full period of data. To prevent calculations such as mass-balance and load quantification being skewed by earlier data (pre-2017) which predominantly had higher concentrations, in comparison to post-2017; BOD data from 2017 onwards will be used for analysis in the following report sections. There are no identifiable trends for ammonia or orthophosphate, the full period of available data (2015-2019) for these parameters should therefore be used in calculations, such as mass-balance and load quantification.

### 1.4.6 Primary Discharge Data – Outlier Detection

RPS developed a custom application to enable a consistent approach to analysis and visualisation of WFD water quality data. The application was developed in Python with a user interface in Jupyter Notebook for interactive table querying, statistical analyses including Theil-Sens Slope, outlier detection, resampling and rolling means. Additional functionalities allow the analyst to:

- Select more than one location for compare ambient and effluent monitoring data;
- Adjust outlier detection sensitivity;
- Remove outliers if appropriate;
- Select time period for trend analysis.

Plots are dynamic such that the axis labels, title and legends update automatically. Figure 1.3 presents the custom tool user interface.



**Figure 1.3: Python user interface**

A sensitivity value of 1 was set for all parameters. The number of outliers detected are listed in Table 1.3 and illustrated graphs in Appendix B.

The outliers identified for BOD and ammonia are high concentrations. The data points generally correlate to elevated concentrations of other effluent parameters and have therefore been retained for analysis.

Outliers were not identified for the water quality parameter orthophosphate.

**Table 1.3: Outlier detection summary**

Sensitivity Value	Effluent Parameter	Number of Detected	Outliers	Number of data points omitted
1	BOD	2		0
	Ammonia	1		0
	Orthophosphate	0		0

**STEP 1 – SUMMARY**

- The Blacklion agglomeration effectively provides tertiary treatment due to the presence of a reed bed system. However, with respect to licence compliance the plant is assessment as a secondary treatment plant.
- The Blacklion WWTP is currently operating within capacity collecting 509 PE, while the plant has a design capacity of 1,025 PE.
- The WFD App identifies the Blacklion WWTP as a significant pressure impacting the Lough Macnean water body, causing nutrient pollution and organic pollution.
- The Blacklion WWTP has one primary discharge, which discharges directly into the Lough Macnean lake water body. This water body is considered "at risk" of not meeting its environmental objectives and is at 'bad' ecological status (2010-2015 and 2013-2018).
- Data quality checks were undertaken on the ambient monitoring and primary discharge data, it was determined that the full period of effluent data for ammonia and Orthophosphate would be appropriate for use in the calculations for Steps 4 to 7. Whereas BOD effluent data prior to 2017 would be omitted.

## 2 STEP 2 - EXISTING ASSESSMENTS

The purpose of this step is to determine if adequate information is already available from existing assessments to achieve the aims of the project as set out in Section 1. Sources of existing assessments include WWDA licence documents, environmental assessments, and Irish Water’s ongoing programmes as well as once-off studies.

Table 2.1 lists the key relevant existing assessments and indicates if any have been undertaken for this Agglomeration, with a complete list of data sources included in Appendix A. Relevant information or conclusions from these assessments are also summarised.

**Table 2.1: Existing Assessments for the Blacklion agglomeration**

Existing Information	Available for this agglomeration	Report Reference
<b><i>Irish Water Registers, Programmes and Studies</i></b>		
Waste Water Capacity Register	✓	Section 6.2
Drinking Water Risk Assessment	n/a	-
National Certificate of Authorisation Programme (NCAP)	n/a	-
Disinfection Programme	n/a	-
Drainage Area Programme (DAP) reports	n/a	-
Modelling Studies	✗	-
SWO Assessments	✓	Section 2.1
<b><i>Environmental Assessments</i></b>		
i. Ecological Impact Assessment (including Small Streams Risk Score)	✗	-
ii. Habitats Directive Assessment	✓	Section 2.2.1, Section 2.2.2
iii. Freshwater Pearl Mussel Assessment	n/a	-
iv. Other environmental assessments	✗	-
<b><i>Discharge authorisation-related reports</i></b>		
AER Report	✓	Section 6.2.2
EPA OEE Inspector Reports	✓	Section 6.2.2

## 2.1 SWO Assessments

The assessment of SWOs undertaken for the AERs is subjective in nature and is often not undertaken consistently across local authorities.

Irish Water’s SWO Programme is a national programme for assessing the impact of SWOs based on repeated outfall site surveys and consideration of impact components and receiving water use. The methodology is robust, objective and consistent. The outputs from the SWO Assessment Programme, when available, will supersede the assessments included in the AERs.

### 2.1.1 SWO Assessments in Discharge Authorisation Reports

#### 2.1.1.1 AERs

The SWO is not assessed in the 2017 or 2018 AERs.

#### 2.1.1.2 SWO Programme

The SWOs in the Blacklion agglomeration will be assessed under the SWO Programme. Information available to date is included in Table 2.2

**Table 2.2: Information available from the SWO Programme**

Overflow Name Type	Asset	Emission Code	Assessed against DoEHLG Criteria	Monitored/ Not Monitored	Significance	Included in Schedule A4 of the WWDL	
SWO	TBC	WwPS	TBC	Meeting	Not Monitored	Low	No

## 2.2 Environmental Assessment

### 2.2.1 Appropriate Assessment Screening Report

An Appropriate Assessment is required under Article 6 of Habitats Directive to assess, in view of best scientific knowledge and conservation objectives, if an activity (either individually or in combination with other plans or projects) is likely to have a significant effect on a European Site. The first stage of the appropriate assessment process is a screening assessment to determine if a project can be screened out of any further assessment where there is no potential for the conservation objectives of the European site to be affected. The output from the stage 1 screening is the Appropriate Assessment Screening report.

**Table 2.3: Appropriate Assessment Screening Report Summary**

Appropriate Assessment Screening			Author	Date
			EPA	February 2015
Protected Area/ Species	Linked to agglomeration	Report Findings/ Conclusion	Further Action	
Upper Lough Erne SAC	Yes	The discharge point at the Blacklion is located on the west side of Lough Macnean, hydrologically connected to the Lough Erne SAC via the Arney River, the SAC is located 22.0 km downstream. The determination is based on the 'poor' ecological status of Lower Lough Macnean (IE_NW_36_445) and on the absence of the downstream water quality monitoring data.	Stage 2 Appropriate Assessment required	

### 2.2.2 Appropriate Assessment - Natura Impact Statement

Irish Water prepared a Natura Impact Statement in March 2015 to outline the findings of the Stage 2 Appropriate Assessment undertaken to assess whether the current discharge from the Blacklion agglomeration was impacting the SAC. The summary of the conclusions of the NIS are provided below.

EPA monitoring results determine the Lough as moderately eutrophic and under the Erne West Water Management Unit Action Plan the WWTP is recorded as a pressure on the Lough. There is no current monitoring data at the discharge location but it could be assumed Lough Macnean Lower can assimilate the discharge.

The SAC is designated under the following Annex I qualifying habitats; natural eutrophic lakes, old sessile oak woods and alluvial forests. The old oak woods are considered non-water dependent habitats and therefore not 'at risk' from the WWTP. Both the alluvial forests and eutrophic lakes are ground and surface water dependent. The eutrophic lakes are considered to be 'at risk' from dissolved and particulate phosphorus enrichment and diffuse and point source nitrogen enrichment. While alluvial forests are considered to be 'at risk' of both nitrogen and phosphorus enrichment, from both diffuse and point source pollution of surface and ground water. The surveyed area did not record any of the qualifying features immediately up or down stream of the WWTP, however, they are potentially occurring over 22km downstream.

The Upper Lough Erne SAC was also selected due to the presence of Annex II species otter (*Lutra lutra*). The habitat both up and down stream of the WWTP is considered favourable for otter, however, there was no observed species presence along the surveyed area.

Although there are hydrological links to the WWTP and the designated site, it is unlikely that the site will be impacted considering its distance of 22km downstream. The WWTP was compliant with both suspended solids and COD, but on one occasion recorded a slightly elevated BOD result. There are no ambient monitoring results to consider the impact of the discharge on the receiving water body. As a

result, it is not possible to fully assess the impact on the receiving Water body and the pre-cautionary principle was employed for this assessment.

By applying the precautionary principle, it was determined that otter and eutrophic lakes may possibly be impacted by the site and mitigation measures must be applied. To mitigate against any deterioration in water quality that may impact these qualifying features the effluent must meet the requirements of the Urban Waste Water Treatment Regulation 2001, effluent discharge and ambient monitoring must be carried out regularly, and the plant must comply with the EPA WWDA licence conditions.

In conclusion, Blacklion WWTP singly or in combination with other projects will not significantly impact the Upper Lough Erne SAC, as long as mitigation measures are adhered to. Therefore, the Stage 2 Appropriate Assessment concluded that the WWTP will not adversely impact the conservation objectives of the Upper Lough Erne SAC.

**Table 2.4: Natura Impact Statement Summary**

Natura Impact Statement	Author	Date
		Irish Water
Protected Area/ Species	Report Findings/ Conclusion in relation to agglomeration	
	Overall	Justification
Upper Lough Erne SAC.	Natural eutrophic lakes	Not likely to have a significant impact on conservation status. Potential impact possible.
	Alluvial Forests	Due to the distance from the effluent to the SAC, it is unlikely that the agglomeration will impact on the water quality of the SAC. Potential impacts are possible however and mitigation required.
	Old sessile oak woods	Primarily a terrestrial habitat and therefore unlikely to impact conservation status.
	Otter (Lutra lutra)	Habitat not considered to be water dependent and therefore no pathway identified. If the agglomeration causes a reduction in water quality and ecological status, alone or in combination with other factors, this will have an indirect effect on otter populations as it will reduce fish stocks. Mitigation required.

**STEP 2 SUMMARY**

- A stage 2 Appropriate Assessment was undertaken in 2015 to assess the impact of the discharge on the downstream SAC, Upper Lough Erne SAC. It concluded that the discharge from the agglomeration are not likely to result in adverse impacts on the ecological integrity of Natura 2000 sites, either by itself or in combination with other plans or projects, as long as mitigation is adhered to.
- The SWO has been assessed as meeting the requirements of DOE criteria for SWOs.

## 3 STEP 3 - CONCEPTUALISATION OF THE CATCHMENT

This section details the conceptualisation of the catchment that the Blacklion agglomeration is located within. A high level description of the catchment is provided as well as a more detailed description of the subcatchment within which the Blacklion Agglomeration is located.

### 3.1 Catchment Description

The Blacklion agglomeration is situated within the Erne Catchment. This catchment includes the area drained by the River Erne and all streams entering tidal water between Aughrus Point and Kildoney Point, Co. Donegal. This is a cross border catchment with a surface areas of 4,451km<sup>2</sup>; of which 2,512km<sup>2</sup> is locate within Republic of Ireland. The largest urban centre is Cavan Town. The other main urban centres include Bundoran, Ballyshannon, Clones, Ballybay, Cootehill and Belturbet.

There are three isolated parts of the catchment located in the Republic; one around Ballyshannon, one near Blacklion and the southern part occupying much of the counties of Cavan and Monaghan. The catchment is dominated by the glacial drumlin landscape of southern Ulster. The River Erne, its lakes and tributaries, are characterised by the sinuous routes through poorly drained inter-drumlin valleys.

The catchment is divided into 28 subcatchments and the Blacklion agglomeration is within subcatchment Macnean Loughs Connector\_SC\_010 (see Figure 3.1). Catchment conceptualisation is focused at this subcatchment level.

### 3.2 Subcatchment Hydrology

As seen in Figure 3.1, this cross border subcatchment has 6 river water bodes and 2 lake water bodies (Macnean Upper and Lower). With the exception of the extreme southwest, the majority of the Lower Lough Macnean is in Northern Ireland while the southern shores of the Upper Lough Macnean are in the Republic of Ireland. Upper Lough Macnean lies within the Belcoo River Sub basin whilst Lower Lough Macnean is within the Drumharriff Burn sub basin.

Roo\_010 and Cornvannoge River (Cornvannoge\_010 flowing east into the Cornvannoge\_020) are both located south of the Upper Lough Macnean and both flow east into the lake. Only a small portion of the Black River water body, which is located to the west of the Upper Lough Macnean, is in the Republic of Ireland.

The Macnean Lough water bodies are connected by a section of the Belcoo River flowing east. Lower Lough Macnean is located within the Drumharriff Burn sub basin which is largely within Northern Ireland.

Hydrogeology and dominant pathways are included in the subcatchment conceptualisation in Section 3.5.

### 3.3 Subcatchment Land Use

The prevailing land cover in this cross border subcatchment of the Macnean Loughs Connector\_SC\_010 is of mixed agricultural land including pastures and also significant areas of peat, forestry and heathlands.

