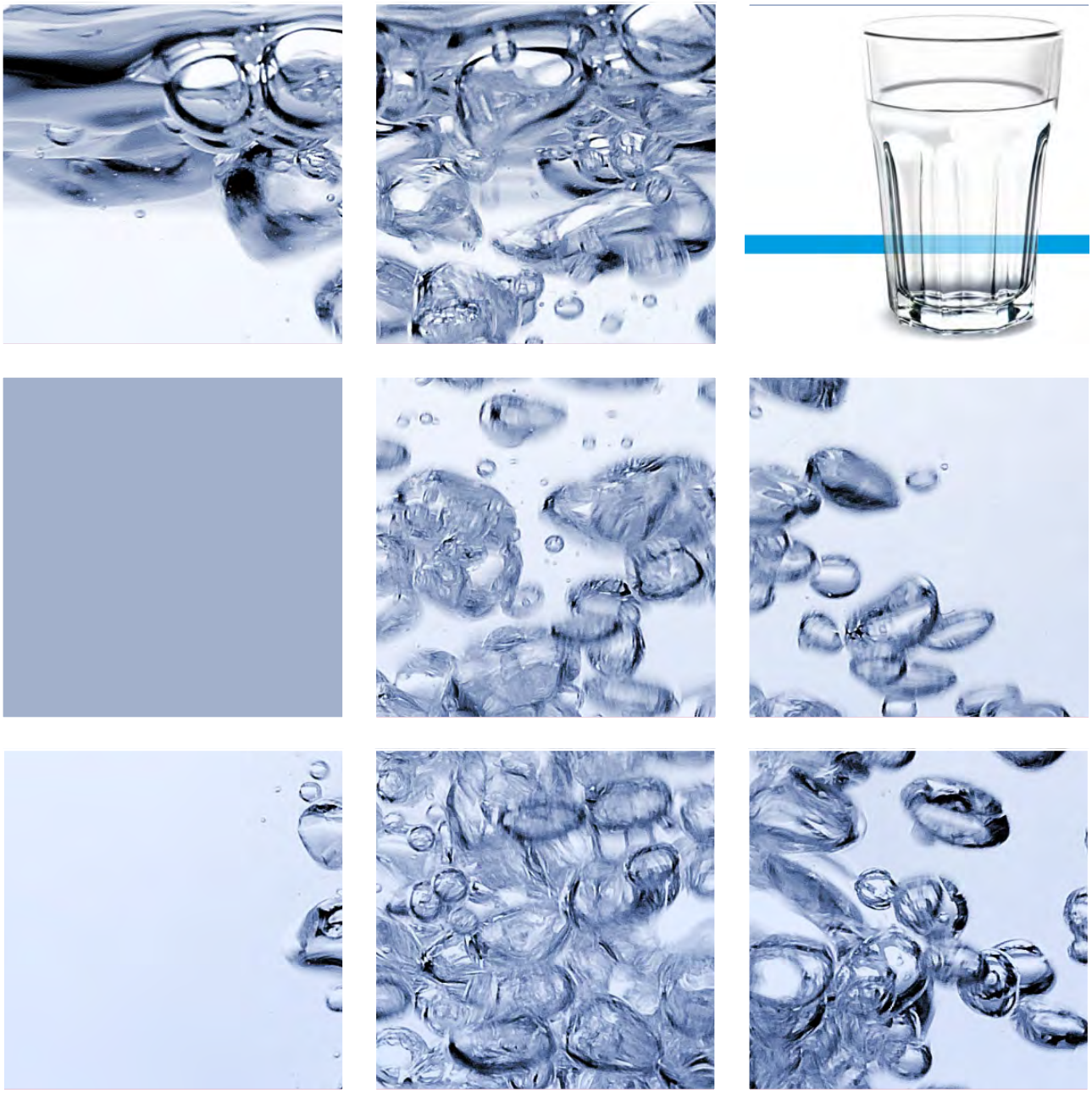
Uisce Éireann - Lead in Drinking Water Mitigation Plan

Screening for Appropriate Assessment

027 Athlone WTP - Athlone WSS WSZ (3200PUB1001)



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Screening for Appropriate Assessment 027 Athlone WSS (3200PUB1001) – Athlone WTP

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GLOSSARY OF TERMS & ABBREVIATIONS

Appropriate Assessment: An assessment of the effects of a plan or project on European Sites.

Biodiversity: Word commonly used for biological diversity and defined as assemblage of living organisms from all habitats including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.

Birds Directive: Council Directive of 2nd April 1979 on the conservation of wild birds (79/409/EEC) as codified by Directive 2009/147/EC.

Geographical Information System (GIS): A GIS is a computer-based system for capturing, storing, checking, integrating, manipulating, analysing and displaying data that are spatially referenced.

Habitats Directive: European Community Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna and has been transposed into Irish law by the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). It establishes a system to protect certain fauna, flora and habitats deemed to be of European conservation importance.

Mitigation measures: Measures to avoid/prevent, minimise/reduce, or as fully as possible, offset/compensate for any significant adverse effects on the environment, as a result of implementing a plan or project.

Natura 2000: European network of protected sites, which represent areas of the highest value for natural habitats and species of plants and animals, which are rare, endangered or vulnerable in the European Community. The Natura 2000 network of sites will include two types of area. Areas may be designated as Special Areas of Conservation (SAC) where they support rare, endangered or vulnerable natural habitats and species of plants or animals (other than birds). Where areas support significant numbers of wild birds and their habitats, they may become Special Protection Areas (SPA). SACs are designated under the Habitats Directive and SPAs are classified under the Birds Directive. In some situations, there may be overlap in extent of SAC and SPA.

Screening: The determination of whether implementation of a plan or project would be likely to have significant environmental effects on the Natura 2000 network.

Special Area for Conservation (SAC): An SAC designation is an internationally important site, protected for its habitats and species. It is designated, as required, under the EC Habitats Directive (1992).

Special Protection Area (SPA): An SPA is a site of international importance for breeding, feeding and roosting habitat for bird species. It is designated under the EC Birds Directive (1979).

Statutory Instrument: Any order, regulation, rule, scheme or byelaw made in exercise of a power conferred by statute.

1 INTRODUCTION

RPS was commissioned by Uisce Éireann (UE) to undertake Screening for Appropriate Assessment (AA) for the proposed orthophosphate dosing (herein referred to as the proposed project) of drinking water supplied by Athlone Water Treatment Plant (WTP), Athlone, Co. Westmeath.

This report comprises information to support the Screening for AA in line with the requirements of Article 6(3) of the EU Habitats Directive (Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (hereafter referred to as the Habitats Directive). The report assesses the potential for likely significant effects resulting from the additional phosphorus (P) load to environmental receptors, resulting from orthophosphate dosing being undertaken to mitigate against consumer exposure to lead in drinking water. It is therefore necessary to consider the sources, pathways and receptors in relation to added phosphorus.

1.1 PURPOSE OF THIS REPORT

The overall purpose of the Screening for AA, as a first step in determining the requirement for AA, is to determine whether the project is likely to have a significant effect on any European Site within the zone of influence (ZoI) of the Water Supply Zone (WSZ), either individually or in combination with other plans or projects, in view of the site's conservation objectives. This Screening report complies with the requirements of Article 6 of the Habitats Directive transposed in Ireland principally through the Planning and Development Act 2000 (as amended) and the European Communities (Birds and Natural Habitats) Regulations, S.I. No. 477 of 2011 (as amended). In the context of the proposed project, the governing legislation is the EC Birds and Habitats Regulations 2011 (as amended).

1.2 THE PLAN

Uisce Éireann, as the national public water utility, prepared a Lead in Drinking Water Mitigation Plan (LDWMP) in 2016 (here after referred to as the Plan). The Plan provides a framework of measures for implementation to effectively address the currently elevated levels of lead in drinking water experienced by some UE customers as a result of lead piping. The Plan was prepared in response to the recommendations in the *National Strategy to reduce exposure to Lead in Drinking Water* which was published by the Department of Environment, Community and Local Government[1] and Department of Health in June 2015.

The overall objective of the Plan is to effectively address the risk of failure to comply with the drinking water quality standard for lead due to lead pipework in as far as is practical within the areas of UE's responsibility. Lead in drinking water is derived from lead pipes that are still in place in the supply network. These pipes are mostly in old shared connections or in the short pipes connecting the (public) water main to the (private) water supply pipes (UE, 2016[2]). Problems can also be caused by lead leaching from domestic plumbing components made of brass and from lead-containing solder, with the most significant portion of the lead pipework lying outside of UE's ownership in private properties (UE, 2016). Lead can be dissolved in water as it travels through lead supply pipes and internal lead plumbing. When lead is in contact with water it can slowly dissolve, a process

[1] Now known as the Department of Housing, Planning and Local Government (DHPLG).
[2] Uisce Éireann (UE) (2016) Lead in Drinking Water Mitigation Plan. https://www.water.ie/projects-plans/lead-mitigation-plan/Lead-in-Drinking-Water-Mitigation-Plan.pdf

known as plumbosolvency. The degree to which lead dissolves varies with the length of lead pipe, local water chemistry, temperature and the amount of water used at the property.

Health studies have identified risks to human health from ingestion of lead. In December 2013, the acceptable limit for lead in drinking water was reduced to 10 micrograms per litre (µg/l) as per the European Union (Drinking Water) Regulations. From 2003 to 2013, the limit was 25µg/l, which was a reduction on the previous limit (i.e. pre 2003) of 50µg/l.

The World Health Organisation (WHO), Environmental Protection Agency (EPA) and Health Service Executive (HSE) recommend lead pipe replacement (both lead service connections in the public supply, and lead supply pipes and internal plumbing in private properties) as the ultimate goal in reducing long-term exposure to lead. It is recognised that this will inevitably take a considerable period of time. In recognition of this, short to medium term proposals to mitigate the risk are being examined.

The Plan sets out the short, medium and longer term actions that UE intends to undertake, subject to the approval of the economic regulator, the Commission for Regulation of Utilities (CRU). It is currently estimated that 85% to 95% of properties meet the lead compliance standards when sampled at the customer's tap. The goal is to increase this compliance rate to 98% by end of 2021 and 99% by the end of 2027 (UE, 2016). This is subject to a technological alternative to lead replacement being deemed environmentally viable.

The permanent solution to the lead issue is to replace all water mains that contain lead. UE proposes that a national programme of replacement of public lead service pipes is required. However, replacing the public supply pipe or the private pipe on its own will not resolve the problem. Research indicates that unless both are replaced, lead levels in the drinking water could remain higher than the Regulation standards. Where lead pipework or plumbing fittings occur within a private property, it is the responsibility of the property owner to replace it.

The Plan assesses a number of other lead mitigation options available to UE. Other measures, including corrective water treatment in the form of pH adjustment and orthophosphate treatment, are being considered as an interim measure for the reduction of lead concentrations in drinking water in some WSZs.