REPORT

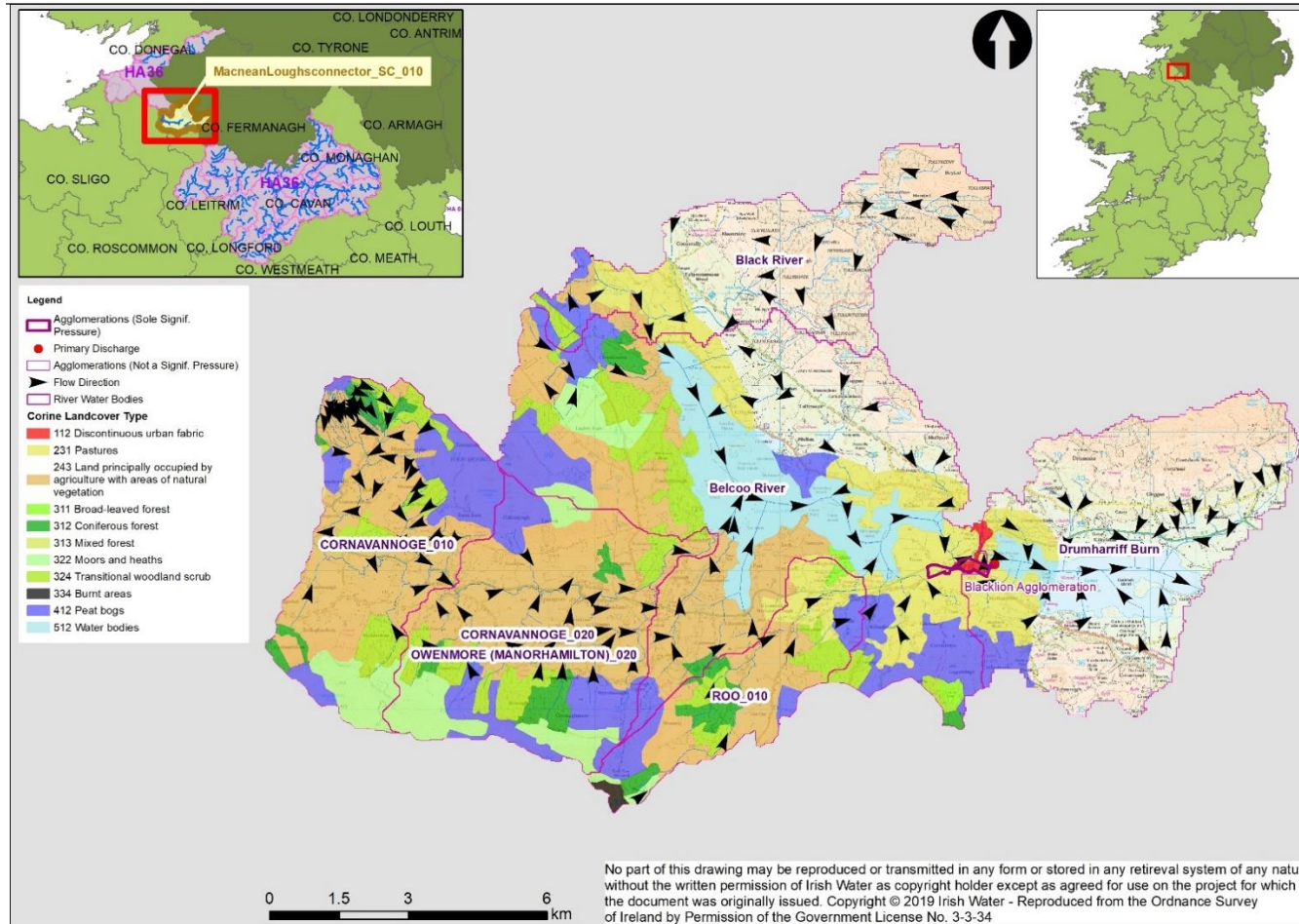


Figure 3.1: Map of subcatchments within Macnean loughs connector\_SC\_010 subcatchment and Blacklion agglomeration

### 3.4 Subcatchment WFD Protected Areas

Protected Areas within a 15km radius of the agglomeration, which encompassed the Macnean Loughs Connector\_SC\_010 subcatchment and beyond, were identified using the WFD App and EPA datasets, and include:

- Drinking water abstractions:
  - There are 3 no. groundwater springs and 1 no. surface water abstraction within the subcatchment which are used to supply drinking water sources.
- Special Areas of Conservations (SACs): The south of the subcatchment intersects the Corratirrim and part of the Boleybrack Mountains SAC. There is also another SAC located within 15km of the agglomeration: Cuilcagh-Anierin Uplands. These areas have no water dependent qualifying features, however there is a hydrological link to the Upper Erne SAC over 20 kilometres downstream.
- Natural Heritage Area (NHA): Dough / Thur Mountains in the west of the subcatchment.
- Proposed Natural Heritage Area (pNHA): Corratirrim and Upper Lough Macnean.

### 3.5 Subcatchment Conceptualisation

The southern and south western boundary of the sub-catchment is dominated by the Boleybrack Mountain and Dough / Thur Mountains, The rest of the subcatchment, south of the border, has a number of elevated areas south of the Macnean Lakes.

The mountainous areas in the south and west are primarily underlain by poor aquifers (mixture of PI and Pu) with small localised areas of locally important aquifer (Li and Lm). There is an area of regionally important karstified aquifer between the 2 Macnean Lakes. This regionally important aquifer comprises primarily of Rkc with smaller areas of Rk around the eastern shore of Upper Lough Macnean and also a small area in the south of the Belcoo River sub-basin. The rest of the subcatchment south of the Macnean lakes is underlain by locally important aquifer, Lm.

The majority of the sub-catchment consists of acid deep, poorly drained, mineral soil and blanket and cut-over peat. The Rk and Rkc areas south of Macnean lake water bodies are overlain primarily by poorly drained gley soils and so the potential for groundwater / surface water interactions are greatly reduced. There is an area of acid shallow lithosolic or podzolic soils in the area south-west of Upper Lough Macnean, underlain by a locally important aquifer (Lm) with an extreme groundwater vulnerability.

The phosphate susceptibility to groundwater pathway is rated as moderate in this area. Overland / near surface pathway is dominant in the rest of the subcatchment, as shown in Figure 3.2.

### 3.6 Catchment Storyboard

A schematic showing the relevant water bodies within the catchment is provided in Figure 3.3.

The upstream water body of the Belcoo River is currently classified as unassigned and is considered not 'at risk' under WFD objectives. There is no physico-chemical monitoring data and no significant pressures were identified to be impacting on the water body status.

The receiving water body of the Blacklion WWTP primary discharge is the Lower Lough Macnean, which is currently classified as 'at risk' of not meeting its environmental objectives under the WFD. The water body has consistently failed to achieve its environmental objectives and was classified as bad ecological and biological status over the 2 most recent programmes in 2010-2015 and 2013 - 2018. Physico-chemical monitoring data suggests that the water body does have nutrient issues, with total phosphorus conditions in the lake indicative of moderate ecological status. Nutrient issues have also been noted in the AER (2017) and EPA Inspector's site visit reports, with Blacklion WWTP's ineffectively treating ammonia however this is not impacting on the nutrient conditions in the lake with ammonia conditions consistent with high ecological status. A review of significant pressures indicates that Blacklion WWTP is the only significant pressure impacting on nutrient and organic chemistry of the water body.

The downstream water body of the Drumaharriff Burn is classified as unassigned. However this water body is classified as 'at risk' of not achieving environmental objectives set out by WFD due to the presence of Blacklion WWTP upstream and also due to unidentified anthropogenic issues acting as a significant pressure in the water body also.

REPORT

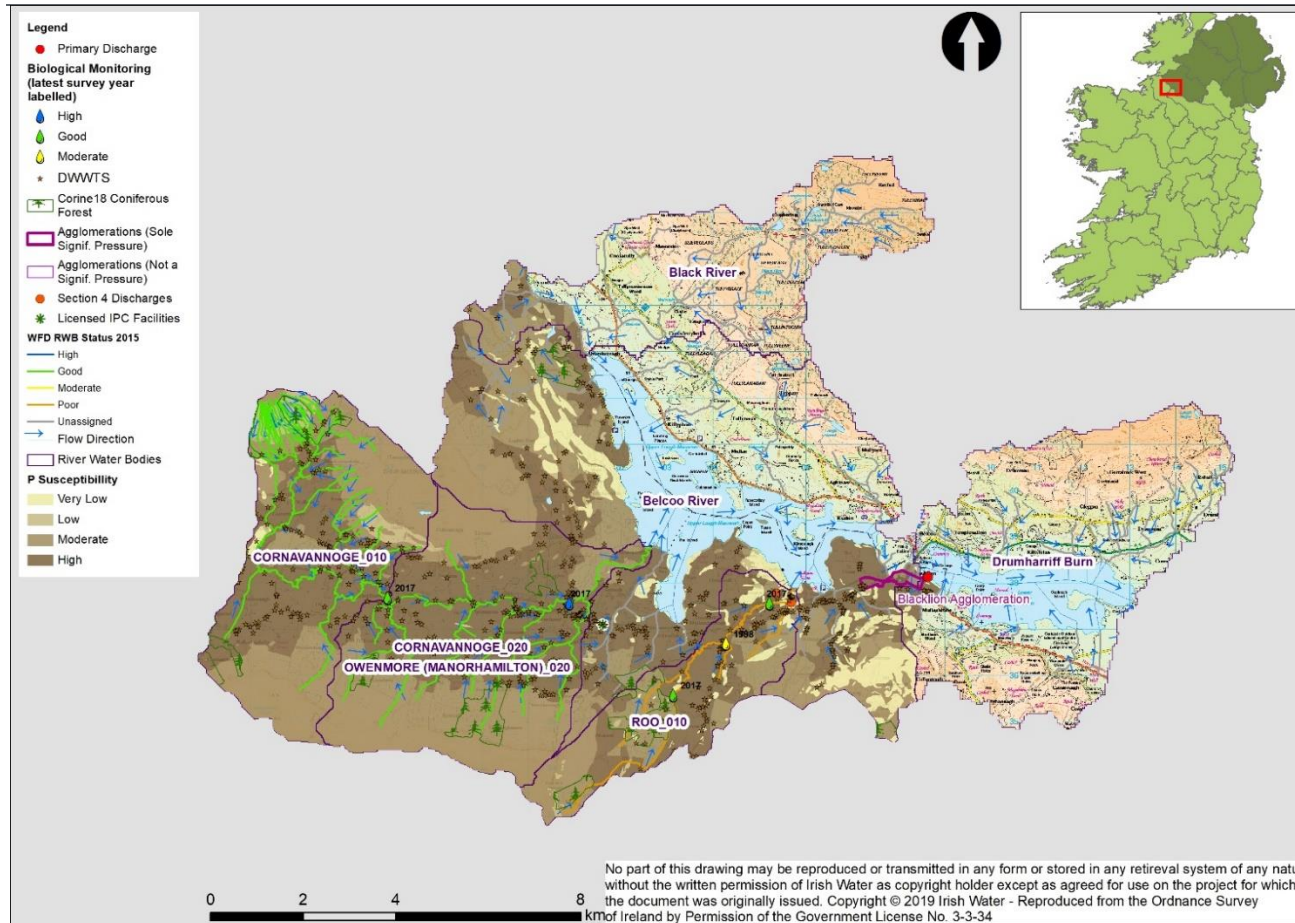


Figure 3.2: Near surface pathway susceptibility (phosphates) in Macnean Loughs Connector\_SC\_010 subcatchment

REPORT

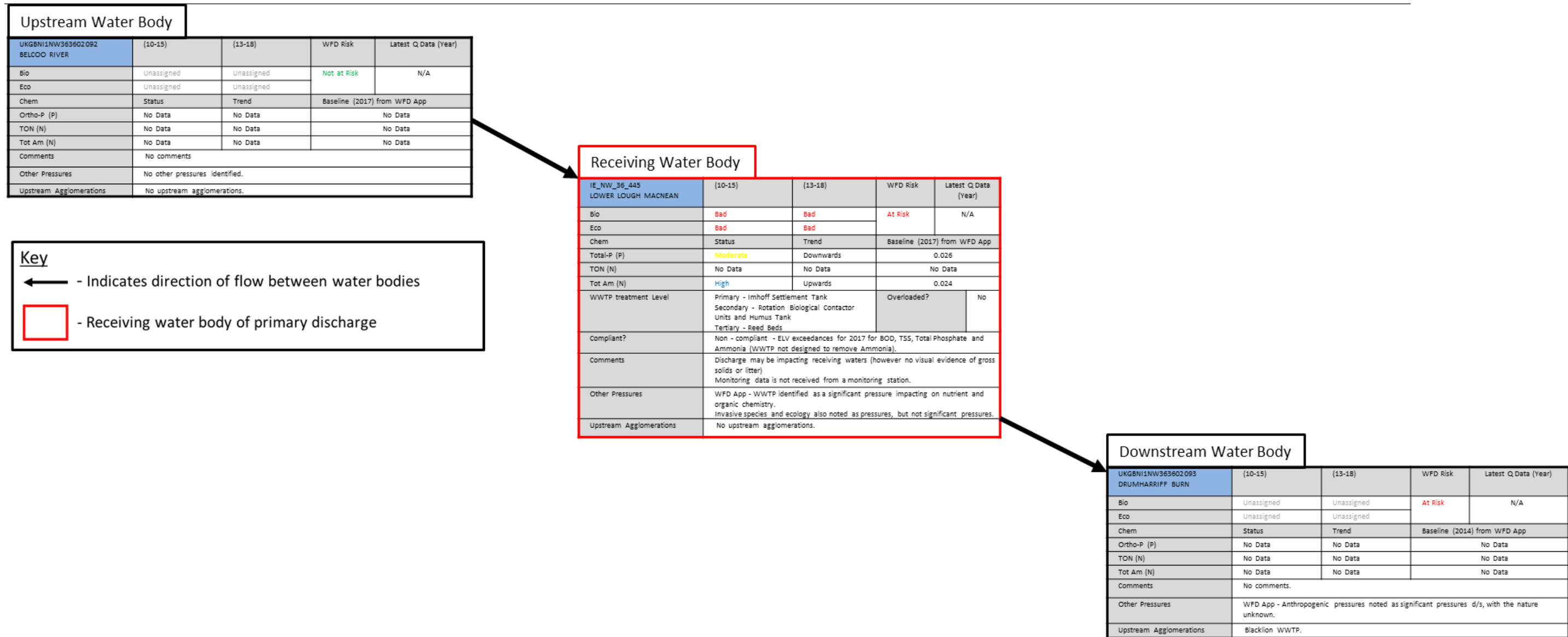


Figure 3.3: Subcatchment storyboard

### STEP 3 SUMMARY

- The Blacklion agglomeration is located within Macnean Loughs Connector\_SC\_010 subcatchment. From the available soils and subsoils information it is likely that diffuse nutrients will be transported by overland / near-surface pathways which dominate the subcatchment.
  - A number of protected areas intersect the Macnean Loughs Connector\_SC\_010 subcatchment within which the Blacklion agglomeration is located. There are also drinking water abstractions located within the subcatchment.
  - The upstream water body of Belcoo River is currently 'unassigned' and considered not 'at risk' of failing to achieve its environmental objectives. There are no significant pressures identified that are acting on the water body.
  - The downstream water body, the Drumaharriff Burn, is also classified as unassigned but is considered 'at risk' of failing to achieve its environmental objectives under WFD due to the significant pressure of Blacklion WWTP upstream and unidentified anthropogenic issues.
-

## 4 STEP 4 - LOAD QUANTIFICATION

Step 4 quantifies urban waste water loads and assesses their significance on the water bodies affected. This quantification of load contribution provides an effective and useful metric to establish the relative significance of pressures; and therefore provides context to other pressures within an overall integrated catchment management (ICM) approach.

### 4.1 Methodology

Existing up-to-date monitoring and reporting data has been analysed and, where appropriate, calculations have been carried out to generate pollutant loads from the Blacklion WWTP, and to derive flow-weighted loads in the receiving waters upstream and downstream of the WWTP.

It should be noted that in order to undertake a direct comparison between the effluent discharge and ambient monitoring, total P was used as ortho-P is not reported in WWTP effluent.

All load quantification calculations are presented in Appendix C.

#### 4.1.1 Effluent Load Estimation

Where possible, effluent loads were based on annual averages for 2015, 2016 and 2017 presented in the AERs. Where there was no measured data available, export coefficient estimation methodologies were utilised. Loads were estimated using British Water Code of Practice<sup>4</sup> (BOD & ammonia) and an adopted EPA methodology (total P) production per capita figures. The effluent loadings were calculated as the product of **per capita production figures** (estimated mass of each parameter produced per person per day), **population equivalents** (from the Irish Water Waste Water Capacity Register) and **treatment reduction factors** (factor that the treatment level at the WWTP reduces concentrations of the key parameters).

##### 4.1.1.1 Estimated Influent Loads (product of PE and production figures)

Influent loads were estimated as the product of per capita production rates and WWTP population equivalents. Population equivalents were available from Irish Water's Waste Water Capacity Register. Residential production per capita figures (production rates) were taken from the British Water Code of Practice<sup>4</sup> for BOD and ammonia, and from a nutrient load apportionment framework used by the EPA<sup>3</sup> for total P (Table 4.2).

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<sup>4</sup> British Water, *Code of Practice - Flows and Loads 4 - Sizing Criteria, Treatment Capacity for Sewage Treatment Systems*, 2013, BW COP: 18.11/13

**Table 4.1: Production per capita figures for BOD, ammonia & total P**

Parameter	Typical (g/person/day)	LoadingSource
<b>BOD</b>	60	British Water
<b>Ammonia as N</b>	8	British Water
<b>Total P</b>	2	Mockler

#### 4.1.1.2 Treatment Reduction Factors

Treatment reduction factors indicate the WWTP’s efficiency in reducing the concentration of a certain parameter between influent and effluent by means of treatment processes.

Total N and Total P reduction factors are taken from OSPAR<sup>5</sup>. BOD reduction factors are taken from CIWEM<sup>6</sup>.

**Error! Reference source not found.** summarises the reduction factors used to compute the estimated effluent loads from WWTPs where effluent monitoring is not available.

**Table 4.2: Treatment reduction factors**

Parameter	Treatment Reduction Factor				Source
	No treatment/preliminary treatment	Primary Treatment	Secondary Treatment	Nutrient Removal	
<b>Total P</b>	1	0.667	0.467	0.1	OSPAR
<b>Total N</b>	1	0.727	0.545	0.3	OSPAR
<b>BOD</b>	1	0.7	0.35	-	CIWEM

#### 4.1.2 Ambient Load Estimation

Upstream and downstream average ambient loads were calculated from monitoring results available from the WFD monitoring programme for the period 2015 to 2018, data is taken from the nearest WFD monitoring stations which have chemistry data available. Flow estimates were taken from the EPA’s Hydrotool where there is insufficient flow data in the subcatchment.

The load for each parameter is derived from the product of mean flow in the river (as per EPA Hydrotool in the case of Blacklion) at the monitoring location and the average monitored concentration for that

<sup>5</sup> OSPAR, *Guidelines for Harmonised Quantification and Reporting Procedures for Nutrients (HARP-NUT)*, 2004

<sup>6</sup> CIWEM Training Module - Municipal Wastewater Treatment

particular parameter. The following hierarchy of sources/methods was used in the estimation of mean flows:

1. Gauged data used where available;
2. Gauged data scaled pro-rata on areal basis where appropriate (hydrologically similar);
3. Hydrotool value (where appropriate);
4. Hydrotool values scaled pro-rata on areal basis (where appropriate).

For hydrotool flow estimates the flow that is equalled or exceeded for 30 percent of the time in the long term (30 percentile), was used in the assessment of ambient loads, as being representative of mean flows<sup>7</sup>.

## 4.2 Ambient Data

There is no upstream or downstream ambient monitoring data available for Blacklion as it discharges directly into Lower Lough Macnean.

## 4.3 Results and Findings

Generally load quantification calculates the difference between upstream and downstream loads and compared to the effluent load for each parameter. If the difference between the upstream and downstream loads is similar to the load within the WWTP effluent, it can be considered that the WWTP is contributing the majority of the pollutant load between the monitoring stations. If the difference in loads between the stations is much larger than the load being contributed by the WWTP, it can be concluded that the WWTP is not the sole contributor along that stretch of watercourse.

As there is no upstream or downstream ambient monitoring information the load quantification calculation cannot be undertaken for Blacklion, further information is required.

### STEP 4 SUMMARY

- There is no ambient monitoring data available upstream or downstream of Blacklion WWTP primary discharge, load quantification analysis could not be carried out.
- 

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<sup>7</sup> Environmental Protection Agency, *Hydrological Data - A list of water level recorders and summary statistics at selected gauging stations*, 1995

## 5 STEP 5 - AMBIENT MONITORING

### 5.1 Overview

The purpose of the ambient monitoring assessment was to analyse water quality data upstream and downstream of the agglomeration in order to determine the significance of the impact and associated response in the receiving waters; identifying patterns and trends that may suggest the presence of certain pressure categories. For example, a seasonal trend would explain elevated pollutant levels at certain times of year which may be linked to weather conditions. It involves a comparison of ambient monitoring data at selected monitoring stations to determine changes in water quality that could be attributed to specific pressures or issues identified along the waterbodies.

A map of the Lower Lough Macnean water body is shown in Figure 5.1.

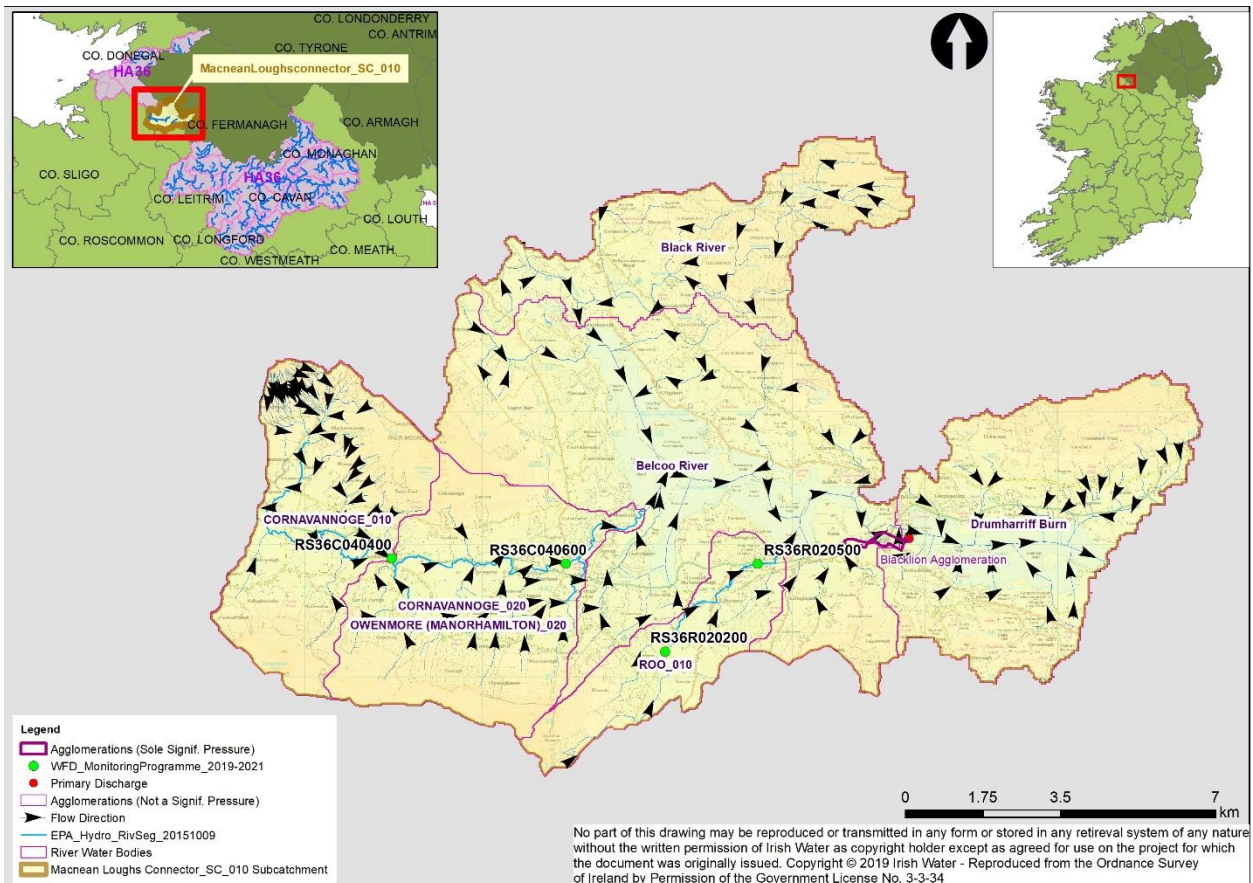


Figure 5.1: Monitoring station location map for Blacklion agglomeration

## 5.2 Methodology

The ambient monitoring assessment provides an insight into the impacts and responses in the receiving water environment upstream and downstream of the Blacklion agglomeration, informing and supporting the determination as to whether the Agglomeration is a significant pressure. The assessment also aids identification of other pollution sources.

### 5.2.1 Data analysis

The following approach has been taken to the data analysis:

1. Summarise key ambient monitoring data (both biology and physico-chemical), including environmental objectives, status and drivers. This provides a high level overview of the water body and identifies potential issues.

Additional factors taken into account include: comments from EPA Biologists; historic data; and any other information available in relation to the waterbodies and pressures.

2. Conduct a time-series analysis of ammonia, orthophosphate (Ortho-P) and BOD. This is to further characterise the water body and understand water quality in the receiving environment. This is completed through consideration and identification of key trends upstream and downstream of the receiving water body (i.e. seasonal or cyclical trends) that may be attributable to pressures within the water body or environmental conditions. The analysis supports the determination of whether an Agglomeration is a significant pressure.

## 5.3 Summary of Ambient and WFD Monitoring Data

Appendix D provides a summary of the ambient monitoring data for Lower Lough Macnean. There is no upstream or downstream ambient monitoring data available for Blacklion, as it discharges directly into Lower Lough Macnean.

### 5.3.1 Review of WFD App Risk Assessment Information

#### 5.3.1.1 Upstream Water Body

The Belcoo River is a river water body that does not have biology, nutrient or ecology information available, and therefore its status is overall 'unassigned' (2010-2015 and 2013-2018). However, it is classed as 'not at risk' of meeting its environmental objectives.