UE initially assessed 400 water treatment plants for the introduction of corrective water treatment. Following this process 138 priority plants have been identified and corrective water treatment will be rolled out during the Lead in Drinking Water Mitigation programme, subject to site-specific environmental assessments. The corrective water treatment will reduce plumbosolvency risk over the short to medium term in high risk water supplies where it is technically, economically and environmentally viable to do so. This practice is now the accepted method of lead mitigation in many countries e.g. Great Britain and Northern Ireland. The dosing would be required to continue whilst lead pipework is still in use, subject to annual review on a scheme by scheme basis.

Orthophosphate is added in the form of Phosphoric acid, which is approved for use as a food additive (E338) in dairy, cereals, soft drinks, meat and cheese. The average adult person consumes between 1,000 and 1,500 milligrams (mg) of phosphorus every day as part of the normal diet. The quantity of orthophosphate that UE will be required to add to treated water is between 0.5 mg/l to 1.5 mg/l. At Athlone WTP orthophosphate will be added at a rate of 0.8 mg/l, with seasonal variation in the proposed dose, as set out within the Preliminary Design Report for the proposed dosing.

The typical concentration of phosphorus ingested from drinking 3 litres of water per day that has been treated with food grade phosphoric acid at 1.5 mg/l phosphorus, would be 4.5 milligrams.

The orthophosphate is dosed into the water at a rate which is dependent on raw water chemistry in a similar process to the addition of chlorine for disinfection. Orthophosphate dosing takes a period of 6-12 months to develop a full coating, after which dosing must be maintained in order to sustain the protective coating.

1.3 PROJECT BACKGROUND

Phosphorus can influence water quality status through the process of nutrient enrichment and promotion of excessive plant growth (eutrophication). It is therefore necessary to evaluate the significance of any potential environmental impact and the pathways by which the added orthophosphate may reach environmental receptors. To facilitate the assessment, an Environmental Assessment Methodology (EAM) has been developed based on a conceptual model of phosphorus transfer (from the water distribution and wastewater collection systems), using the source-pathway-receptor framework.

The first step of the EAM is to identify the European Sites that have a hydrological or hydrogeological connectivity to the WSZs affected by the proposed orthophosphate dosing. The EAM recognises that for those European Sites with nutrient sensitive Qualifying Interests (habitats and species) and connectivity to the WSZ indicates that pathways for effects exist. The project effects on these European Sites, and an evaluation as to whether these are potentially significant, are the subject of the Screening for AA. The Screening report applies objective scientific information from the EAM as outlined in this document in the context of the SiteSpecific Conservation Objectives (SSCO) as published on the NPWS website.

The EAM process identified 28 European sites with potential hydrological or hydrogeological connectivity to the WSZ;

- SAC sites included: River Shannon Callows SAC; Lough Ree SAC; Lough Funshinagh SAC; Pilgrim's Road Esker SAC; Crosswood Bog SAC; Ballynamona Bog and Corkip Lough SAC; Moneybeg And Clareisland Bogs SAC; Corbo Bog SAC; Ballinturly Turlough SAC; Carn Park Bog SAC; Ardagullion Bog SAC; Castlesampson Esker SAC; Garriskil Bog SAC; Derragh Bog SAC; Mongan Bog SAC; Lough Forbes Complex SAC and Fortwilliam Turlough SAC.
- SPA sites included: Mongan Bog SPA; Lough Derravaragh SPA; Glen Lough SPA; Lough Iron SPA; Lough Kinale and Derragh Lough SPA; Lough Ree SPA; Lough Sheelin SPA; Middle Shannon Callows SPA; Ballykenny-Fisherstown Bog SPA; Garriskil Bog SPA and River Suck Callows SPA; and Lough Derg (Shannon) SPA.

Each of these European Sites includes habitats and/or species identified as nutrient sensitive. Following the precautionary principle the potential for likely significant effects arising from the proposed project requires assessment, due to connectivity to each of the identified European Sites, in light of their nutrient sensitive Qualifying Interests.

2 APPROPRIATE ASSESSMENT METHODOLOGY

2.1 LEGISLATIVE CONTEXT

Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora better known as the "Habitats Directive" provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC) as codified by Directive 2009/147/EC.

The obligation to undertake appropriate assessment derives from Articles 6(3) and 6(4) of the Habitats Directive and both involve a number of steps and tests that need to be applied in sequential order. Article 6(3), which is concerned with the strict protection of sites, establishes the requirement for AA:

"Any plan or project not directly connected with or necessary to the management of the [European] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public".

Article 6(4) states:

"If, in spite of a negative assessment of the implications for the [European] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted".

The results of each step must be documented and recorded so there is full traceability and transparency of the decisions made.

Over time legal interpretation has been sought on the practical application of the legislation concerning AA, as some terminology has been found to be unclear. European and National case law has clarified a number of issues and some aspects of European Commission (EC) published guidance documents have been superseded by case law.

2.2 GUIDANCE FOR THE APPROPRIATE ASSESSMENT PROCESS

The assessment completed has had regard to the following legislation and guidance documents:

European and National Legislation:

- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive');
- Council Directive 2009/147/EC on the conservation of wild birds, codified version, (also known as the 'Birds Directive');
- European Communities (Birds and Natural Habitats) Regulations 2011 to 2015; and
- Planning and Development Act 2000 (as amended).

Guidance / Case Law:

- *Article 6 of the Habitats Directive – Rulings of the European Court of Justice*. Final Draft September 2014;
- *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities.* DEHLG (2009, revised 10/02/10);
- *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.* European Commission (2002);
- *Communication from the Commission on the Precautionary Principle*. European Commission (2000b);
- *EC study on evaluating and improving permitting procedures related to Natura 2000 requirements under Article 6.3 of the Habitats Directive 92/43/EEC*. European Commission (2013);
- *Guidance Document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission*. European Commission (2007); and
- *Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. European Commission (20018).

Departmental/NPWS Circulars:

- *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities.* Circular NPWS 1/10 and PSSP 2/10. (DEHLG, 2010);
- *Appropriate Assessment of Land Use Plans*. Circular Letter SEA 1/08 & NPWS 1/08;
- *Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments*. Circular L8/08;
- *Guidance on Compliance with Regulation 23 of the Habitats Directive.* Circular Letter NPWS 2/07; and

- *Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites*. Circular Letter PD 2/07 and NPWS 1/07.

2.3 STAGES OF THE APPROPRIATE ASSESSMENT PROCESS

According to European Commission Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive, the assessment requirements of Article 6 establish a four-staged approach as described below. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The four stages are as follows:

- Stage 1 – Screening of the proposed plan or project for AA;
- Stage 2 – An AA of the proposed plan or project;
- Stage 3 – Assessment of alternative solutions; and
- Stage 4 – Imperative Reasons of Overriding Public Interest (IROPI)/ Derogation.

Stages 1 and 2 relate to Article 6(3) of the Habitats Directive; and Stages 3 and 4 to Article 6(4).

Stage 1: Screening for a likely significant effect

The aim of screening is to assess firstly if the plan or project is directly connected with or necessary to the management of European Site(s); or in view of best scientific knowledge, if the plan or project, individually or in combination with other plans or projects, is likely to have a significant effect on a European Site. This is done by examining the proposed plan or project and the conservation objectives of any European Sites that might potentially be affected. If screening determines that there is potential for likely significant effects or there is uncertainty regarding the significance of effects then it will be recommended that the plan is brought forward to full AA.

Stage 2: Appropriate Assessment (Natura Impact Statement or NIS)

The aim of stage 2 of the AA process is to identify any adverse impacts that the plan or project might have on the integrity of relevant European Sites. As part of the assessment, a key consideration is 'in combination' effects with other plans or projects. Where adverse impacts are identified, mitigation measures can be proposed that would avoid, reduce or remedy any such negative impacts and the plan or project should then be amended accordingly, thereby avoiding the need to progress to Stage 3.

Stage 3: Assessment of Alternative Solutions

If it is not possible during the stage 2 to reduce impacts to acceptable, non-significant levels by avoidance and/or mitigation, stage 3 of the process must be undertaken which is to objectively assess whether alternative solutions exist by which the objectives of the plan or project can be achieved. Explicitly, this means alternative solutions that do not have negative impacts on the integrity of a European Site. It should also be noted that EU guidance on this stage of the process states that, 'other assessment criteria, such as economic criteria, cannot be seen as overruling ecological criteria' (EC, 2002). In other words, if alternative solutions exist that do not have negative impacts on European Sites; they should be adopted regardless of economic considerations.

Stage 4: Imperative Reasons of Overriding Public Interest (IROPI)/Derogation

This stage of the AA process is undertaken where no alternative solutions exist and where adverse impacts remain. At this stage of the AA process, it is the characteristics of the plan or project itself that will determine whether or not the competent authority can allow it to progress. This is the determination of 'over-riding public interest'.

It is important to note that in the case of European Sites that include in their qualifying features 'priority' habitats or species, as defined in Annex I and II of the Directive, the demonstration of 'over-riding public interest' is not sufficient and it must be demonstrated that the plan or project is necessary for 'human health or safety considerations'. Where plans or projects meet these criteria, they can be allowed, provided adequate compensatory measures are proposed. Stage 4 of the process defines and describes these compensation measures.

2.4 INFORMATION SOURCES CONSULTED

To inform the assessment for the project and preparation of this Screening report, the following key sources of information have been consulted, however it should be noted that this is not an exhaustive list and does not reflect liaison and/ or discussion with technical and specialist parties from UE, RPS, NPWS, IFI, EPA etc. as part of Plan development.

- Information provided by UE as part of the project;
- Environmental Protection Agency – Water Quality www.epa.ie and www.catchments.ie;
- Geological Survey of Ireland – Geology, Soils and Hydrogeology www.gsi.ie;
- Information on the conservation status of birds in Ireland (Colhoun & Cummins 2013);
- National Parks and Wildlife Service – online Natura 2000 network information www.npws.ie;
- National Biodiversity Action Plan 2017 - 2021 (DCHG 2017);
- Article 17 Overview Report Volume 1 (NPWS, 2019a);
- Article 17 Habitat Conservation Assessments Volume 2 (NPWS, 2019b);
- Article 17 Species Conservation Assessment Volume 3 (NPWS, 2019c);
- EPA Qualifying Interests database, (EPA, 2015) and updated EPA Characterisation Qualifying Interests database (EPA/RPS, September 2016);
- Third Cycle Draft River Basin Management Plan 2022-2027 Consultation Report - www.housing.gov.ie;
- Ordnance Survey of Ireland – Mapping and Aerial photography www.osi.ie;
- National Summary for Article 12 (Cummins et al., 2019); and
- Format for a Prioritised Action Framework (PAF) for Natura 2000 (2014) www.npws.ie/sites/default/files/general/PAF-IE-2014.pdf.

2.5 EVALUATION OF THE RECEIVING ENVIRONMENT

Ireland has obligations under EU law to protect and conserve biodiversity. This relates to habitats and species both within and outside designated sites. Nationally, Ireland has developed a National Biodiversity Plan (DCHG, 2017) to address issues and halt the loss of biodiversity, in line with

international commitments. The vision for biodiversity is outlined: "*That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally*".

Ireland aims to conserve habitats and species, through designation of conservation areas under both European and Irish law. The focus of this Screening report is on those habitats and species designated pursuant to the EU Birds and EU Habitats Directives in the first instance, however it is recognised that wider biodiversity features have a supporting role to play in many cases if the integrity of designated sites is to be maintained/restored.