#### 5.3.1.2 Receiving Water Body

Lower Lough Macnean is at 'bad' ecological and biological status over the two consecutive monitoring periods (2010-2015 and 2013-2018) and therefore is 'at risk' of not meeting its environmental objectives. Physico-chemical conditions supporting the biological elements are at 'moderate' status over the two monitoring periods. The Blacklion agglomeration is therefore impacting on this lake water body.

### 5.3.1.3 Downstream Water Body

The Drumharriff Burn is a river Water body that does not have biology, nutrient or ecology information available, and therefore its status is overall 'unassigned' (2010-2015 and 2013-2018). However, it is classed as 'at risk' of not meeting its environmental objectives.

## 5.4 Physico-chemical Data - Time Series Analysis

There was no upstream or downstream data of the Blacklion agglomeration discharge, as this discharges directly into Lower Lough Macnean. It was therefore not possible to compare upstream and downstream time series analysis for the Blacklion agglomeration.

The monitoring stations in Lower Macnean and available monitoring data are listed in Table. 5.1. The locations of the monitoring stations with physico-chemical data are shown in Figure 5.1.

**Table 5.1: Ambient monitoring stations and available data**

Monitoring Station	Water Body	BOD Available	DataAmmonia Available	DataOrtho-P Available	Data
D/S	LS360012313000010	Lower Lough Macnean Open Water	2013-2019 (Apr)	2013-2019 (Apr)	2013-2019 (Apr)
D/S	LS360012313000020	Lower Lough Macnean Shoreline	2013-2019 (Apr)	2013-2019 (Apr)	2013-2019 (Apr)
<b>Effluent</b>					
Eff	TPEFF0200D0498SW001		2015-2019(Apr)	2015-2019(Apr)	2015-2019(Apr)

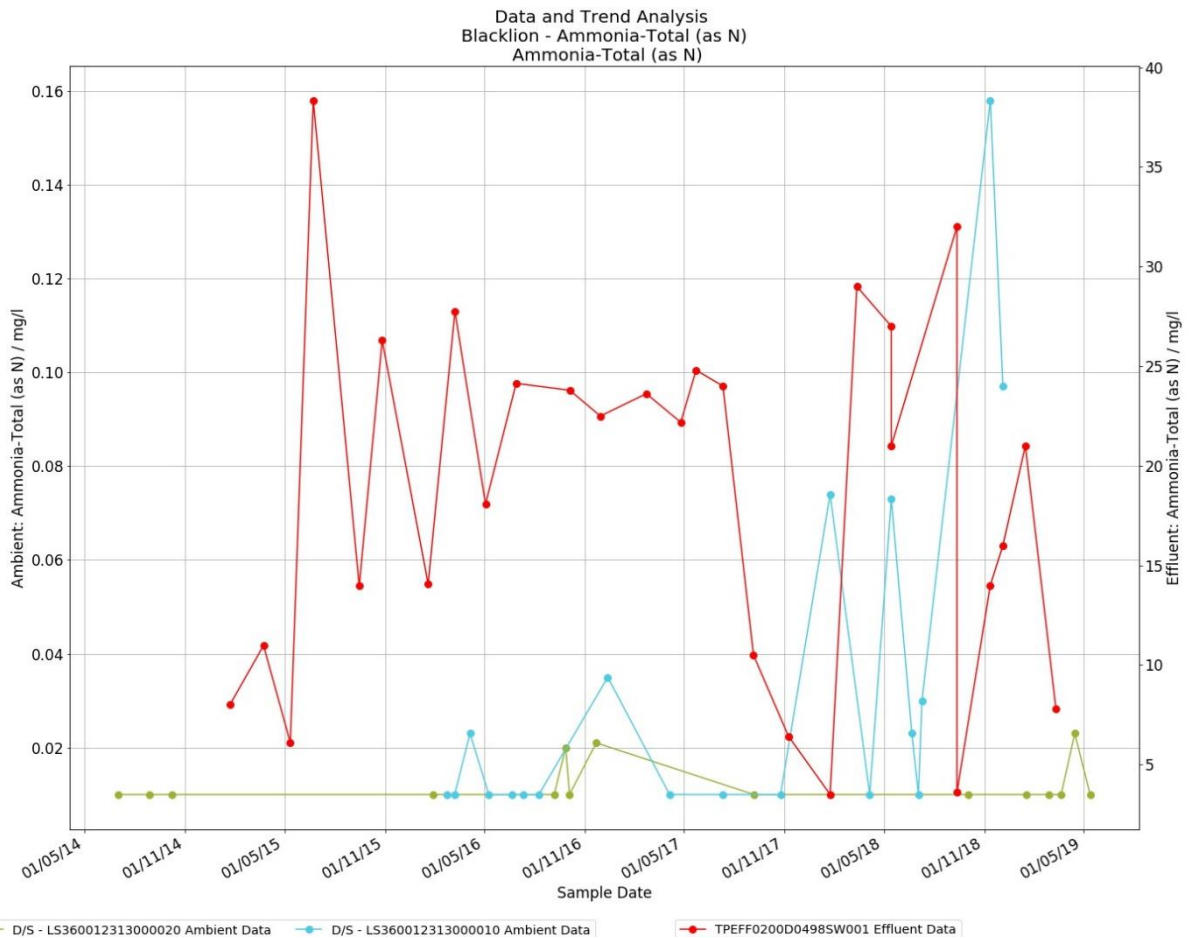
### 5.4.1 BOD

There is limited BOD monitoring information available for Lower Lough Macnean at these monitoring stations, therefore meaningful analysis was not possible.

### 5.4.2 Ammonia

Figure 5.1 plots ammonia concentrations at the ambient monitoring within Lower Lough Macnean with effluent ammonia concentrations also included on the graph for comparison. The shoreline monitoring station (LS360012313000020) is consistently achieving conditions consistent with the achievement of high ecological status. The open water surveillance and operation monitoring station (LS360012313000010) is generally indicative of conditions consistent with high ecological status, however ammonia peaks in the effluent do correlate with the spikes in the ambient monitoring at this station.

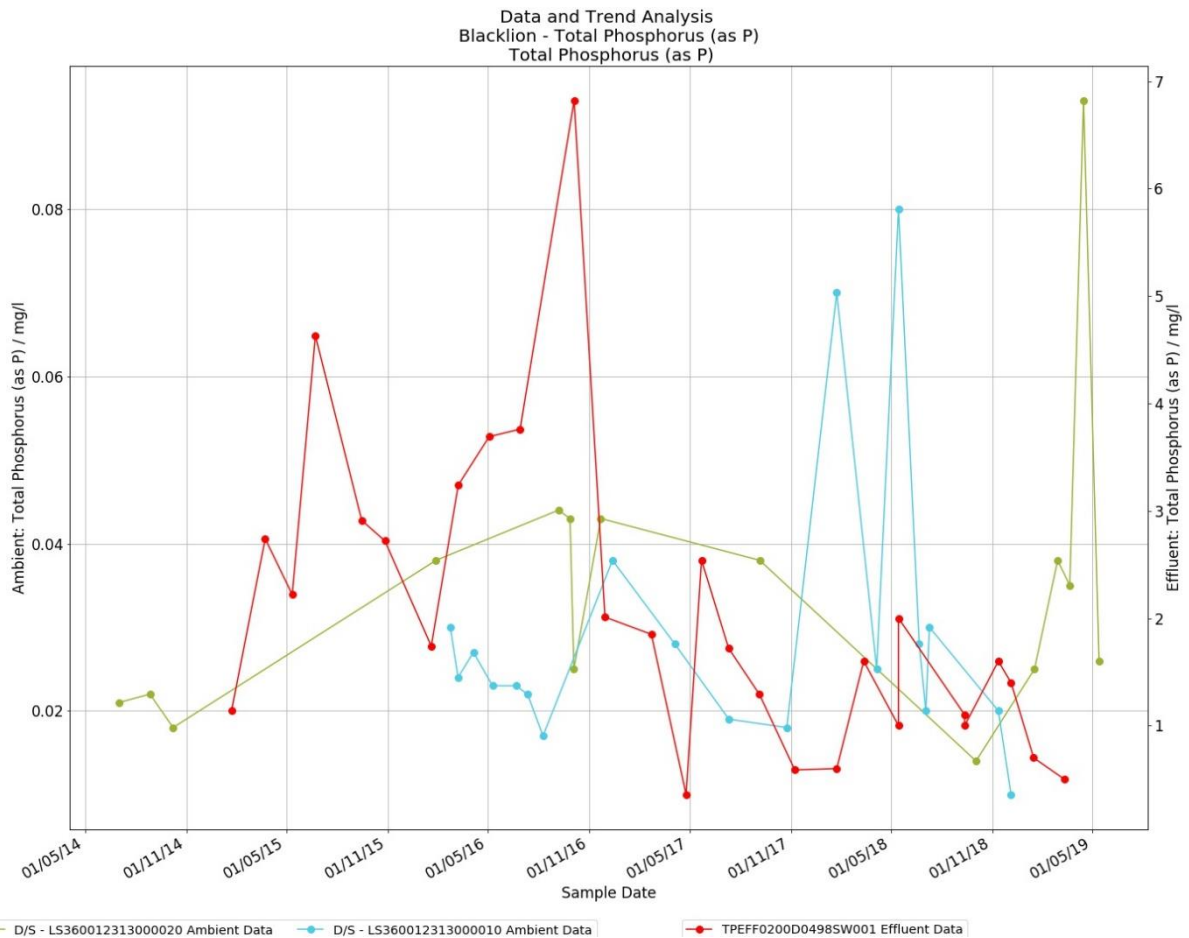
The potential impact of the agglomeration on the lake is not considered to be significant given the supporting ammonia conditions are considered to be consistent with the achievement of high ecological status in the lake.



### 5.4.3 Total Phosphorus

Figure 5.1 plots total phosphorus concentrations at the ambient monitoring within Lower Lough Macnean with effluent concentrations also included on the graph for comparison. The shoreline monitoring station (LS360012313000020) is consistently achieving total phosphorus conditions consistent with the achievement of 'less than good' ecological status. The open water surveillance and operation monitoring station (LS360012313000010) is also generally indicative of conditions consistent with 'less than good' ecological status. There is no obvious correlation between elevated levels of total P in the effluent and in the receiving water suggesting that there are other significant pressures causing the elevated levels of total P in Lower Lough Macnean.

These other pressures include the Belcoo WWTP and associated SWO in Northern Ireland which also discharges directly into Lower Lough Macnean and other wider catchment pressures within the Drumhariff Burn sub basin, e.g. Carrontreemall WWTP in Northern Ireland and diffuse nutrient pressures from the wider catchment land use which is predominantly agriculture.



## 5.5 Biological Monitoring

Within Lower Lough Macnean there are a number of monitoring stations, at some of which WFD biological monitoring is undertaken in Figure 5.1 There is no WFD biological monitoring data available for the upstream and downstream water body.

**Table 5.2: Biological monitoring summary**

Water body	Monitoring station	Conclusions drawn from available information
Lower Lough Macnean	Various	Biological status has remained at 'bad' status for the two consecutive monitoring periods. In 2010-2015 both phytoplankton and phytobenthos are indicative of conditions consistent with 'good' ecological status. Macrophytes and fish are both at 'bad' ecological status. In 2013-phytoplankton conditions remain at 'good' status whilst phytobenthos deteriorated to conditions consistent with 'moderate' ecological status. Macrophytes conditions improved to 'poor' ecological status whilst fish remained at 'bad' ecological status.

## STEP 5 SUMMARY

- Based on the review of ambient monitoring data in Lower Lough Macnean and the effluent quality, it is apparent that the nutrient issues in the Lough are not solely attributable to the Blacklion agglomeration. There are other significant pressures in the wider catchment, including in Northern Ireland, where there are urban wastewater pressures also which impact directly and indirectly on Lower Lough Macnean.
  - Biological monitoring data indicates that Lower Lough Macnean has remained at 'bad' status for three consecutive monitoring periods primarily due to the fish status.
-

## 6 STEP 6 - AGGLOMERATION ASSESSMENT

This step identifies the reasons for the inclusion of agglomeration on the EPA’s Priority Action for Waste Water Improvements List (the PAL), it also details the WWTP’s compliance from historic data and reporting.

### 6.1 Reason for Inclusion in the Priority Action List (PAL)

A total of 57 no. of the sole significant urban waste water pressures have been added to the Priority Action List (PAL) by the EPA OEE. Table 6.1 lists the reasons for Blacklion’s inclusion on the PAL.

**Table 6.1: Reasons for inclusion of Blacklion on PAL**

Reason on the PAL	for	Inclusion	Applicable to Blacklion agglomeration?
Larger agglomeration which is non-compliant with the UWWTD:			x
- An agglomeration requiring secondary treatment under Article 4 of the Directive			x
- An agglomeration requiring more stringent treatment under Article 5 of the Directive			
Agglomeration is contributing to ‘poor’ quality bathing waters			x
Sole significant pressure on water body ‘at risk’ of not achieving WFD environmental objectives			✓
Agglomeration requires improvement to protect or improve habitat of the Freshwater Pearl Mussels			x
Improvement needed to protect shellfish waters			x
Network Improvements are needed			x

### 6.2 Compliance

#### 6.2.1 Capacity

A Waste Water Capacity Register has been developed by Irish Water to provide an indication of the available headroom (in terms of organic loads expressed as population equivalent (PE)) at WWTPs. The purpose is to support growth and development, in line with the national spatial planning policy, national housing policy and national rural development policy; without having a significant impact on the environment, specifically receiving water bodies and European sites.

The Blacklion plant has a design peak hydraulic capacity of 534 m<sup>3</sup>/day and a 2018 average hydraulic loading of 257 m<sup>3</sup>/day. The annual maximum hydraulic loading to the plant was 1,003 m<sup>3</sup>/day in 2018 and therefore with the lack of storm storage at the WWTP can result in issues with the hydraulic loading. Organically, the plant is operating within the design capacity of 1,025 PE with a 2019 collected load of 509 PE.

#### 6.2.2 ELV Compliance Assessment

The purpose of the ELV compliance check is to understand the performance of the WWTP, establishing whether it is operating as designed.

The ELVs outlined in the WWDA licence are summarised in Table 6.2.

**Table 6.2: ELVs for Blacklion WWDA licence**

	BOD	COD	TSS	Total-P	Ammonia
<b>WWDA License ELV (Schedule A)</b>	25	125	35	1	5

The compliance of the WWTP for 2016, 2017 and 2018 is summarised in Table 6.3 based on compliance reporting provided by Irish Water. The effluent is largely not achieving the ELVs specified in the WWDA license, however it is noted that the plant is achieving BOD, COD, SS and pH ELVs in 2018, which is indicative of the improvements in maintenance and operation at the plant. It should also be noted that the monitoring point for compliance is located upstream of the reed beds.

**Table 6.3: Summary of compliance for Blacklion agglomeration 2016-2018**

Parameter	2016				2017				2018			
	No. Samples	of No. Breach	ELV Compliance N (Number) Q (Quality)		No. Samples	of No. Breach	ELV Compliance N (Number) Q (Quality)		No. Samples	of No. Breach	ELV Compliance N (Number) Q (Quality)	
<b>pH</b>	7	0	PASS		6	0	PASS		8	0	PASS	
<b>SS</b>	7	1	PASS		6	3	FAIL Q		8	1	PASS	
<b>COD</b>	7	1	PASS		6	0	PASS		8	0	PASS	
<b>BOD</b>	7	3	FAIL Q		6	3	FAIL Q		8	0	PASS	
<b>Ammonia</b>	7	7	FAIL Q		6	6	FAIL Q		8	6	FAIL Q	
<b>Total P</b>	7	7	FAIL Q		6	4	FAIL Q		8	5	FAIL Q	

ELV breaches can be due to changes to WWTP processes or operations, rather than to enduring issues with plant performance.

Blacklion WWTP has been consistently non-compliant, with frequent breaches of its ELVs set out in the WWDA licence for several parameters. From the effluent data there has been consistent breaches for ammonia and total P, with 6 out of 8 samples failing for BOD and 5 out of 8 samples failing for total P, respectively in 2018. There is also a trend of breaches for BOD in the past, although 2018 saw no ELV breaches for BOD. It should be noted that although the plant is not compliant with the license ELVs it is not designed to do so and is more likely designed to achieve a 25/35 standard and possibly the Total P standard due to its age and the legislation in place around the time it was originally designed and built as well as any subsequent upgrades.

In addition the licensed treated effluent monitoring point is located upstream of the reed bed, and therefore analysis of the WWTP final effluent data should be undertaken with this in mind, as compliance is assessed at secondary treatment stage, however the reed bed effectively provides tertiary treatment, leading to an improvement in effluent from the works.

### 6.2.2.1 Annual Environmental Report

The latest AER (2018) notes that the WWTP is non-compliant with the ELVs set in the WWDA licence. A total of 10 samples exceeded the ELVs with condition 2 interpretation applied in relation to total phosphorus and ammonia.

The causes of the exceedances include storm events, insufficient chemical dosing for phosphate removal, and the fact that the plant is not designed to achieve the ammonia ELV. The AER states that the discharge from the WWTP does not have an observable negative impact on water quality or WFD status. Other potential causes of deterioration in water quality in the area noted in the report include villages (diffuse urban pressures), agriculture, and unknown cross-border pressures.

There was one incident type (non-compliance) reported during 2018 which accounted for five incidents in total. The cause is reported as the requirement for a WWTP upgrade to meet ELVs.

There were no capital or operational changes undertaken in 2018.

An update on the status of the agglomeration from Irish Water from 2019 indicated a number of improvements were made to the agglomeration during 2018. The RBC units were upgraded and ferric dosing point was relocated. The process controls and humus tanks were cleaned. However it was concluded that the operational measures alone will not achieve licence compliance and therefore, further infrastructural interventions are required to meet the license conditions.

### 6.2.2.2 EPA Inspector's Report

The latest EPA Inspector's Site Visit Report from December 2018 was conducted as part of the annual visitation programme to check with the plant's WWDS license compliance. The report states that there have been regular ELV breaches for ammonia, total phosphorous and suspended solids.

The report states that an Implementation Group is in place for Blacklion and is overseeing the progress on the implementation of improvements to optimise the plant's performance, which are noted in the AER (2017). However it is stated that despite these actions the plant continues to breach ELVs. Irish Water has stated that Blacklion is included in its national Inlet Works, Storm and Sludge (IWSS) Programme.

The report concludes that Irish Water are required to take all necessary measures to ensure that discharges from the Blacklion agglomeration do not prevent the receiving waters from meeting their environmental objectives, with the onus on Irish Water to comply with the requirements of the licence for Blacklion.

## 6.2.3 Proposed Improvement Measures for Agglomeration

As part of the recommended improvement works at the Blacklion agglomeration in the Site Options Report prepared under the IWSS Programme, the following are the main capital maintenance works proposed:

- Upgrade the inlet works, which includes the provision of inlet screens, grit removal and flow control,
- Construct storm water holding tank for the plant
- Upgrade the sludge storage, thickening and dewatering facilities, including the use of reedbeds.

It is noted that the works may be carried out in phases and there is currently no timeframe for completion.

Compliance with the ammonia ELV is the main issue at the WWTP. Whilst the works proposed are not going to address nitrification issues specifically, overall they will address the hydraulic loading issues and storm storage and help overall performance. It should also be noted that the reed beds included in the treatment process downstream of the effluent monitoring point for polishing will provide further treatment of ammonia levels.

The improved efficiency of the plant after the upgrades should ensure that the agglomeration is not a significant pressure on the ammonia conditions in Lough Macnean, particularly given the reed bed system which acts as a polishing process for the treated effluent and considering the current conditions in the lake water body are consistent with 'high' ecological status.

The key nutrient issue in Lough Macnean is phosphorus with the conditions in the lake not consistent with those required to support 'moderate' ecological status. As outlined in section 5, the fish status is the biological element that is driving the overall ecological status of the lake which is currently classified at 'bad' ecological status. Addressing the hydraulic issues and storm water holding tank should result in improvements in the nutrient conditions in addition to the relocated dosing unit as outlined above.

#### STEP 6 SUMMARY

- Blacklion WWTP is overloaded hydraulically but has headroom in terms of organic loading.
  - There have been recurring ELV breaches for ammonia, BOD, SS and total phosphorus over the last number of years due to ongoing operational issues at the plant.
  - The plant has been part of a targeted operational improvement programme to implement improvements to optimise the plant's performance including moving of ferric dosing point and more appropriate desludging programme.
-

## 7 STEP 7 – TROPHIC ASSESSMENT

A mass balance assessment is not possible for a discharge into standing water. Therefore an assessment of the discharge on the trophic status of Lough Macnean has been undertaken on the assumption that the Lough is achieving its environmental objective, i.e. ‘good’ ecological status. The background concentration has therefore been taken to be the midpoint between the EQS for total phosphorus supporting conditions indicative of ‘good’ and ‘high’ ecological status, i.e. 0.018 mg/l.

### 7.1 Methodology

The assessment of lake water quality is commonly carried out by reference to a scheme proposed by the OECD<sup>8</sup>. This scheme defines the five traditional trophic categories by setting boundaries for the annual average values for total phosphorus, chlorophyll and water transparency and for the maximum and minimum values for the latter two parameters. These are the three key parameters in assessing the level of eutrophication and its effects. Inputs of phosphorus to freshwaters commonly result in planktonic algal and cyanobacterial growth, which are most easily quantified by measurement of the algal pigment chlorophyll. Water transparency is an important aesthetic characteristic in lakes and frequently determines the suitability of a water body for recreational pursuits such as game fishing and swimming.

Phytoplankton chlorophyll gives a very good measure of phytoplankton biomass and is very widely used as an index of lake trophic state. The figures for annual total phosphorus load based on ‘good’ status, flow and volume for Lower Lough Macnean have been used to predict chlorophyll responses. The predicted chlorophyll levels are then compared to OECD fixed boundary conditions for the trophic classes included in Table 7.1 below.

**Table 7.1: OECD fixed boundary system for Lake Trophic Classes based on annual maximum chlorophyll concentration in mg/m<sup>3</sup>**

Chl-a (mg/m <sup>3</sup> )	Trophic Class
< 8	Oligotrophic
8 – 25	Mesotrophic
26 – 35	Moderately Eutrophic
36 – 55	Strongly Eutrophic
56 – 75	Highly Eutrophic
> 75	Hypereutrophic

The assessment assumed Lower Lough Macnean is achieving its environmental objectives of physico-chemical supporting conditions consistent with ‘good’ ecological status and then includes the addition total P loading from the WWTP to establish if this additional load impacts on the trophic status of the lake.

<sup>8</sup> Organisation for Economic Cooperation and Development, *Eutrophication of Waters, Monitoring, Assessment and Control*, 1982

## 7.2 Results

The results of the trophic assessment are summarised in Table 7.1 below. Appendix E includes the completed assessment. Lower Lough Macnean is a naturally mesotrophic lake (i.e. those in the middle of the trophic range). If an assumed mid point for the background concentration is taken as the baseline then the trophic assessment confirms it is at the lower end of the mesotrophic range. The existing loading to the Lough from the WWTP, based on the AER data, suggests that the WWTP is increasing the chlorophyll levels by approximately 5 percent but it remains in the lower end of the mesotrophic range. In both scenarios, i.e. the trophic assessment with and without the WWTP load the lake is considered to be mesotrophic with a marginal increase in the chlorophyll levels of 5 % predicted. This suggests that Blacklion is not the sole significant pressure acting on the Lower Lough Macnean lake water body with addition loading from the wider catchment also contributing to the less than good supporting nutrient conditions.

If the proposed upgrades undertaken ensure compliance with the TP ELV and address the storm water issues at the agglomeration the increase in chlorophyll levels as a result of the discharge would be 2.7% further reducing the impact of the primary discharge.

The assessment does not consider the load from the SWO in the agglomeration, data is currently being collected on the operation of the SWO.

REPORT

**Table 7.2: Impact of discharge on Lower Lough Macnean based on existing loading from the WWTP**

							Without WWTP Load		WWTP Load included		
	EU_CD	Name	Surface Area (m <sup>2</sup> )	Outflow (m <sup>3</sup> /s)	Annual Outflow (m <sup>3</sup> /yr)	Mean Depth (m)	Maximum chlorophyll (0.74*Flushing <sup>0.89</sup> ) (mg/m <sup>3</sup> /yr)	Trophic Status	Maximum chlorophyll (0.74*Flushing <sup>0.89</sup> ) (mg/m <sup>3</sup> /yr)	Trophic Status	% Increase
Existing Loading from AER reports	IE_NB_36_445	Lower Lough Macnean	4574214	3.885	122517360	1.5	7.8	Oligotrophic	8.2	Mesotrophic	5
Loading assuming compliance with the ELV							7.8	Oligotrophic	8.0	Mesotrophic	2.7

## STEP 7 - SUMMARY

- The trophic assessment of the impact of the WWTP discharge has demonstrated that the WWTP will not affect the trophic status of the lake and is therefore not the sole significant pressure. This is based on an assumed background concentration (i.e. that other pressures upstream of the lake are addressed, and that Lough Macnean achieves at least 'good' status), and the latest AER loadings for the WWTP.
  - If the proposed upgrades are completed and it is assumed that the WWTP is achieving its total P ELV and the hydraulic issues are addressed then the impact of the discharge will be further reduced.
  - The trophic assessment does not consider the SWO on the agglomeration that is also discharging into the lake and so the agglomeration cannot be discounted as a Sole significant pressure
  - Monitoring of this SWO is scheduled under the SWO programme and will allow the determination of the potential impact of the SWO.
-

## 8 STEP 8 - FURTHER DETAILED ASSESSMENT

The desktop-based assessment has been carried out (i.e. Steps 1 to 7). It has demonstrated that Blacklion agglomeration is a significant pressure, however it is unlikely to be a sole significant pressure. The data quality checks as part of Step 1 and detailed calculations produced robust determinations, with high confidence in the outputs of each step in most cases however monitoring information on the SWO is required to discount this as a pressure, as summarised in Table 8.2.