In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water related environmental supporting conditions that support Favourable Conservation Status. In preparing the RBMP (2018-2021) (DHPLG, 2018[3]) the characterisation assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES), or High Ecological Status (HES) where required. GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS. A number of lake habitats (e.g. oligotrophic lakes) and species (e.g. the freshwater pearl mussel) will require a more stringent environmental objective i.e. high status. Where this applies, this has been taken into account in the EAM and evaluated within the context of this Screening report.

2.5.1 Identification of European Sites

Current guidance (DEHLG, 2010) on the ZoI to be considered during the Screening for AA states the following:

"A distance of 15km is currently recommended in the case of plans, and derives from UK guidance (Scott Wilson et al., 2006). For projects, the distance could be much less than 15km, and in some cases less than 100m, but this must be evaluated on a case-by-case basis with reference to the nature, size and location of the project, and the sensitivities of the ecological receptors, and the potential for in-combination effects".

As stated above, a buffer of 15km is typically taken as the initial ZoI extending beyond the reach of the footprint of a plan or project, although there may be scientifically appropriate reasons for extending this ZoI further depending on pathways for potential impacts. With regard to the current project, the 15km distance is considered inadequate to screen all likely significant effects that might impact upon European Sites. This is primarily due to the need to consider the potential for likely significant effects on European Sites with regard to aquatic and water dependent receptors. Therefore, the ZoI for this project includes all of the hydrologically connected surface water sub catchments and groundwater bodies **Figure 4-2**.

[3] DHPLG (2018) The River Basin Management Plan for Ireland (2018-2021). Available at: https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021-0

2.5.2 Conservation Objectives

Article 6(3) of the Habitats Directive states that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications of the site in view of the site's ***conservation objectives****.*

Qualifying Interests (QIs)/ Special Conservation Interests (SCIs) are annexed habitats and annexed species of community interest for which an SAC or SPA has been designated respectively. The Conservation Objectives (COs) for European Sites are set out to ensure that the QIs/ SCIs of that site are maintained or restored to a favourable conservation condition. Maintenance of favourable conservation condition of habitats and species at a site level in turn contributes to maintaining or restoring favourable conservation status of habitats and species at a national level and ultimately at the Natura 2000 Network level.

In Ireland 'generic' COs have been prepared for all European Sites, while 'site specific' COs have been prepared for a number of individual Sites to take account of the specific QIs/ SCIs of that Site. Both the generic and site specific COs aim to define favourable conservation condition for habitats and species at the site level.

Generic COs which have been developed by NPWS encompass the spirit of site specific COs in the context of maintaining and restoring favourable conservation condition as follows:

For SACs:

- '*To maintain or restore the favourable conservation condition of the Annex I habitats and/or Annex II species for which the SAC has been selected'.*

For SPAs:

- '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for the SPA*'.

Favourable Conservation status of a habitat is achieved when:

- Its natural range, and area it covers within that range, are stable or increasing;
- The specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future; and
- The conservation status of its typical species is "favourable".

Favourable Conservation status of a species is achieved when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats;

- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis.

A full listing of the COs and QIs/ SCIs for each European Site, as well as the attributes and targets to maintain or restore the QIs/ SCIs to a favourable conservation condition, are available from the NPWS website www.npws.ie. Web links for COs for the European Sites relevant for this Screening report, are included in **Appendix A**.

2.5.2 Existing Threats and Pressures to EU Protected Habitats and Species

Given the nature of the proposed project, a review has been undertaken of those QIs/SCIs which have been identified as having sensitivity to orthophosphate loading. Information has been extracted primarily from a number of NPWS authored reports, including recently available statutory assessments on the conservation status of habitats and species in Ireland namely; *The Status of EU Protected Habitats and Species in Ireland* (NPWS 2013a, b & c) and on information contained in Ireland's most recent Article 12 submission to the EU on *the Status and Trends of Birds Species* (NPWS 2013d). Water dependent habitats and species were identified as having the greatest sensitivity to the proposed dosing activities, and the Water Framework Directive SAC water dependency list (NPWS, December 2015), was used as part of the criteria for screening European Sites.

There are 60 habitats, 25 species and 68 bird species which are water dependent and / or where nutrients are a key pressure or threat and where compliance with the Environmental Quality Standards for nutrient levels (including orthophosphate) will contribute to achieving or maintaining favourable conservation status. These are listed in **Appendix B**.

3 DESCRIPTION OF THE PROJECT

3.1 OVERVIEW OF THE PROPOSAL

Athlone WTP supplies Athlone WSS WSZ (3200PUB1001) on the border of Roscommon and Westmeath and rural areas to the east of the town. The distribution input for the Athlone WSS is 10,946 m^3/day (47% of which is accounted for) serving a population of approximately 19,000. The area is served by Athlone WWTP (ref D0007-01), which is licenced in accordance with the requirements of the Waste Water Discharge (Authorisation) Regulations 2007 as amended, and the impact of the orthophosphate dosing on the emission limit values and receiving water bodies downstream of the point of discharge are assessed. The non-domestic demand is 16% of the distribution input. There are no other WWTPs within this WSZ. There are an estimated 1,518 properties across the WSZ that are serviced by domestic waste water treatment systems DWWTS (see **Appendix C**).

Athlone WTP and WSZ lie adjacent to the River Shannon within the sub-catchments: Breensford_SC_010; Inny [Shannon]_SC_090; Shannon [Upper]_SC_100; Shannon [Upper]_SC_090; Shannon [Lower]_SC_010, in the Shannon catchment. The EAM process identified 28 European sites with potential hydrological or hydrogeological connectivity to the WSZ:

- SAC sites included: River Shannon Callows SAC; Lough Ree SAC; Lough Funshinagh SAC; Pilgrim's Road Esker SAC; Crosswood Bog SAC; Ballynamona Bog and Corkip Lough SAC; Moneybeg And Clareisland Bogs SAC; Corbo Bog SAC; Ballinturly Turlough SAC; Carn Park Bog SAC; Ardagullion Bog SAC; Castlesampson Esker SAC; Garriskil Bog SAC; Derragh Bog SAC; Mongan Bog SAC; Lough Forbes Complex SAC; Fortwilliam Turlough SAC;
- SPA sites included: Mongan Bog SPA; Lough Derravaragh SPA; Glen Lough SPA; Lough Iron SPA; Lough Kinale and Derragh Lough SPA; Lough Ree SPA; Lough Sheelin SPA; Middle Shannon Callows SPA; Ballykenny-Fisherstown Bog SPA; Garriskil Bog SPA; River Suck Callows SPA.

3.2 CONSTRUCTION OF CORRECTIVE WATER TREATMENT WORKS

The corrective water treatment works at Athlone WTP will involve the provision of orthophosphate dosing, pH control works and associated safety equipment.

There are three possible locations for the orthophosphate dosing system at Athlone WTP all of which will be located within the confines of the existing WTP boundary. The surrounding landscape is dominated by the River Shannon, residential housing, urban fabric of Athlone town and amenity grassland. The location of the works is shown on **Figure 3-1**.

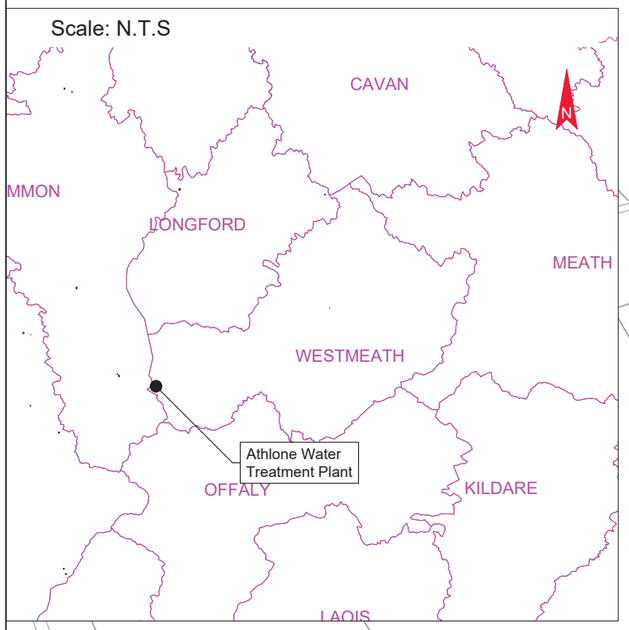
The implementation of orthophosphate dosing at the Athlone WTP will require the following elements:

- Bulk Storage Tanks for phosphoric acid;
- Dosing pumps;
- Dosing pipework and carrier water pipework; and
- Associated electrical installations.

WESTMEATH

Athlone Water Treatment Plant

Scale: N.T.S



Proposed Location 3
Sulphuric Acid Building
[Not in Use]

Coagulant Dosing

Soda Ash Storage and Dosing [Not in Use]

Chlorine Bulk Storage

Fluoride Bulk Storage

Clarifiers

Distribution Pump House

Filters

Location 2
Dosing Points
(3 rising mains)

Proposed Location 2

Proposed Location 1

Water Works (Athlone UDC)

Administration Block and UV Treatment

Location 1 & 3
Orthophosphate Dosing Point
(Proposed Soda Ash Dosing Point)

Slipway

10kV

T

Tks

St Kieran's Terrace

ROAD

Marine View

RIVER

Shannon Lodge

Tk

Ramp

BM 38.26

10m SCALE 1:500

R:\MDW0766_Lead Mitigation Plan\8.0 Drawings\SK\MDW0766SK0000 Series.dwg

Client

Uisce Éireann Irish Water

No.	Date	Drn. Chk.	Amendment / Issue	App
F01	MAR 19	JR BR	ISSUED FOR INFORMATION	GJG
D01	AUG 18	JR BL	DRAFT	DC

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Drawn	JR
Checked	BL
Approved	GJG
Date	AUG 18
Scale	1:500 @ A1 1:1,000 @ A3
Job No.	MDW0766

Project
LEAD MITIGATION PLAN

Figure 3.1
ATHLONE WATER TREATMENT PLANT - SITE LAYOUT

File Ref. MDW0766SK0000 Series.dwg

Drg. No. WTP0027

Rev. F01

The Bulk Storage Tanks (2 no. tanks, each with a working volume of 1,000l) will sit upon a reinforced concrete plinth with approximate dimensions - 4.5m x 2.5m x 0.25m, designed to support the combined weight of the storage tanks, equipment and total volume of chemical to be stored (**Figure 3-2**).

Each storage tank will be self-bunded to accommodate greater than 110% of the tank working volume. The tanks shall conform to UE design guidelines, and shall be insulated and be provided with filling points, vents, associated ultrasonic level, temperature, point level bund leak detection, visual level indicators. All materials and associated equipment, fixtures and fittings shall be compatible with 75% phosphoric acid.

A stable pH is critical to facilitate effective plumbosolvency control. The Athlone WTP does not have final water pH correction as part of its treatment process and is not capable of achieving the recommended level of 8 pH units for plumbosolvency control. The WTP does have existing infrastructure to dose soda ash for pH correction but was never made operational. It is proposed that this existing infrastructure is made operational and pH correction introduced to the plant.