If Steps 1 to 7 have not provided adequate evidence that an agglomeration is a significant pressure, or a sole significant pressure, a further detailed assessment (Step 8) may be required in order to make these determinations. Further assessment categories are described in Table 8.1 **Error! Reference source not found.**

**Table 8.1: Further detailed assessment categories**

### Further Detailed Assessment Categories

<b>A</b>	Full scoping of further detailed assessment work required to achieve the aims of the overall assessment.
<b>B</b>	Visual assessment in relation to a discharge point in line with EPA CSMU Guidance on Further Characterisation for Local Catchment Assessments; including undertaking a stream walk, taking field notes, preparing a succinct summary and interpreting results for use in the assessments.
<b>C</b>	Monitoring of biological indicators upstream and downstream of a discharge point and interpreting results for use in the assessments.
<b>D</b>	Monitoring of physico-chemical indicators upstream and downstream of a discharge point and interpreting results for use in the assessments.
<b>E</b>	Taking water samples upstream and downstream of a discharge point and arranging analysis in an accredited laboratory for physicochemical parameters and interpreting results for use in the assessments.
<b>F</b>	Subcatchment scale modelling exercise using platforms such as SAGIS-SIMCAT or similar (to be approved by Irish Water); and interpretation of results for use in the assessments.

**Table 8.2: Summary of data issues**

Step	Data Confidence Issues	Data Gaps
1	No issues	No issues
2	No issues	No issues
3	No issues	No issues
4	No issues	No issues
5	No issues	No issues
6	SWO assessment	IW's SWO Programme will determine the impact of the SWO
7	No issues	No issues



## STEP 8 - SUMMARY

- Though the SWO is not identified in the WFD App as a significant pressure, the impact of the SWO that discharges to Lower Lough Macnean will be established under Irish Water's SWO programme to determine if it is affecting the water body's ability to achieve its environmental objectives.
-

## 9 STEP 9 - OVERALL CONCLUSIONS AND DETERMINATIONS

The final step draws together the findings of the preceding steps to draw overall conclusions for the Agglomeration based on a weight-of-evidence approach. These conclusions and determinations are presented on a water body basis for each water body where urban waste water was identified as a sole significant pressure. Table 9.1 presents the overall conclusions and determinations of the assessment.

**Table 9.1: Overall conclusions and determinations**

### Water Body: Lower Lough Macnean

<b>Significant pressure</b>	Yes
Is the agglomeration a significant pressure i.e. is it causing water quality issues?	
<b>Sole significant pressure</b>	No
Is the agglomeration a sole significant pressure i.e. is urban waste water the only pressure category causing water quality issues?	
Is the agglomeration causing water quality issues that, in the absence of other pressures, would result in the water body failing to achieve its environmental objectives?	No

- A stage 2 Appropriate Assessment was undertaken in 2015 to assess the impact of the discharge on the downstream SAC, Upper Lough Erne SAC. It concluded that the discharge from the agglomeration are not likely to result in adverse impacts on the ecological integrity of Natura 2000 sites, either by itself or in combination with other plans or projects, as long as mitigation is adhered to, i.e. the WWTP is compliant with the EPA WWDA licence conditions.
- The Blacklion agglomeration is located within Macnean Loughs Connector\_SC\_010 subcatchment. From the available soils and subsoils information it is likely that diffuse nutrients will be transported by overland / near-surface pathways which dominate the subcatchment.
- Based on the review of ambient monitoring data in Lower Lough Macnean and on the effluent quality, it is apparent that the nutrient issues in the lake are not solely attributable to the Blacklion agglomeration. There are other significant pressures in the wider catchment including in Northern Ireland where there are urban wastewater pressures also which impact directly and indirectly on Lower Lough Macnean.
- Blacklion WWTP is overloaded hydraulically but is operating within capacity in terms of organic loading.
- There have been recurring ELV breaches for ammonia, BOD, SS and total phosphorus over the last number of years due to ongoing operational issues at the plant.
- The plant has been part of a targeted improvement programme to implement improvements to optimise the plant's performance including moving of ferric dosing point and more appropriate desludging programme.
- The trophic assessment of the impact of the WWTP discharge has demonstrated that the WWTP will

not affect the trophic status of the lake and is therefore not the sole significant pressure.

- If the proposed upgrades are completed and it is assumed that the WWTP is achieving its total P ELV, and the hydraulic issues are addressed; then the impact of the discharge will be further reduced. The assessment of the polishing effects of the reed bed system are not considered in this assessment but should further improve the quality of the effluent from the WWTP.
- The trophic assessment does not consider the potential impact of the SWO. This should be established to determine whether the SWO is affecting the water body's ability to achieve its environmental objectives. The SWO that discharges to Lower Lough Macnean is included in the SWO programme. Though the SWO is not identified in the WFD App as a significant pressure, the impact of this intermittent discharge should be established to determine if it is affecting the water body's ability to achieve its environmental objectives.

## STEP 9 - SUMMARY

- The Blacklion agglomeration is a significant pressure on the Lower Lough Macnean lake water body causing water quality issues. However it is not the sole significant pressure, other pressures are contributing to the water quality issues in the receiving water body particularly as the fish status is currently classified at 'bad' due to fish abundance and biomass metrics. The trophic assessment demonstrates that, in the absence of other pressures on the lake, the WWTP discharge would not result in the lakes failing to achieve its environmental objectives. The SWO programme assessments should be used to determine whether the SWO is a contributing factor to the water quality issues in Lower Lough Macnean.
-

## **Appendix A**

### **Data Collection Summary**

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
24/08/2017	Irish Water	Irish Water	CoA data _22_08_2017_For Upload	Summary information for certified agglomerations	
20/11/2018	Irish Water	Irish Water	IW-AM-ES-DWRA-20181116	WWDA Drinking Water Risk Assessment – methodology document and example scoresheet	N/A
20/11/2018	Irish Water	Irish Water	DWRA Official Scoresheet_20181120	WWDA Drinking Water Risk Assessment – example scoresheet	N/A
20/11/2018	Irish Water	Irish Water	IW-AM-ES-CapRegAssessment-20180831	Capacity Register assessment document – includes an assessment of impact on receiving water quality	According to the CoA (Certificate of Authorisation) (2017) Headroom Available is 466 (2017 AER). Project status undefined.
20/11/2018	Irish Water	EPA	National Surface Water Characterisation Spreadsheet 06122017 (full)	National Characterisation Spreadsheet	Macnean is considered ‘at risk’ (2010-2015) bad ecological status.

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
20/11/2018	Irish Water	EPA	National WRAA 17_Regions_2018priorities_20181108	11-09-Priority Areas for Action indicating where Sole significant pressures are located in PAAs (also includes RBMP Appendix 1 information) (National WRAA...)	Macnean NOT identified as Area for Action.
20/11/2018	Irish Water	EPA	HES_Objectives_Feb2018	National Ecological objective	High Status N/A
20/11/2018	Irish Water	EPA	PAs_Deter_WBs_10_11_17_EDITED 2018_queried	8-2-Priority water bodies	Macnean identified as Area for Action. Pressure: DU.

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
20/11/2018	Irish Water	Irish Water	UWW_Final_Pressure_List_24_10_17_queried	Urban waste water significant pressures spreadsheet	WWTP discharges directly into this water body. Total ammonia and total phosphorous breaches noted at the WWTP. Operational issues noted.
IBE1556   Sole significant pressures   F01   June 2020					

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
20/11/2018	Irish Water	Irish Water	Priority Area List Q2 2018_IW Update	Priority Action List (PAL) information i.e. the reason(s) why the EPA consider the agglomerations to be priority agglomerations for action	Likely cause - WWTP. It is a candidate for the next investment. IW is investigating the measures required to resolve Sole significant pressure issue.

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
	Irish Water	Irish Water	Q3 2018 Update Including EDEN responses	Compliance investigation ss	<p>The EPA CSMU's initial characterisation impact assessment noted ammonia and phosphorous breaches and operational issues at the WWTP as the likely causes for the significant pressure on the receiving water body. The following improvements were completed at Blacklion in 2018:-</p> <p>RBC units upgraded; Ferric Dosing Point relocated; controls on forward feed pumps to the RBC's; Humus Tanks cleaned.</p> <p>Irish Water is undertaking comprehensive assessment of those agglomerations that have been identified as 'sole' significant pressures within "at risk" water bodies which includes Blacklion. This assessment work will build on the initial characterisation exercise undertaken by the EPA CSMU during 2015/6. The aim of the assessment is to update the initial characterisation, verify if the agglomeration is still a significant pressure following any changes since the CMSU's assessment of 2015/6, and quantify any improvements necessary to contribute to the achievement of water body objectives. As a first step, up-to-date information and assessments in relation to the</p>
IBE1556	Sole significant pressures		F01	June 2020	
<a href="http://rpsgroup.com">rpsgroup.com</a>					

**REPORT**

<b>Date received</b>	<b>Organisation Received from</b>	<b>Data owner</b>	<b>File name as received</b>	<b>Description</b>	<b>Blacklion</b>
20/11/2018	Irish Water	Irish Water	2016_Article_17_report_for_upload	UWWTD Article 17 report	N/A
28/11/2018	Irish Water	Irish Water	Significant Pressure Monitoring Data	Significant Pressure Monitoring Data	No Influent & Effluent Data Available
21/11/2018	Irish Water	Irish Water	Limnos Assessment Tracker	Limnos Assessment Tracker	N/A
21/11/2018	Irish Water	Irish Water	2017 AER Data Collector - cleansed MH	AER Data Collector	The WWTP was non-compliant with the ELV's set in the discharge licence.
22/11/2018	Irish Water	Irish Water	211118 Surface Water Yield Assessment	Surface Water Yield Assessment	0200PUB0109 Not included in Assessment
21/11/2018	Irish Water	Irish Water	IW_EPA_SW Methodology 091216 for IW presentation	Irish Water National Water Resources Plan	
22/11/2018	Irish Water	Irish Water	FPM ES Report Tracker 2018	FPM Ecological Statement Report	Blacklion not located in FPM catchment -N/A
28/11/2018	Irish Water	Irish Water	Ambient Mon Locations 63	Monitoring locations	Blacklion data from monitoring stations NOT available.
07/12/2018	RPS Galway	RPS	NCAP Reports Priority 1.zip	Site Assessment report for 7 agglomerations (CoA) on NCAP Programme	NCAP Report NOT Completed for Blacklion.
07/12/2018	RPS Galway	RPS	Small Stream Risk Score for 7 WWTP and their associated discharges	Small Stream Risk Score for 7 WWTP and their associated discharges	N/A

**REPORT**

<b>Date received</b>	<b>Organisation Received from</b>	<b>Data owner</b>	<b>File name as received</b>	<b>Description</b>	<b>Blacklion</b>
18/12/2018	Irish Water	Irish Water	IW_Agglomerations_141218	Shapefile boundaries of agglomerations	with boundary included of
17/12/2018	Irish Water	Irish Water	WFD_Chemistry_Monitoring_17122018_Donegal	WFD Monitoring Data	Blacklion monitoring stations included.
14/12/2018	Irish Water	Irish Water	SWO Outfall Field Inspection - Entries (Rev 6) - to SFPA.xlsx	A spreadsheet outlining the information that will be collected in the field using the SWO Visual Assessment App (this is still draft but is unlikely to change much). I have copied some text below to put some context to this.	Information that will be collected but has not yet been captured
14/12/2018	Irish Water	Irish Water	Annex 1 - EPA correspondence of 8 November 2016.pdf	A PDF document of an EPA report on a review of nutrient sensitive areas as required by the UWWTD. As mention in the workshop on Tuesday, Irish Water do not agree with all aspects of this report.	N/A

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
14/12/2018	Irish Water	Irish Water	Loads Template v11 20170405	Information on loads (existing and projected) issues to the EPA CSMU to assist them in their initial characterisation work.	N/A
17/12/2018	Irish Water	Irish Water	20181126-DAP Progress	List of agglomerations in our DAP programme. DAP outputs are on the SPA Alfresco Cloud site.	N/A
17/12/2018	Irish Water	Irish Water	IW-AM-ES-SPA Aggloms	63 aggloms in the SPA project with extra columns of info attached for: whether the agglomeration is included in the telemetry programme; whether the aggloms has (or will get) event duration monitors (EDMs).	Blacklion not scheduled for inclusion in either monitoring programme
18/12/2018	Irish Water	Irish Water	IW-AM-ES-SPA Aggloms	63 agglomerations with a new column indicating which agglomerations are contained with existing/planned model domains	As Above

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
18/12/2018	EPA	EPA	<a href="http://www.epa.ie/QValue/webusers/">http://www.epa.ie/QValue/webusers/</a>	Hyperlink to Q values	Blacklion included
18/12/2018	Irish Water	Irish Water	Q4 2018 PAL IW Update_SPs	Q4 2018 PAL update attached for Sole significant pressure agglomerations (only 57 of the 63 Sole significant pressure agglomerations are included on the PAL).	Blacklion still classified as Sole significant pressure in this dataset
20/12/2018	Irish Water	Irish Water	Shellfish Tracker for 2018 AERs_SPA aggloms	Info in relation to the disinfection programme attached	N/A

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
20/12/2018	Irish Water	Irish Water	Shellfish_LSR_SourceMapper_SPA aggloms	Info in relation to the disinfection programme attached	N/A
IBE1556   Sole significant pressures   F01   June 2020					