Dosing pipelines, carrier water pipework and electrical cables shall be installed within 100mm diameter ducts, placed in trenches constructed within existing made ground at the Athlone WTP. The ducts will be installed at approximately 700mm below ground level and following installation the trench will be backfilled and the surface reinstated to match the existing surface. Where pipework and cables are routed through existing structures, they shall be surface mounted within trunking. All spillages / leaks from storage tanks, valve connections and dosing pumps shall be contained within bunded areas.

A suitable kiosk will be installed on a concrete plinth to house all electrical and control equipment required for the orthophosphate system. This shall be provided to achieve sufficient control and incorporation into the existing supervisory control and data acquisition (SCADA) system on site. The proposed automation solution will use a new programmable logic computer (PLC) / human machine interface (HMI) controller.

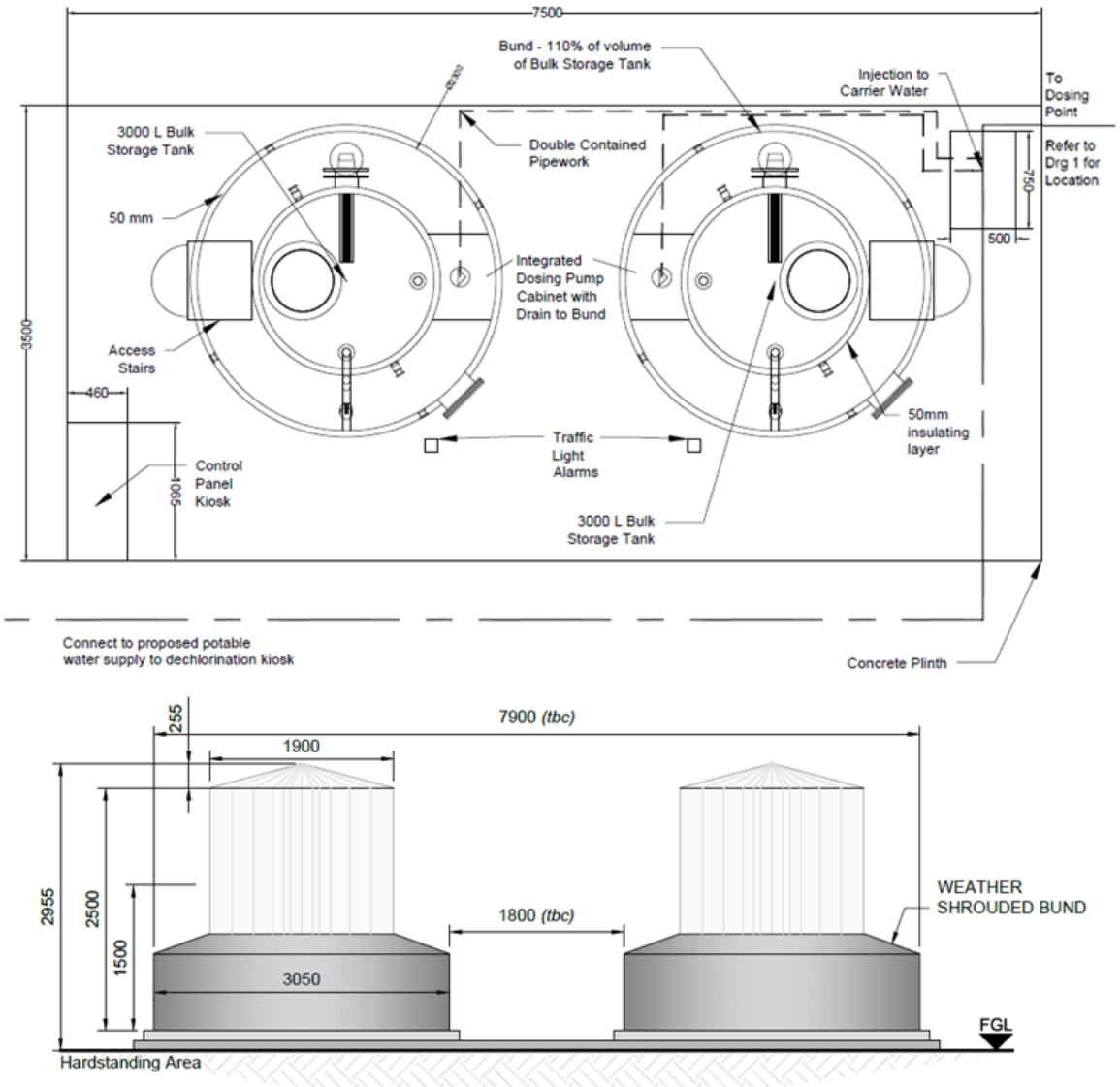


Figure 3-2: Plan and Elevation Drawings of a typical Orthophosphate Dosing Unit

3.3 CONSTRUCTION METHODOLOGY

The proposed works will be carried out by suitably qualified contractors. The proposed dosing unit will be located within the bounds of the existing Athlone WTP.

There are three possible locations for the orthophosphate dosing system at Athlone WTP, each of which will be located within the confines of the existing WTP boundary. The proposed dosing point for each location varies. Location 1 is located at the inlet of the clear water tank where chlorine and fluoride is dosed, location 2 requires the installation of three dosing points and dosing lines while location 3 requires long lengths of dosing pipeworks. The WTP is bordered to the west by the River Shannon, to the south and east by the urban environment of Athlone town and expansive amenity grassland habitat to the north. The grounds of the WTP consist of existing built infrastructure. The location of the works is shown on **Figure 3-1**.

3.4 OPERATION CORRECTIVE WATER TREATMENT WORKS

The operational stage for the corrective water treatment works will be a part of the day to day activities of the WTP and will be operated in accordance with the SOPs.

The orthophosphate dosing system will be controlled by the site SCADA system, whereby, orthophosphoric acid will be dosed proportional to the flow of the water being distributed to the network. At Athlone WTP, orthophosphate will be added to treated water at a rate of 0.8 mg/l. The onsite storage tanks have been designed to provide 60 days of storage so it is anticipated that deliveries will be approximately once every two months. All deliveries will be via existing access roads within the boundary of the WTP.

3.5 LDWMP APPROACH TO ASSESSMENT

3.5.1 Work Flow Process

In line with the relevant guidance, the Screening report for AA comprises of two steps:

- **Impact Prediction** – where the likely impacts of this project (impact source and impact pathways) are examined.
- **Assessment of Effects** - where the significance of project effects are assessed on the basis of best scientific knowledge (the EAM); in order to identify whether they are likely to give rise to likely significant effects on any European Sites, in view of their conservation objectives.

At the early stages of consideration, UE identified the requirement to evaluate environmental impact and the pathways by which the added orthophosphate may reach and / or affect environmental receptors including European Sites. In order to carry out a robust and defensible environmental assessment and to ensure a transparent and consistent approach, UE devised a conceptual model based on the 'source – pathway – receptor' framework. This sets out a specific environmental risk assessment of any proposed orthophosphate treatment and provides a methodology to determine the risk to the receiving environment of this corrective water treatment.

This EAM conceptual model, which includes a GIS model that follows similar principles to the EPA Catchment Characterisation Tool (CCT), has been discussed with the EPA and has been developed using EPA datasets including the orthophosphate susceptibility output mapping for subsurface pathways; the nutrient risk assessment for water bodies; water quality information; available low flow estimation for gauged and ungauged catchments; and a new methodology which has been developed for the assessment of water quality risk from domestic wastewater treatment systems.

Depending on the potential impacts identified, appropriate measures may be built into the project proposal, as part of an iterative process to avoid / reduce those potential impacts for the orthophosphate treatment being proposed. Project measures adopted within the overall design proposal may include selected placement of the orthophosphate treatment point within the WSZ; enhanced wastewater treatment (to potentially remove equivalent phosphorus levels related to the orthophosphate treatment at the WTP); reduced treatment rate; and water network leakage control. The EAM will be the basis of the decision support matrix to inform any programmes developed as part of the LDWMP. Further detail on the model is presented in **Section 3.5.2** below.

3.5.2 Environmental Assessment Methodology

The EAM has been developed based on a conceptual model of P transfer (**Figure 3-3**), based on the source-pathway-receptor model, from the water distribution and wastewater collection systems.

- The source of phosphorus is defined as the orthophosphate dosing at the water treatment plant which will be dependent on the water chemistry of the raw water quality, the integrity of the distribution network and the extent of lead piping.
- Pathways include discharges from the wastewater collection system (WWTP discharges and intermittent discharges – Storm Water Overflows (SWOs)), leakage from the distribution system and small point source discharges from DWWTSs.
- Receptors refer to SACs and SPAs which may receive orthophosphate dosed water via the pathway examples outlined above. Receptors and their sensitivity, is of key consideration in the EAM. A water body may be more sensitive to additional phosphorus loadings where it has a low capacity for assimilating the load e.g. high status sites, such as the habitat of the freshwater pearl mussel or oligotrophic lakes. Where a SAC/SPA could receive orthophosphate dosing inputs at more than one WSZ, the cumulative effects are considered in the EAM.

A flow chart of the methodology applied in the EAM is provided in **Figure 3-4** and illustrates the importance of the European Sites in the process. In all instances where nutrient sensitive qualifying features within the Natura 2000 network are hydrologically linked with the WSZ, a Screening to inform AA will be required in the first instance.

For each WSZ where orthophosphate treatment is proposed, the conceptual model allows the quantification of loads in a mass balance approach to identify potentially significant pathways, as part of the risk assessment process. A summary report outlining the EAM results is available in **Appendix C**, which further outlines P dynamics and the consideration of P trends and capacity in receiving waters and the risk to WFD objectives from any increase in P load from orthophosphate dosing.

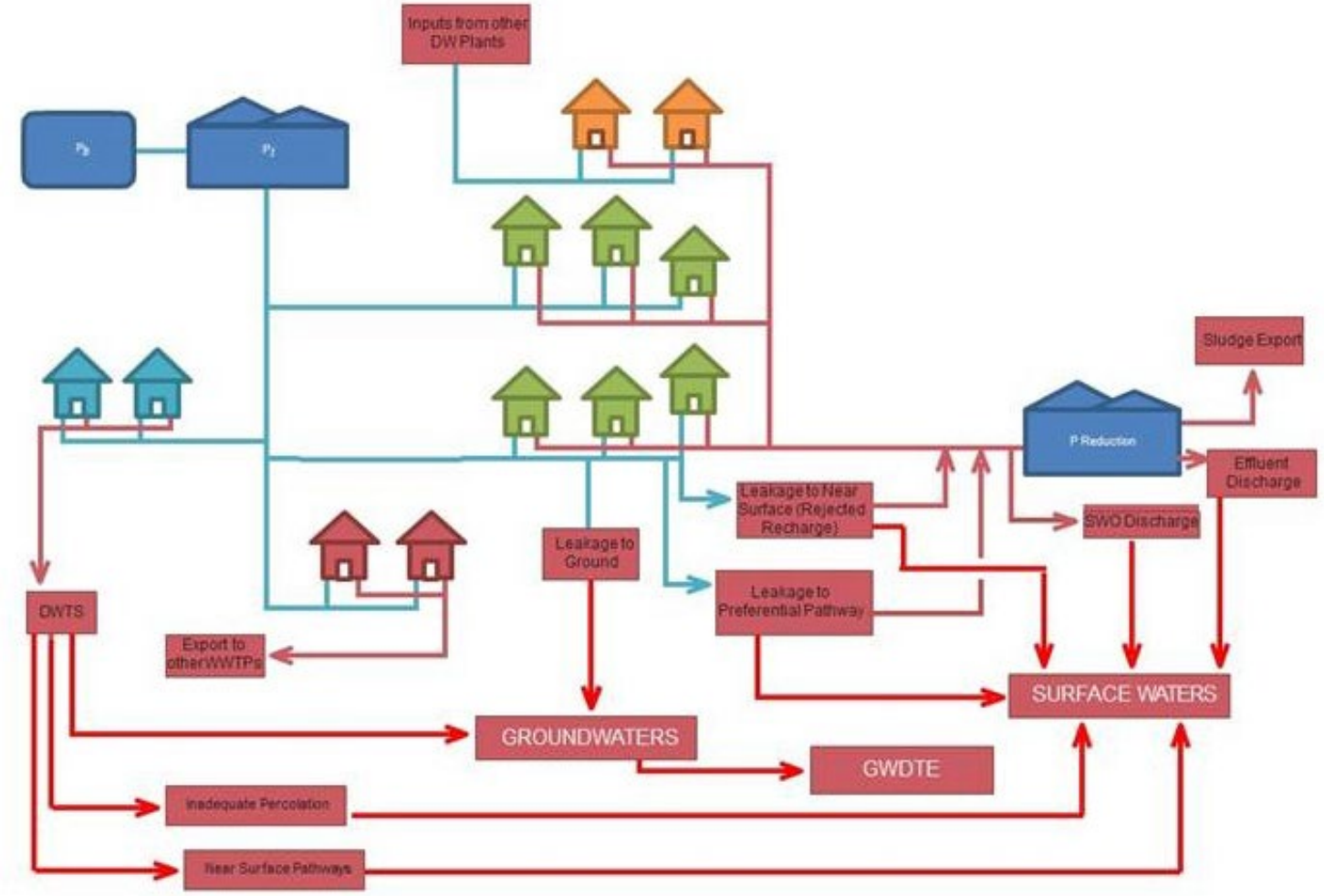


Figure 3-3: Conceptual Model of P Transfer

(Diagrammatic layout of P transfers from drinking water source (top left), through DW distribution (blue), wastewater collection (brown) and treatment systems to environmental receptors (red). P transfers that by-pass the WWTP (leakages, storm overflows, discharges to ground, and misconnections) are also indicated.)

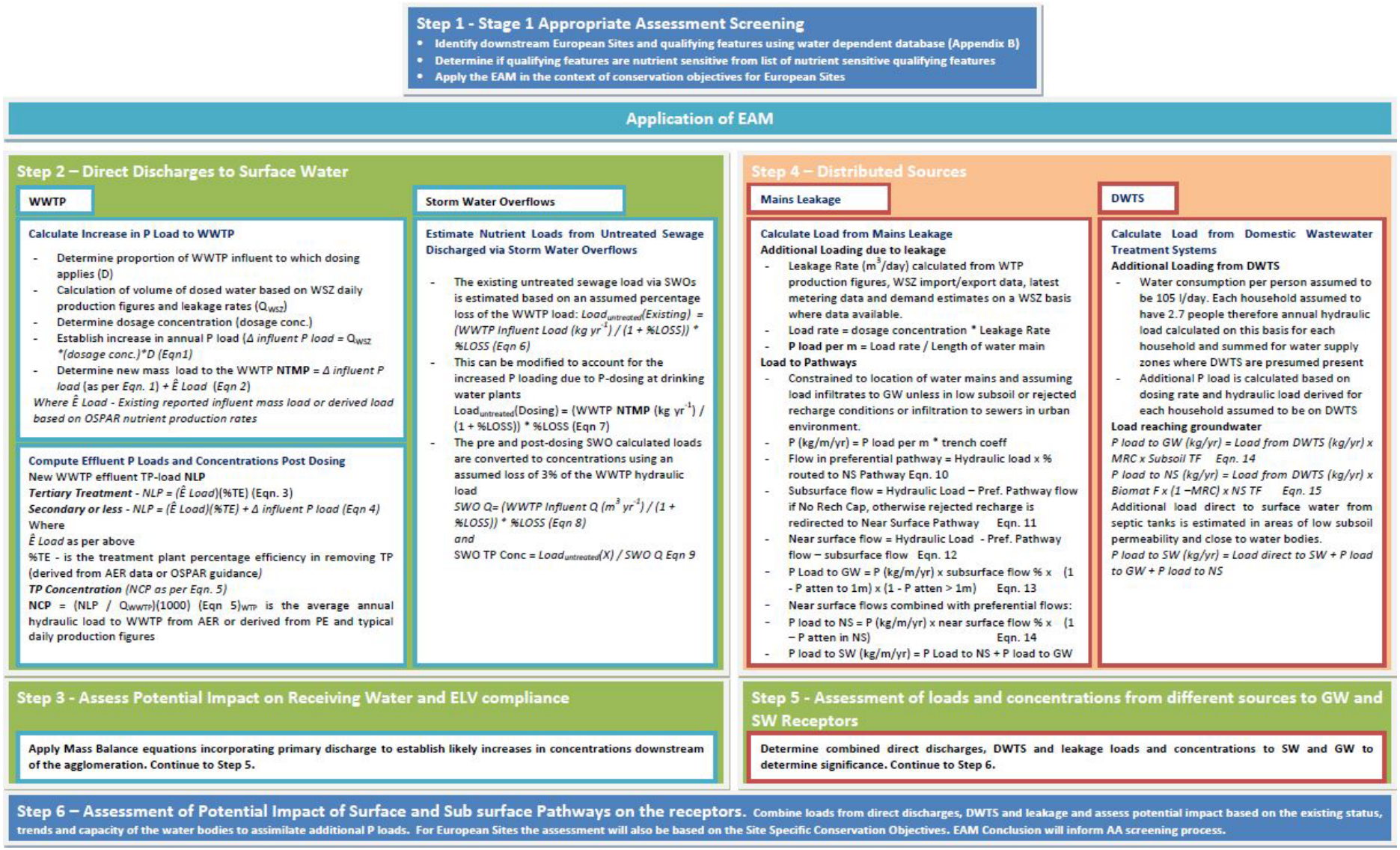


Figure 3-4: Stepwise Approach to the Environmental Assessment Methodology

4 PROJECT CONNECTIVITY TO EUROPEAN SITES

4.1 OVERVIEW OF THE PROJECT ZONE OF INFLUENCE

4.1.1 Construction Phase

The construction phase of the proposed project will take place within the confines of the existing Athlone WTP. The WTP is not located within any European Site. The River Shannon flows along the western boundary of the WTP. Lough Ree SPA and Lough Ree SAC are located 670m upstream of the WTP while the River Shannon Callows SAC and Middle Shannon Callows SPA are located 1km downstream. Given the small-scale nature of construction works, the ZoI was considered to include the footprint of the existing Athlone WTP followed by a review of hydrological and hydrogeological connectivity between the proposed development site and European Sites. The European Sites within ZoI for the construction phase of the project are listed in **Table 4-1** and displayed in **Figure 4-1.**

Table 4-1: European Sites within the ZoI of the Proposed Project – Construction Phase

	Site Name	SAC / SPA Code	Direct Impact	Water Dependent Species / Habitats	Surface Water Connectivity	Ground-water Connectivity[4]	Potential Source Pathway Receptor
1	River Shannon Callows SAC	000216	Yes	Yes	Yes – RWB (Shannon Upper and Shannon Lower)	Yes (Inny)	Yes
2	Lough Ree SAC	000440	No	Yes	No	Yes (Inny)	No
3	Pilgrim's Road Esker SAC	001776	No	Yes	Flood Risk – RWB (Shannon Upper)	Yes (Inny)	Yes
4	Crosswood Bog SAC	002337	No	Yes	No	Yes (Inny)	No
5	Moneybeg & Clareisland Bogs SAC	002340	No	Yes	No	Yes (Inny)	No
6	Carn Park Bog SAC	002336	No	Yes	No	Yes (Inny)	No
7	Ardagullion Bog SAC	002341	No	Yes	No	Yes (Inny)	No
8	Garriskil Bog SAC	000679	No	Yes	No	Yes (Inny)	No
9	Derragh Bog SAC	002201	No	Yes	No	Yes (Inny)	No
10	Mongan Bog SAC	000580	Yes	Yes	Flood Risk – RWB (Shannon Upper and Shannon Lower)	Yes (Inny)	Yes

[4] Athlone RWSS WTP overlies the Inny (IE_SH_G_110) groundwater body. All European sites overlying or supporting connectivity to this groundwater body have been assessed to determine potential source impact pathways. This groundwater body comprises poorly productive bedrock and flow direction is expected to mimic numerous rivers and streams which flow off the higher ground in the northwest and southeast to the River Inny in the centre of the body. The European Sites listed in the Table 4-1 are all >300m from the WTP, as flow paths in the GWB are typically 30-300m and follow the local surface waters. For European Sites which are only hydrogeologically connected to the site via the Inny GWB there is no potential source impact pathway via groundwater above as a result of construction activities (Sites 2, 4-9,13-18 & 21)

	Site Name	SAC / SPA Code	Direct Impact	Water Dependent Species / Habitats	Surface Water Connectivity	Ground-water Connectivity[4]	Potential Source Pathway Receptor
11	Lough Derg, North-east Shore SAC	002241	Yes	Yes	Yes – RWB (Shannon Upper and Shannon Lower)	No	Yes
12	Mongan Bog SPA	004017	Yes	Yes	Flood Risk – RWB (Shannon Upper and Shannon Lower)	Yes (Inny)	Yes
13	Lough Derravaragh SPA	004043	No	Yes	No	Yes (Inny)	No
14	Glen Lough SPA	004045	No	Yes	No	Yes (Inny)	No
15	Lough Iron SPA	004046	No	Yes	No	Yes (Inny)	No
16	Lough Kinale and Derragh Lough SPA	004061	No	Yes	No	Yes (Inny)	No
17	Lough Ree SPA	004064	No	Yes	No	Yes (Inny)	No
18	Lough Sheelin SPA	004065	No	Yes	No	Yes (Inny)	No
19	Middle Shannon Callows SPA	004096	Yes	Yes	Yes – RWB (Shannon Upper and Shannon Lower)	Yes (Inny)	Yes
20	River Suck Callows SPA	004096	Yes	Yes	Yes – RWB (Shannon Upper and Shannon Lower)	Yes (Inny)	Yes
21	Garriskil Bog SPA	004102	No	Yes	No	Yes (Inny)	No
22	Lough Derg (Shannon) SPA	004058	Yes	Yes	Yes – RWB (Shannon Upper and Shannon Lower)	No	Yes