**REPORT**

<b>Date received</b>	<b>Organisation Received from</b>	<b>Data owner</b>	<b>File name as received</b>	<b>Description</b>	<b>Blacklion</b>
20/12/2018	Irish Water	Irish Water	IW-AM-ES-SPA Aggloms_20181220v2	Update of overall list on Project status	No project status
21/12/2018	Irish Water	Irish Water	Sole significant pressure Sites - BOD Data	BOD data for the Sole significant pressure aggloms	BOD data available for Blacklion
21/12/2018	Irish Water	Irish Water	Ww Disinfection Shellfish Tracker_SP	information on the disinfection programme	N/A
21/12/2018	Irish Water	Irish Water	20745 - Prioritisation Matrix_SP	information on the disinfection programme	N/A
21/12/2018	Irish Water	Irish Water	20745 SAR - Conclusions	information on the disinfection programme	N/A
24/12/2018	Irish Water	Irish Water	Proposed Interim Generated Load Methodology IW 20161128 v5.2	Interim load methodology document. The methodology is currently under revision, due to be complete by end Jan 2019	Blacklion NOT included in the Pilot Study
24/01/2019	Irish Water	Irish Water	NCAP Report_H2_2018.xlsx	BOD data for the Sole significant pressure cert sites (CoA) aggloms (<500 PE)	N/A
30/01/2019	Irish Water	Irish Water	Regulatory_Influent_Effluent2018	2018 influent and effluent regulatory data	Data available for Blacklion
04/02/2019	Irish Water	Irish Water	Cert Sites 2016-2018	Available effluent monitoring for CoA sites for 2016 - 2018	N/A

REPORT

Date received	Organisation Received from	Data owner	File name as received	Description	Blacklion
05/02/2019	Irish Water	Irish Water	IW-AM-ES-DraftReviewList-20180720_record decisions	List of licences that we are considering for review	N/A
05/02/2019	Irish Water	Irish Water	Phosphate Susceptibility	Phosphate Susceptibility mapping from EPA CCT	Susceptibility mapping for Blacklion Available
13/02/2019	Irish Water	Irish Water	Cert Sites 2014-2018	Available effluent monitoring for CoA sites for 2014 - 2018	N/A

**Appendix B**

Data

Quality

Checks

## Monitoring Data General Quality Check

Numerous datasets have fed into the calculations required to assess the effluent loads, the data is listed in Appendix A.

Data availability and quality checks have been carried out to ensure that data is fit for purpose. Note that ambient data downloaded from the WFD App has already undergone review and cleansing by the EPA. Data checks typically ensured:

- that the data is within the expected range for each parameter;
- that the data has valid entries for missing data (zeros have been removed to aid statistical analysis);
- that the data has valid entries for samples below ELVs of detection or quantification;
- that the data has valid sample date and time information;
- that the measurement units are correctly recorded;
- whether flow data is available concurrently with concentrations (data taken from Hydrotool mean flow estimates at the ambient monitoring locations, if available, to calculate existing upstream and downstream loads);
- whether flows correlate with any physical constraints on the discharge arrangements (e.g. consistent pipe capacity exceedances could indicate that a sample is in a receiving watercourse rather than the actual discharge);
- that the analysis quality assurance metadata is also available (samples would have been taken and analysed in line with EPA methodologies);
- that sampling point locations are known, ideally are georeferenced, and correctly identified (analysed in ArcGIS to avoid any inter-mixing of discharge/upstream or downstream concentration datasets);
- that there is no seasonal bias within the sampling regime which might extrapolate to inaccurate annual loadings given population loading variation and other seasonal factors (the WFD monitoring programme collects samples quarterly, effluent samples are generally sampled monthly thereby ensuring averages are not heavily swayed by seasonal bias).

## Step Change Detection

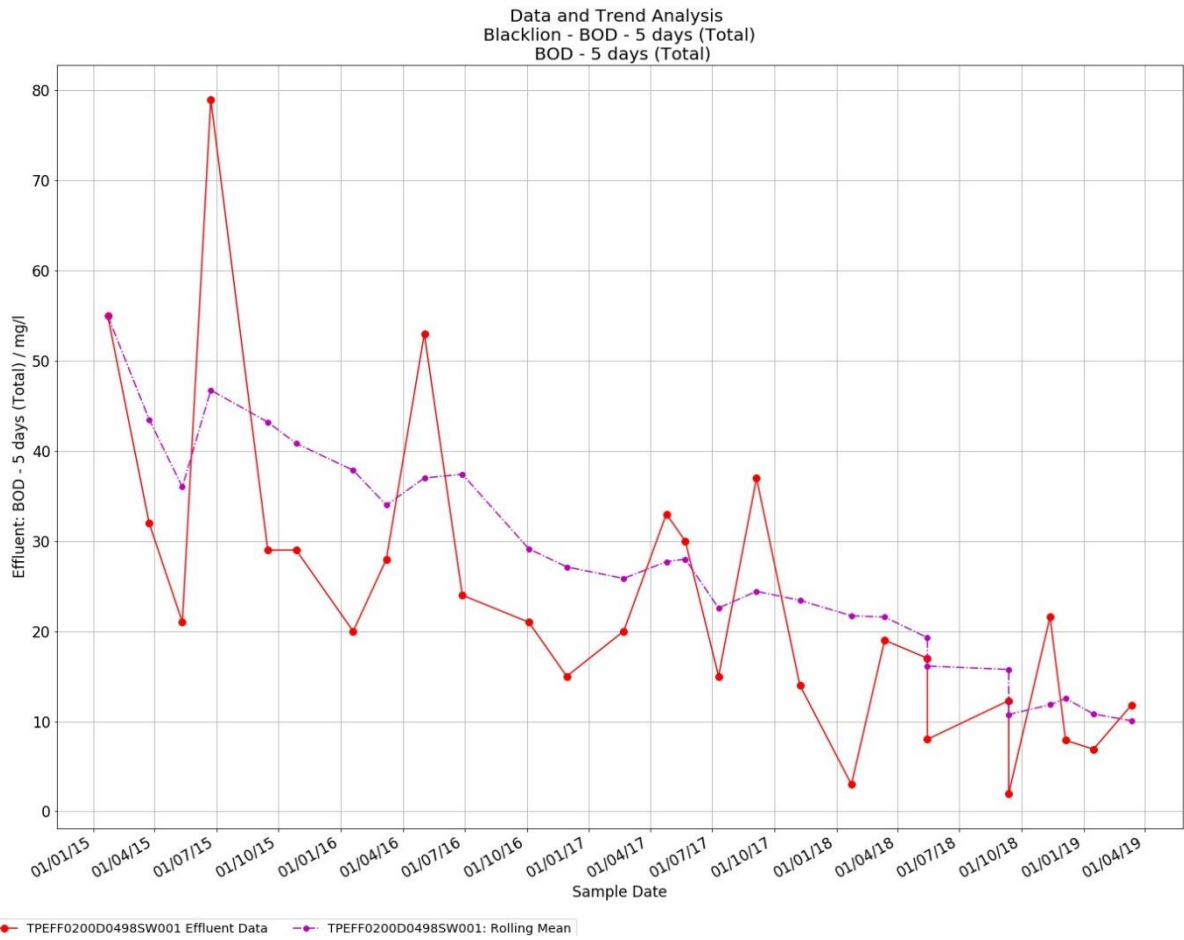


Figure 9.1: Blacklion effluent BOD concentrations step change detection

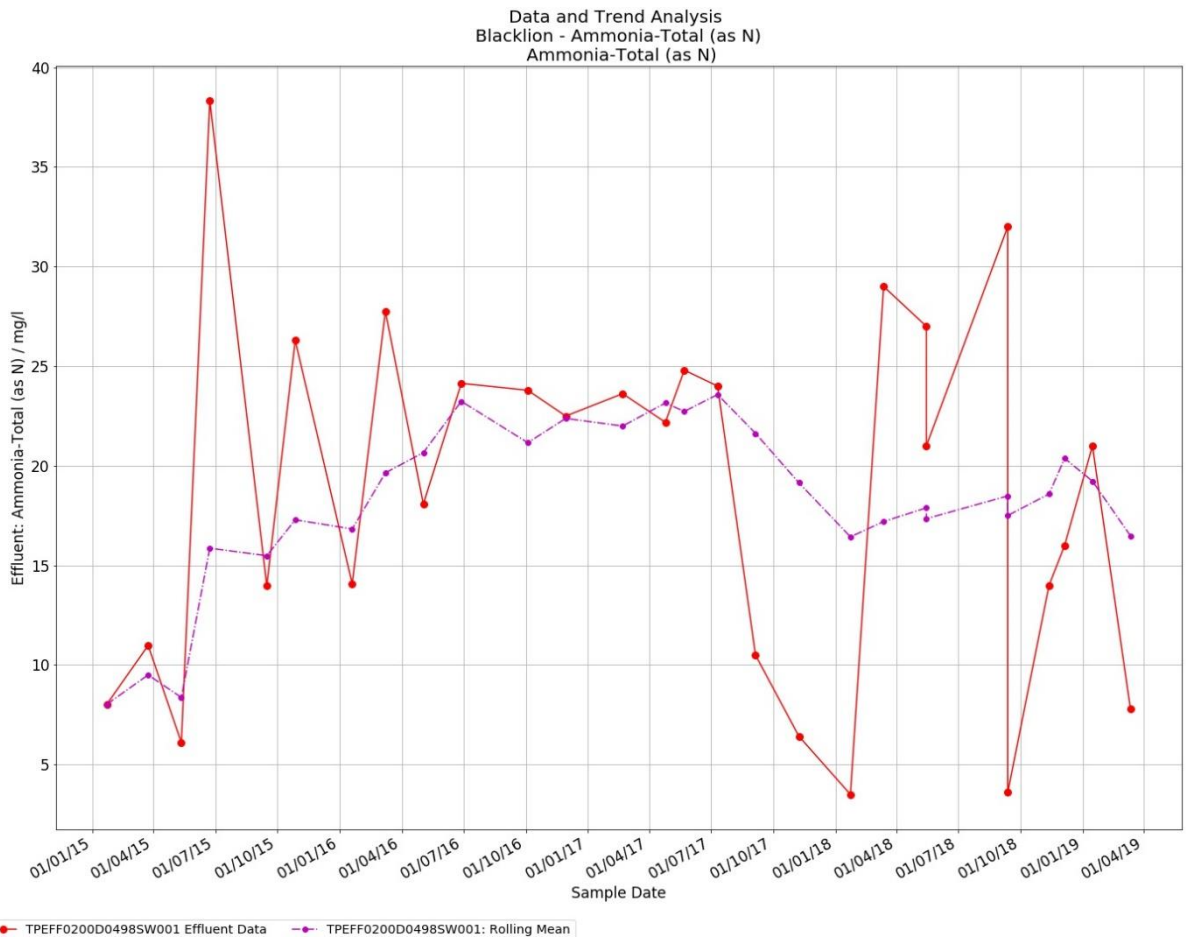


Figure 9.2: Blacklion effluent ammonia concentrations step change detection

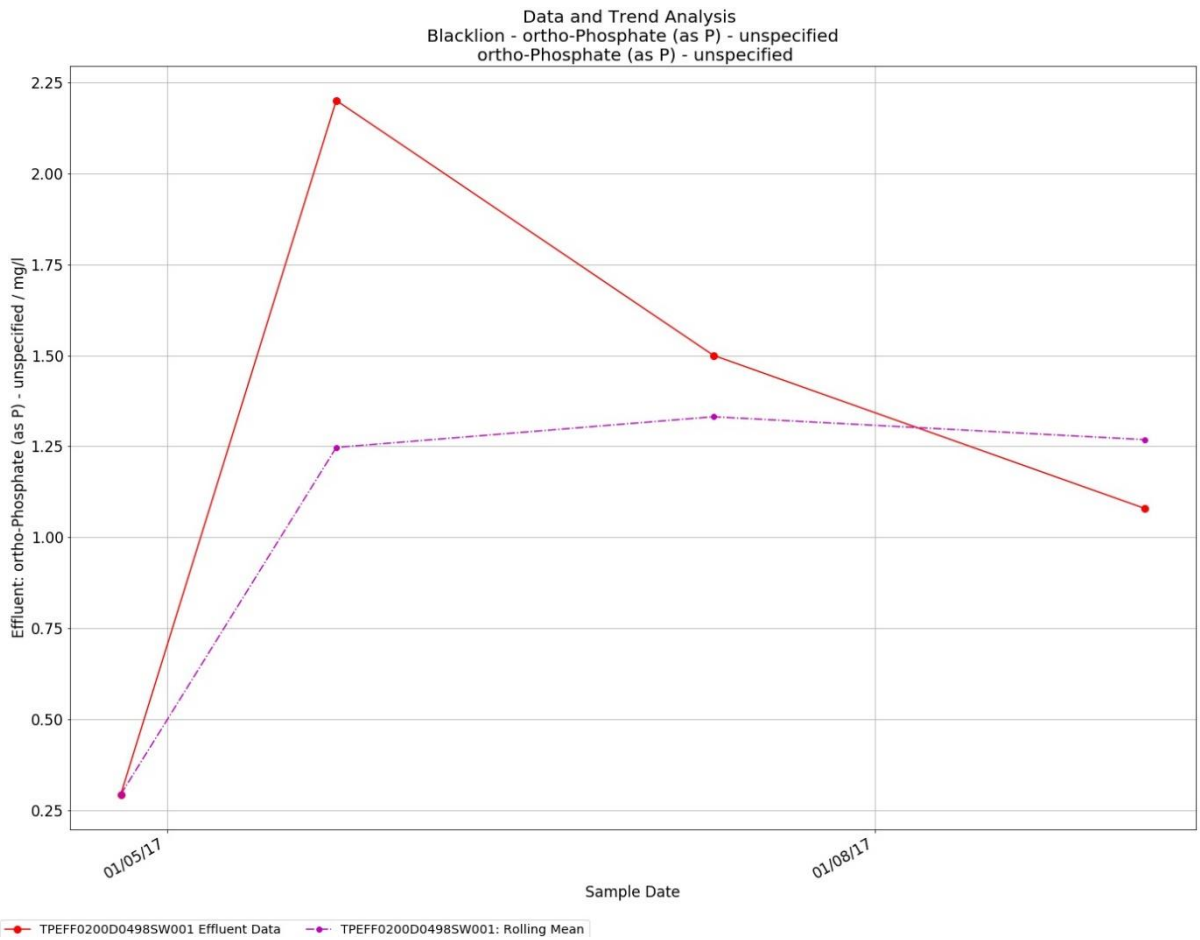


Figure 9.3: Blacklion effluent Orthophosphate concentrations step change detection