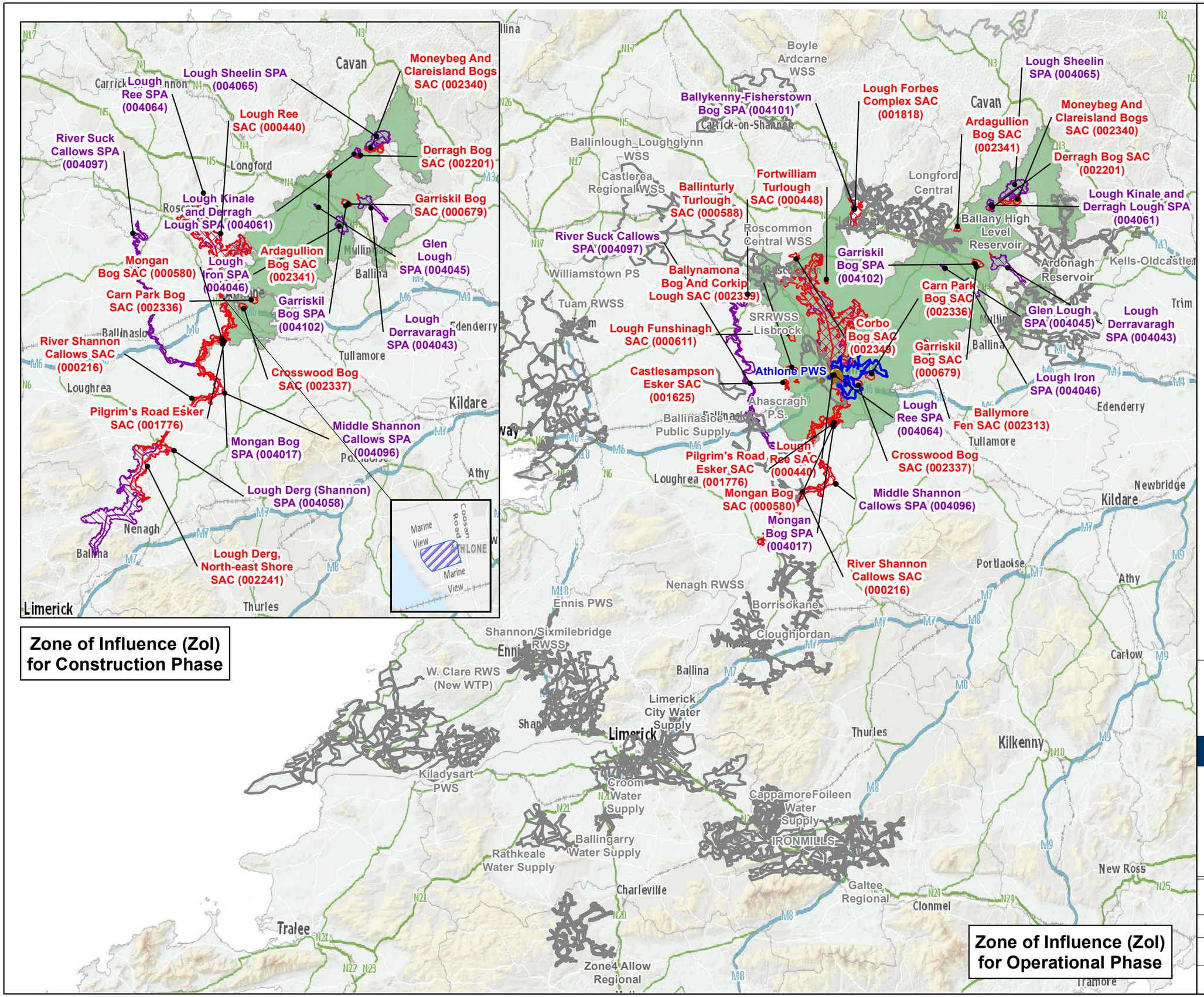
4.1.2 Operational Phase

The ZoI for the operational phase of the proposed project was determined by establishing the potential for hydrological and hydrogeological connectivity between the Athlone WTP, the associated WSZ and European Sites. The ZoI was therefore defined by the surface water sub-catchments and groundwater bodies that are hydrologically and hydrogeologically connected with the Project.

In the EAM, all water bodies linked to the WSZ have been identified. Downstream water bodies to the estuary and coastal water bodies have also been identified. Groundwater bodies intersecting the WSZs are also included in the ZoI. Hydrogeological linkages in karst areas have also been taken into account. European Sites within the ZoI are listed in **Table 4-2** and are displayed in **Figure 4-1**.

Table 4-2: European Sites within the ZoI of the Proposed Project – Operational Phase

	Site Name	SAC / SPA Code	Water Dependent Species / Habitats	Nutrient Sensitive	Surface Water Connectivity	Groundwater Connectivity	Potential Source Pathway Receptor
1	River Shannon Callows	SAC 000216	Yes	Yes	Yes (Athlone West and Inny)	Yes – RWB (Shannon Upper)	Yes
2	Lough Ree	SAC 000440	Yes	Yes	Yes (Funshinagh, Athlone West, Athlone Gravels and Inny)	Yes – RWB (Shannon Upper)	Yes
3	Lough Funshinagh	SAC 000611	Yes	Yes	Yes (Funshinagh)	No	Yes
4	Pilgrim's Road Esker	SAC 001776	No	Yes	Yes (Inny)	Flood Risk	Yes
5	Crosswood Bog	SAC 002337	Yes	Yes	Yes (Inny)	No	Yes
6	Ballynamona Bog And Corkip Lough	SAC 002339	Yes	Yes	Yes (Funshinagh)	No	Yes
7	Moneybeg And Clareisland Bogs	SAC 002340	Yes	Yes	Yes (Inny)	No	Yes
8	Corbo Bog	SAC 002349	Yes	Yes	Yes (Funshinagh)	No	Yes
9	Ballinturly Turlough	SAC 000588	Yes	Yes	Yes (Funshinagh)	No	Yes
10	Carn Park Bog	SAC 002336	Yes	Yes	Yes (Inny)	Yes – RWB (Breesford)	Yes
11	Ardagullion Bog	SAC 002341	Yes	Yes	Yes (Inny)	No	Yes
12	Castlesampson Esker	SAC 001625	Yes	Yes	Yes (Funshinagh)	No	Yes
13	Garriskil Bog	SAC 000679	Yes	Yes	Yes (Inny)	No	Yes
14	Derragh Bog	SAC 002201	Yes	Yes	Yes (Inny)	No	Yes
15	Mongan Bog	SAC 000580	Yes	Yes	Yes (Inny)	No	Yes
16	Lough Forbes Complex	SAC 001818	Yes	Yes	Yes (Funshinagh)	No	Yes
17	Fortwilliam Turlough	SAC 000448	Yes	Yes	Yes (Funshinagh)	No	Yes
18	Mongan Bog	SPA 004017	Yes	Yes	Yes (Inny)	No	Yes
19	Lough Derravaragh	SPA 004043	Yes	Yes	Yes (Inny)	No	Yes
20	Glen Lough	SPA 004045	Yes	Yes	Yes (Inny)	No	Yes
21	Lough Iron	SPA 004046	Yes	Yes	Yes (Inny)	No	Yes
22	Lough Kinale and Derragh Lough	SPA 004061	Yes	Yes	Yes (Inny)	No	Yes
23	Lough Ree	SPA 004064	Yes	Yes	Yes (Funshinagh, Athlone West, Athlone Gravels and Inny)	Yes – RWB (Shannon Upper)	Yes
24	Lough Sheelin	SPA 004065	Yes	Yes	Yes (Inny)	No	Yes
25	Middle Shannon Callows	SPA 004096	Yes	Yes	Yes (Athlone West and Inny)	Yes – RWB (Shannon Upper)	Yes
26	Ballykenny-Fisherstown Bog	SPA 004101	Yes	Yes	Yes (Funshinagh)	No	Yes
27	Garriskil Bog	SPA 004102	Yes	Yes	Yes (Inny)	No	Yes
28	River Suck Callows	SPA 004097	Yes	Yes	Yes (Inny)	Yes – RWB (Shannon Upper)	Yes



Legend

LEMA Emission Type

- Primary Discharge Point
- Storm Water Overflow
- Waste Water Treatment Plant
- Athlone WTP
- Water Supply Zone Boundary (WSZ)
- Additional WSZ considered for dosing
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Zone of Influence

Data Source:
Irish Water
NPWS (August 2019)
EPA

N

0 5 10 20 Kilometres

Client: Uisce Éireann Irish Water

Project: Lead Mitigation Plan
Corrective Water Treatment Works

Figure 4.1

Athlone WSS

European Sites within the ZoI of the Proposed Project

RPS

Scale: 1:820,000 @ A3	Date: 26/08/2019
File Ref: MDW0766Arc0010aF02	Map Projection: Irish National Grid (TM65)

4.2 IDENTIFICATION OF RELEVANT EUROPEAN SITES

For the construction and operational phase of the project, each European Site was assessed for the presence of water dependent habitats and species, their associated nutrient sensitivity, together with the hydrological/hydrogeological connectivity of each site to the proposed project. A number of sites are excluded from further assessment in **Section 6.** Those included are detailed in **Table 4-3** and are displayed in **Figure 4-2**. Eight sites are included for further assessment for the construction phase and nine sites for the operational phase, with justification provided below.

The construction phase of the proposed project will take place within the confines of the existing Athlone WTP. There is potential for surface water connectivity to the River Shannon Callows SAC, Lough Derg North-east Shore SAC, Lough Derg (Shannon) SPA, River Suck Callows SPA and Middle Shannon Callows SPA. Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA are not hydrologically connected to the WTP; however, these sites lie on the floodplain of the Shannon (Upper)_120 and therefore are also included for further assessment. The WTP overlies the Inny groundwater body (Inny IE_SH_G_110), however there is no potential hydrogeological connectivity between the proposed construction works at Athlone WTP and the European Sites within the ZoI (see **Table 4-1**).

The WSZ for the operational phase is located adjacent to the lake water body IE_SH_26_750a Ree and the river water body IE_SH_26S021800 Shannon (Upper)_120. The WSZ directly intersects both water bodies in addition to intersecting their tributaries. As a result, four European sites are intersected by the WSZ via river pathways including: Lough Ree SAC; Lough Ree SPA; River Shannon Callows SAC and Middle Shannon Callows SPA. These sites are included in the **Section 5** and **Section 6** assessment. The water bodies that connect the WSZ to the European Sites include: IE_SH_26G060300 Glassan Stream_010; IE_SH_26S021660 Shannon (Upper)_110; IE_SH_26S021800 Shannon (Upper)_120; IE_SH_26C460200 Cloonbonny Stream_010; IE_SH_26B100100 Breensford_010; and, IE_SH_26B100400 Breensford_020.

The River Suck Callows SPA is also hydrologically connected to the WSZ via the River Suck tributary which has its confluence with the river water body IE_SH_26S021920 Shannon (Upper)_130 downstream of IE_SH_26S021800 Shannon (Upper)_120. As the increase in orthophosphate concentration in IE_SH_26S021800 Shannon (Upper)_120 following dosing is undetectable i.e. 0.0000 mg/l, there is no potential for the transfer of orthophosphate concentration downstream to IE_SH_26S021920 Shannon (Upper)_130 and therefore, no potential for impact to the SPA and its SCIs. River Suck Callows SPA is therefore excluded from further assessment in **Section 6**.

The WSZ also intersects four groundwater bodies including: IE_SH_G_014 Athlone West; IE_SH_G_110 Inny; IE_SH_G_091 Funshinagh and, IE_SH_G_246 Athlone Gravels. In addition to the four sites already identified as hydrologically connected to the WSZ, the following 24 European Sites overlay or intersect these groundwater bodies: Lough Funshinagh SAC; Pilgrim's Road Esker SAC; Crosswood Bog SAC; Ballynamona Bog And Corkip Lough SAC; Moneybeg And Clareisland Bogs SAC; Corbo Bog SAC; Ballinturly Turlough SAC; Carn Park Bog SAC; Ardagullion Bog SAC; Castlesampson Esker SAC; Garriskil Bog SAC; Derragh Bog SAC; Mongan Bog SAC; Lough Forbes Complex SAC; Fortwilliam Turlough SAC; Mongan Bog SPA; Lough Derravaragh SPA; Glen Lough SPA; Lough Iron SPA; Lough Kinale and Derragh Lough SPA; Lough Sheelin SPA; Ballykenny-Fisherstown Bog SPA; Garriskil Bog SPA; and, River Suck Callows SPA.

The Pilgrim's Road Esker SAC is included for further assessment in **Section 6** due to its location immediately adjacent to the river water body IE_SH_26S021800 Shannon (Upper)_120 and the potential for the transfer of orthophosphate from the river water body to the SAC during flood events.

For the remaining European Sites which are connected to the WSZ by hydrogeological pathways, an assessment of the direction of flow in the groundwater body forming the connection is made.

Groundwater flows through voids such as connected pore spaces in sand and gravel aquifers and through fissures, faults, joints and bedding planes in bedrock aquifers. Regional groundwater flows tend to follow the regional topography and generally discharge towards main surface water bodies including rivers, lakes and coastal water bodies. In areas of karstified limestones, high permeability zones give rise to rapid groundwater velocities with more complex flow directions, which may vary seasonally and are difficult to predict with certainty. In this case, the assumption is that groundwater flow direction is from areas of higher elevations to lower elevations, unless groundwater specific information indicates otherwise. Groundwater body specific information relating to flow and discharge is available from the GSI[5], and was consulted in making the assessment.

The WSZ lies predominantly within the groundwater bodies IE_SH_G_110 Inny and IE_SH_G_246 Athlone Gravels. There is no site specific description of the groundwater body IE_SH_G_246 Athlone Gravels available from the GSI[6]. It is however considered together with sand/gravel deposits in the vicinity of Moate and Ballycumber as the Inny/Lough Ree Gravel groundwater body[7] because of the similarity in the configuration of the groundwater bodies i.e. similar morphology; located in low-lying areas with similar land use patterns in the southern part of the Inny/ Lough Ree sub-catchment. Groundwater discharges in this water body is to small springs, rivers/streams that flow through the deposits and Lough Ree. The length of flow paths depend on the size of the sand/gravel deposit. In general, locally important sand/gravel aquifers are expected to have relatively short flow paths, i.e., up to several hundreds of metres. Sand/gravel has an intergranular porosity[8], thus groundwater flow is diffuse. Groundwater flow directions are driven by topography and are generally to the west. In general, groundwater from sand/gravel deposits discharges to streams/rivers flowing through the deposits[9]. The European Sites that intersect body IE_SH_G_246 Athlone Gravels include: Lough Ree SAC and SPA, which have already been included for further assessment because of river pathways.

The groundwater body IE_SH_G_110 Inny is a poorly productive bedrock aquifer. It comprises a large area stretching from south Cavan and the eastern boundary of the Shannon River Basin District to Lough Ree. The River Inny runs south southeast through the centre of this groundwater body from Lough Sheelin in the northeast to Lough Ree in the southwest. Numerous rivers and streams flow off the higher ground in the northwest and southeast to the River Inny in the centre of the body. The main discharges will be local, to the River Inny and its tributaries crossing the groundwater body, and to Lough Ree in the southwest. Groundwater flow in this groundwater body will be of a local nature. Groundwater flow will be concentrated in fractured and weathered zones and in the vicinity

[5] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
[6] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
[7] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/InnyLoughReeGravelsGWB.pdf
[8] There are two main types of aquifer in Ireland – bedrock aquifers, and sand and gravel aquifers. In sand and gravel aquifers, which underlie <5% of the land area, groundwater is stored and flows between the sand and gravel grains. This is known as intergranular porosity and permeability.
[9] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/InnyLoughReeGravelsGWB.pdf

of fault zones (these rocks do not exhibit intergranular permeability). Groundwater flow paths will be short, in general between 30 and 300 m, with groundwater discharging locally to rivers and streams. Most groundwater flow is likely to circulate in the upper tens of metres of bedrock, recharging and discharging in local zones. Groundwater and surface water interactions require special attention where terrestrial ecosystems are dependent on a sustainable balance between the two. A number of fens, bogs and lakes are recorded in this groundwater body which may have varying dependence on groundwater.

The European Sites intersected by the groundwater body IE_SH_G_110 Inny include: Moneybeg and Clareisland Bogs SAC; Carn Park Bog SAC; Ardagullion Bog SAC; Garriskil Bog SAC; Derragh Bog SAC; Mongan Bog SAC; River Shannon Callows SAC; Lough Ree SAC; Pilgrim's Road Esker SAC; Crosswood Bog SAC; Mongan Bog SPA; Lough Derravaragh SPA; Glen Lough SPA; Lough Iron SPA; Lough Kinale and Derragh Lough SPA; Lough Ree SPA; Lough Sheelin SPA; Middle Shannon Callows SPA and, Garriskil Bog SPA. The River Shannon Callows SAC; Lough Ree SAC; Pilgrim's Road Esker SAC; Lough Ree SPA and Middle Shannon Callows SPA, are previously included for further assessment due to the potential for impact via river pathways. Crosswood Bog SAC is intersected by the WSZ while Carn Park Bog SAC is located 32 metres from the WSZ boundary. Both SACs are included for further assessment in **Section 6** due to the potential for impact via groundwater pathways. Groundwater flow paths in the vicinity of the River Shannon are not described for IE_SH_G_110 Inny. Two European Sites, Mongan Bog SAC and Mongan Bog SPA are located south of the WSZ close to the River Shannon. On a precautionary basis these sites are included for further assessment in **Section 6**.

The WSZ and the Inny tributaries affected by dosing are located to the south-west of the River Inny. As described, the main groundwater discharges in IE_SH_G_110 Inny will be local to the River Inny and its tributaries crossing the groundwater body, and to Lough Ree in the southwest. The following European Sites are located north and north east of the River Inny: Moneybeg and Clareisland Bogs SAC; Ardagullion Bog SAC; Garriskil Bog SAC; Derragh Bog SAC; Lough Derravaragh SPA; Glen Lough SPA; Lough Iron SPA; Lough Kinale and Derragh Lough SPA; Lough Sheelin SPA and Garriskil Bog SPA. As the River Inny hydrologically separates any surface and groundwater flow paths to these European Sites from the WSZ there is no potential for impact to these sites as a result of dosing at Athlone WTP and therefore the sites have been excluded from further assessment.

The WSZ intersects a relatively small section of the karstic groundwater body IE_SH_G_091 Funshinagh to the south of the lake water body IE_SH_26_750a Ree. The main discharges in this water body are to the streams and rivers crossing the body and to the large springs found within the body. In winter groundwater will discharge to the turloughs found in the area. Groundwater flow through karst areas is extremely complex and difficult to predict. As flow pathways are often determined by discrete conduits, actual flow directions will not necessarily be perpendicular to the assumed water table contours, as shown by several tracing studies. Flow velocities can be rapid and variable, both spatially and temporally. The rapid groundwater flow velocities recorded in this body indicate that a large proportion of groundwater flow takes place in enlarged conduit systems. The presence of high yielding springs in this body indicates that the permeability of the rock unit is high enough to permit the throughput of significant quantities of groundwater. High yielding springs are indicative of regional-scale flow systems. Flow path lengths can be up to a several kilometres in length. Overall groundwater flow will be towards Lough Ree, but the highly karstified nature of the bedrock means that local groundwater flow directions can be highly variable. There is a high degree of interconnection between groundwater and surface water in this groundwater body. Numerous karst features such as turloughs, swallow holes and enclosed depressions are evident. Because of the close interaction between surface water and groundwater in karstified aquifers, surface water

and groundwater quality are also closely linked. Any contamination of surface water is rapidly transported into the groundwater system, and vice versa[10].

The European Sites intersected by the groundwater body IE_SH_G_091 Funshinagh include: Lough Ree SAC; Lough Funshinagh SAC; Ballynamona Bog And Corkip Lough SAC; Corbo Bog SAC; Ballinturly Turlough SAC; Castlesampson Esker SAC; Lough Forbes Complex SAC; Fortwilliam Turlough SAC; Lough Ree SPA and, Ballykenny-Fisherstown Bog SPA. Lough Ree SAC and SPA are previously included for further assessment in **Section 6** on the basis of its surface water connectivity to the WSZ. There is an underground traced line in the main part of this groundwater body which indicates flow to the south/south-east. Since there are no karst features of groundwater recharge such as swallow holes, in the small area of IE_SH_G_091 Funshinagh intersected by the WSZ, potential impacts to the eight European Sites (Lough Funshinagh SAC; Ballynamona Bog And Corkip Lough SAC; Corbo Bog SAC; Ballinturly Turlough SAC; Castlesampson Esker SAC; Lough Forbes Complex SAC; Fortwilliam Turlough SAC and, Ballykenny-Fisherstown Bog SPA) that occur in the wider groundwater body are ruled out.

The WSZ also intersects the groundwater body IE_SH_G_014 Athlone West. This water body is comprised of poorly productive bedrock. The main discharges will be local, to the streams crossing the body, where the subsoil thickness allows, and to the River Shannon in the east and south of the body. There may be some groundwater discharge at lagg zones at the margins of the bogs which skirt the River Shannon. There may also be the potential for emergence of groundwater in these bogs when the peat cover is completely removed by harvesting from areas where the underlying marl and clay deposits are thin. Groundwater flow occurs in fractures and faults. Permeability is highest in the upper few metres of bedrock, but decreases rapidly with depth. In general groundwater flow is concentrated in the upper 15 m of the aquifer. Local zones of high permeability can be encountered near fault zones and in areas of intensive fracturing. Groundwater flow in this body will be of a local nature. Groundwater flow paths are generally short, with groundwater discharging to small springs, or to the streams and rivers that traverse the aquifer. Flow directions are expected to approximately follow the local surface water catchments. Overall, groundwater flow is to the east and south towards the River Shannon. In general groundwater is unconfined in this groundwater body; however, groundwater can become confined beneath the clayey till and lacustrine clay deposits that underlie the large bogs along the River Shannon.