Outlier Detection

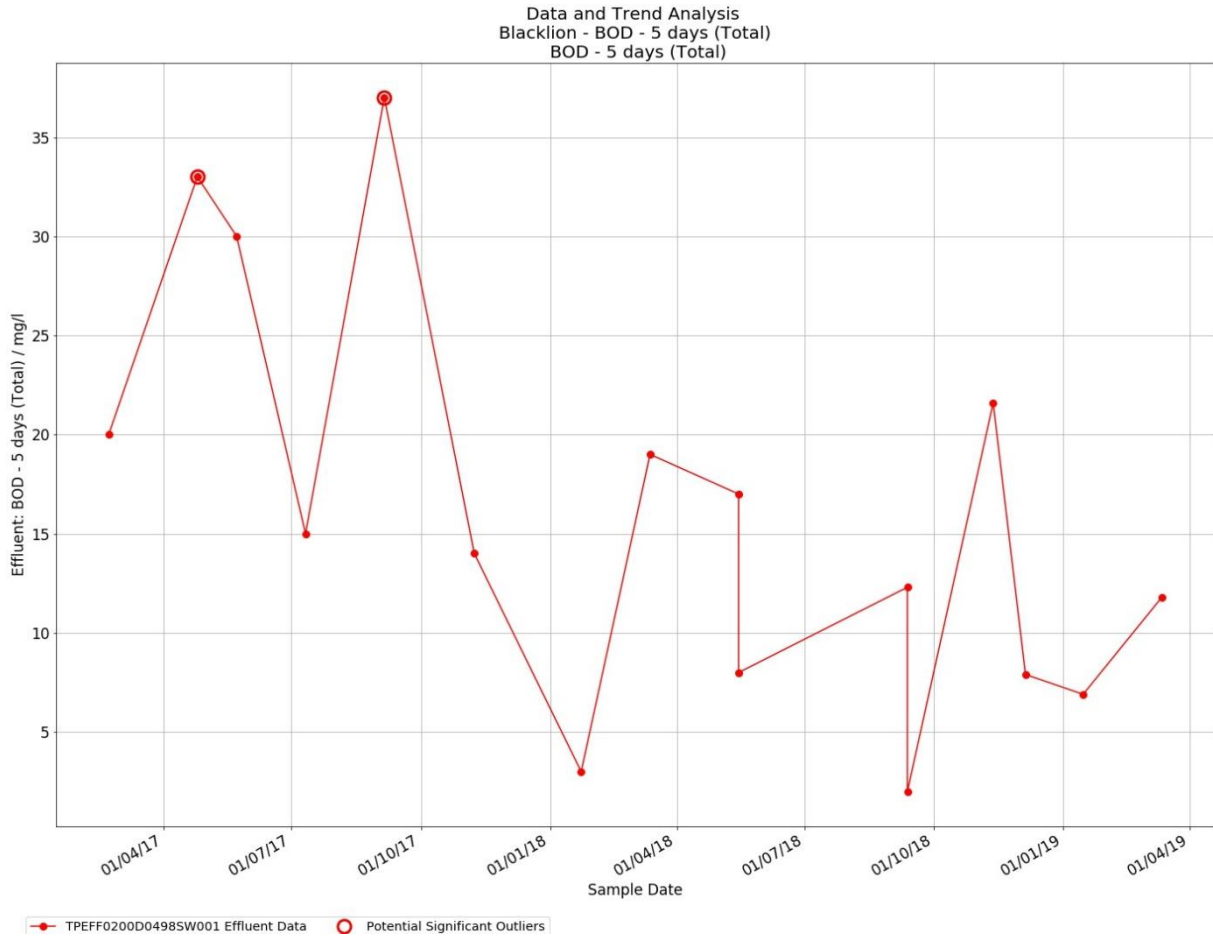


Figure 9.4: Blacklion Effluent Outlier Detection for BOD concentrations

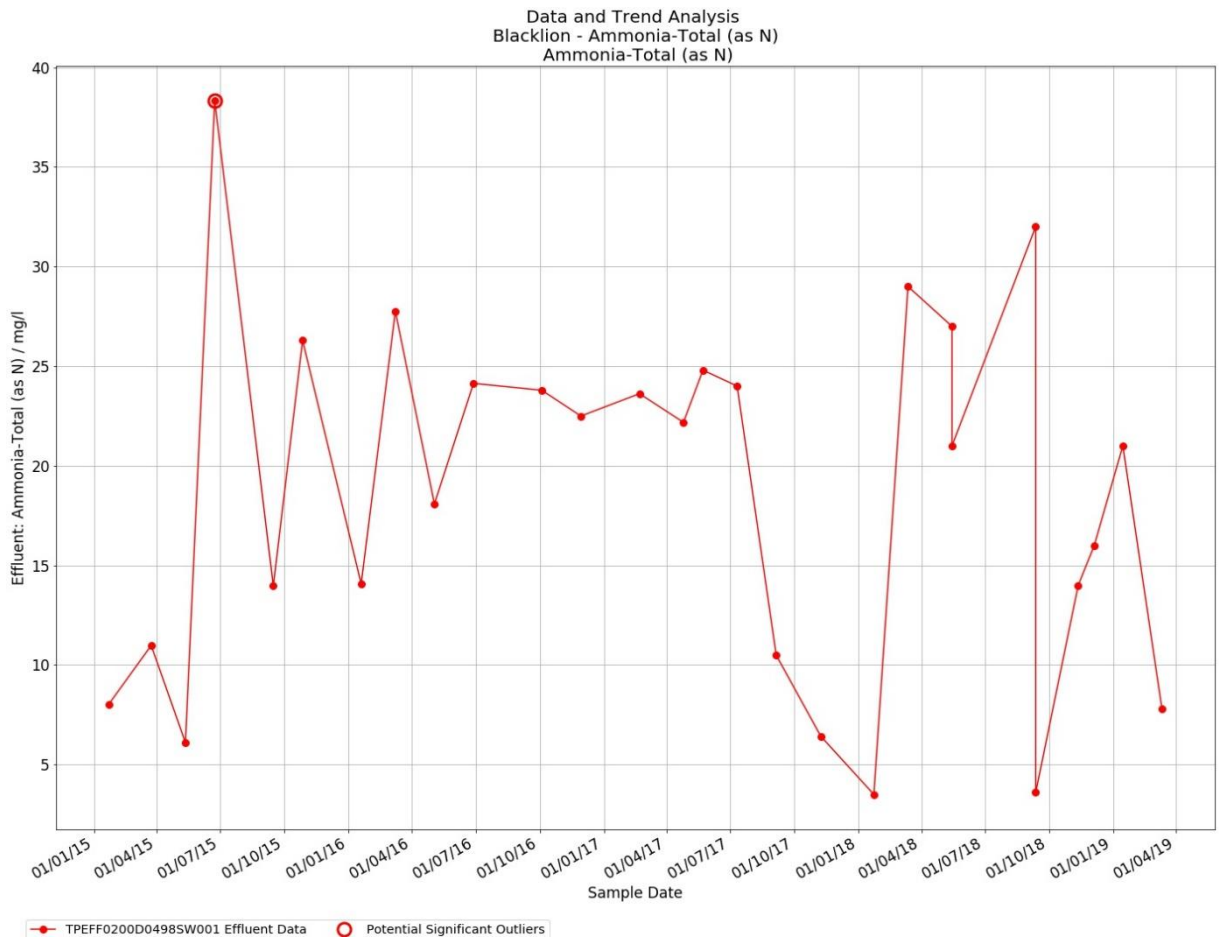


Figure 9.5: Blacklion Outlier Detection for Ammonia concentrations

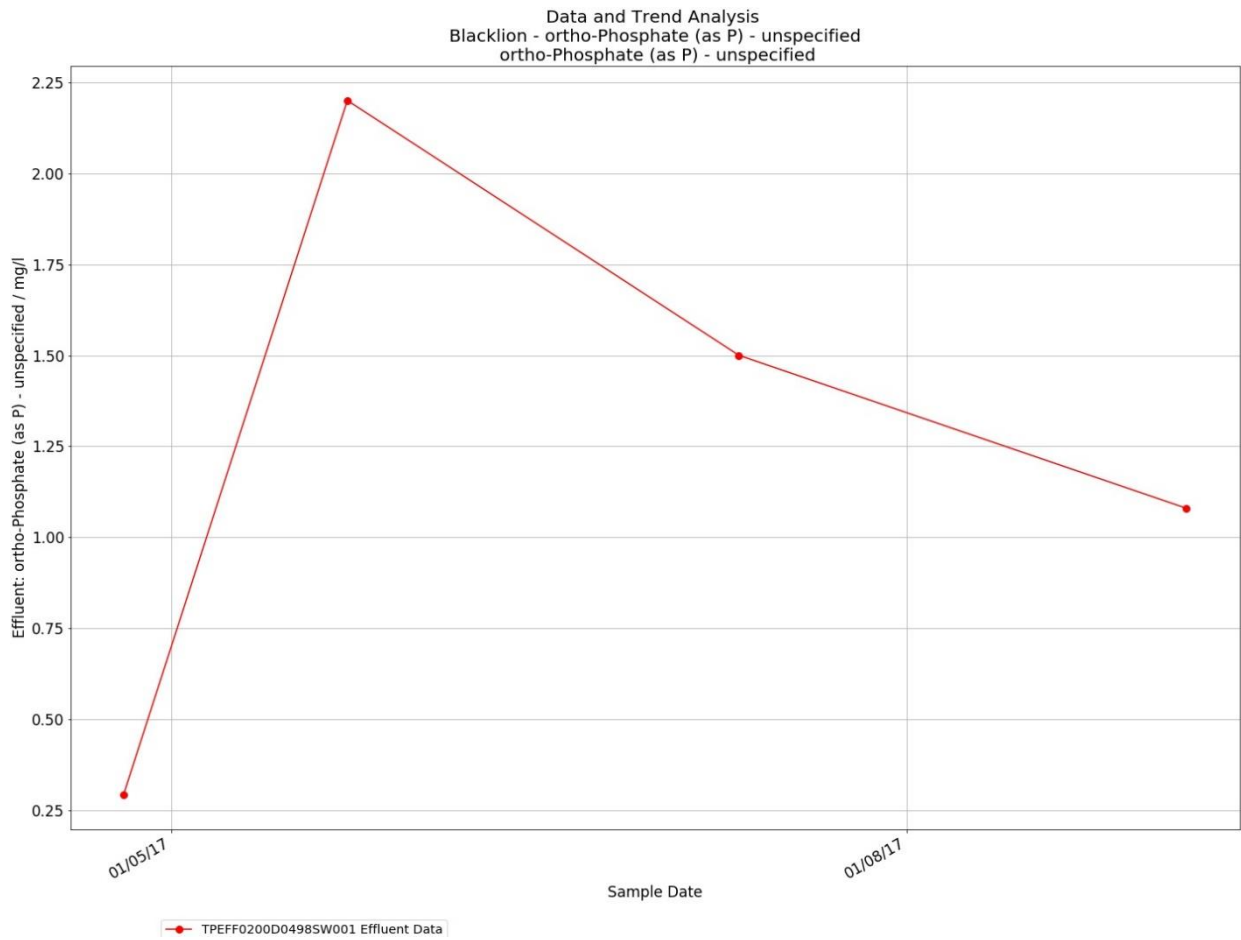


Figure 9.6: Blacklion Effluent Outlier Detection for Orthophosphate concentrations

## Appendix C

### Load Quantification Calculations

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# LOAD QUANTIFICATION METHODOLOGY

## Appendix D

Ambient

Monitoring

Summary

Ambient and WFD monitoring data for the Lower Lough Macnean water body

## Appendix E

### Trophic Assessment