Groundwater provides an element of base flow to the River Shannon and to streams crossing the body. There are many areas of raised bogs within this groundwater body. Raised bogs are generally considered as ecosystems that are independent or only locally dependant on groundwater. However, lagg zones can develop at bog fringes, where mixing of upwelling groundwater flow and surface runoff from the bog provide added nutrients for the development of a diverse range of plant species. Groundwater is generally confined beneath low permeability clayey till and 2-3 m of lacustrine clay which underlie the peat in the large bogs. In areas where the underlying clays are thin or absent there is potential for upward movement of groundwater to the bog system. The complete removal of up to 10 m of peat from large areas of bog adjacent to the River Shannon, and the cessation of pumped drainage once harvesting is complete may have implications for future groundwater surface water interactions. Occasionally the post harvesting level of peat is lower that the winter water levels of the River Shannon. Karstification is rare in the limestones in this

[10] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/FunshinaghGWB.pdf

groundwater body however some features can occur. There are a small number of potential karst features currently recorded for the area - two swallow holes and an enclosed depression[11].

The European Sites intersected by the groundwater body IE_SH_G_014 Athlone West include: Lough Ree SAC and SPA; River Shannon Callows SAC and, Middle Shannon Callows SPA, are previously included for further assessment due to the potential for impact via river pathways. The potential for impact via groundwater pathways will be also be considered in **Section 6**.

On this basis, eight sites have been included for further assessment as a result of potential effect arising during construction phase in **Section 5** below i.e. River Shannon Callows SAC, Lough Derg North-east Shore SAC, Lough Derg (Shannon) SPA, River Suck Callows SPA and Middle Shannon Callows SPA, Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA. Nine sites have been included for further assessment for the operational phase in **Sections 5** and **6** below i.e. Lough Ree SAC, Lough Ree SPA; River Shannon Callows SAC, Pilgrim's Road Esker SAC, Crosswood Bog SAC, Carn Park Bog SAC, Mongan Bog SAC, Mongan Bog SPA and Middle Shannon Callows SPA.

[11] https://jetstream.gsi.ie/iwdds/delivery/GSI_Transfer/Groundwater/GWB/AthloneWestGWB.pdf

Table 4-3: European Sites Hydrologically and Hydrogeologically Connected to or Downstream of the WTP and WSZ

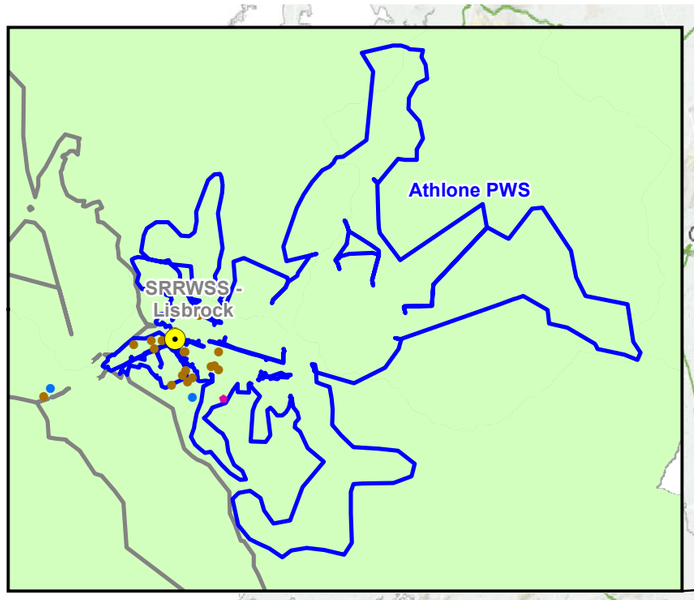
Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature code	Qualifying Interests/Special Conservation Interests	Water Dependant Species / Habitats	Nutrient Sensitive Species / Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Impact Pathway
Construction Phase Only								
Lough Derg, North East Shore	SAC 002241	21st Feb 2018 Generic	5130	*Juniperus communis* formations on heaths or calcareous grasslands	No	No	Yes	Yes
			7210	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae**	Yes	Yes		
			7230	Alkaline fens	Yes	Yes		
			8240	Limestone pavements*	No	Yes		
			91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)*	Yes	Yes		
			91J0	*Taxus baccata* woods of the British Isles*	No	No		
Lough Derg (Shannon)	SPA 004058	21st Feb 2018 Generic	A017	Cormorant (*Phalacrocorax carbo*)	Yes	Yes	Yes	Yes
			A061	Tufted Duck (*Aythya fuligula*)	Yes	Yes		
			A067	Goldeneye (*Bucephala clangula*)	Yes	Yes		
			A193	Common Tern (*Sterna hirundo*)	Yes	Yes		
River Suck Callows	SPA 004097	21st Feb 2018 Generic	A038	Whooper Swan (*Cygnus cygnus*)	Yes	Yes	Yes	Yes
			A050	Wigeon (*Anas penelope*)	Yes	Yes		
			A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature code	Qualifying Interests/Special Conservation Interests	Water Dependant Species / Habitats	Nutrient Sensitive Species / Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Impact Pathway
			A142	Lapwing (*Vanellus vanellus*)	Yes	Yes		
			A395	Greenland White-fronted Goose (*Anser albifrons flavirostris*)	Yes	Yes		
			A999	Wetland and Waterbirds	Yes	Yes		
Operation Phase Only								
Carn Park Bog	SAC 002336	23 Nov 2015 Version 1	7110	* Active raised bogs	Yes	Yes	Yes	Yes
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes		
Crosswood Bog	SAC 002337	10 Feb 2016 Version 1	7110	* Active raised bogs	Yes	Yes	Yes	Yes
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes		
Lough Ree	SAC 000440	09 Aug 2016 Version 1	1355	Otter (*Lutra lutra*)	Yes	Yes	Yes	Yes
			3150	Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation	Yes	Yes		
			6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)	Flood risk	Yes		
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes		
			7230	Alkaline fens	Yes	Yes		
			8240	* Limestone pavements	No	Yes		
			91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	No	Yes		

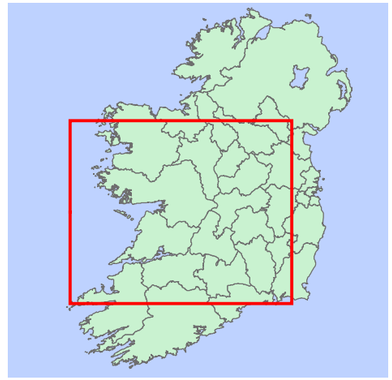
Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature code	Qualifying Interests/Special Conservation Interests	Water Dependant Species / Habitats	Nutrient Sensitive Species / Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Impact Pathway
			91D0	* Bog woodland	Yes	Yes		
Lough Ree	SPA 004064	21st Feb 2018 Generic	A004	Little Grebe (*Tachybaptus ruficollis*)	Yes	Yes	Yes	Yes
			A038	Whooper Swan (*Cygnus cygnus*)	Yes	Yes		
			A050	Wigeon (*Anas penelope*)	Yes	Yes		
			A052	Teal (*Anas crecca*)	Yes	Yes		
			A053	Mallard (*Anas platyrhynchos*)	Yes	Yes		
			A056	Shoveler (*Anas clypeata*)	Yes	Yes		
			A061	Tufted Duck (*Aythya fuligula*)	Yes	Yes		
			A065	Common Scoter (*Melanitta nigra*)	Yes	Yes		
			A067	Goldeneye (*Bucephala clangula*)	Yes	Yes		
			A125	Coot (*Fulica atra*)	Yes	Yes		
			A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes		
			A142	Lapwing (*Vanellus vanellus*)	Yes	Yes		
			A193	Common Tern (*Sterna hirundo*)	Yes	Yes		
			A999	Wetlands and Waterbirds	Yes	Yes		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature code	Qualifying Interests/Special Conservation Interests	Water Dependant Species / Habitats	Nutrient Sensitive Species / Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Impact Pathway
Construction and Operation Phase								
River Shannon Callows	SAC 000216	21st Feb 2018 Generic	1355	Otter (*Lutra lutra*)	Yes	Yes	Yes	Yes
			6410	*Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinia caeruleae*)	Yes	Yes		
			6510	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)	Flood risk	Yes		
			8240	* Limestone pavements	No	Yes		
			91E0	* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	Yes	Yes		
Pilgrim's Road Esker	SAC 001776	21st Feb 2018 Generic	6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (* important orchid sites)*	Flood Risk	Yes	Yes	Yes
Mongan Bog	SAC 000580	01 Apr 2016 Version 1	7110	* Active raised bogs	Yes	Yes	Yes	Yes
			7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes		
			7150	Depressions on peat substrates of the *Rhynchosporion*	Yes	Yes		
Mongan Bog	SPA 004017	21 Feb 2018 Generic	A395	Greenland White-fronted Goose (*Anser albifrons flavirostris*)	Yes	Yes	Yes	Yes
Middle Shannon Callows	SPA 004096	21 Feb 2018 Generic	A038	Whooper Swan (*Cygnus cygnus*)	Yes	Yes	Yes	Yes
			A050	Wigeon (*Anas penelope*)	Yes	Yes		
			A122	Corncrake (*Crex crex*)	Yes	Yes		
			A140	Golden Plover (*Pluvialis apricaria*)	Yes	Yes		

Site Name	SAC / SPA Code	Conservation Objectives Establishment Date	Feature code	Qualifying Interests/Special Conservation Interests	Water Dependant Species / Habitats	Nutrient Sensitive Species / Habitats	Potential Hydrological / Hydrogeological Connectivity	Potential Source Impact Pathway
			A142	Lapwing (*Vanellus vanellus*)	Yes	Yes		
			A156	Black-tailed Godwit (*Limosa limosa*)	Yes	Yes		
			A179	Black-headed Gull (*Chroicocephalus ridibundus*)	Yes	Yes		



Zone of Influence (ZoI) for Operational Phase



Legend

- Athlone WTP

LEMA Emission Type

- Primary Discharge Point
- Storm Water Overflow
- Waste Water Treatment Plant
- Water Supply Zone Boundary (WSZ)
- Additional WSZ considered for dosing
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Subcatchments intersecting Water Supply Zone(s) related to the WTP
- Zone of Influence

Data Source:
Irish Water
NPWS (August 2019)
EPA

N

0 5 10 20 Kilometres

Client: Uisce Éireann Irish Water

Project: Lead Mitigation Plan
Corrective Water Treatment Works

Figure 4.2

Athlone WSS

European Sites within the ZoI which are hydro(geo)logically connected

RPS

Scale: 1:820,000 @ A3	Date: 27/08/2019
File Ref: MDW0766Arc0010bF02	Map Projection: Irish National Grid (TM65)

5 EVALUATION OF POTENTIAL IMPACTS

5.1 CONTEXT FOR IMPACT PREDICTION

The methodology for the assessment of impacts is derived from the *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites* (EC, 2002). When describing changes/activities and impacts on ecosystem structure and function, the types of impacts that are commonly presented include:

- Direct and indirect effects;
- Short and long-term effects;
- Construction, operational and decommissioning effects; and
- Isolated, interactive and cumulative effects.

5.2 IMPACT IDENTIFICATION

In considering the potential for impacts from implementation of the project, a "source–pathway–receptor" approach has been applied.

The Screening for AA has considered the potential for the following likely significant effects:

- Altered structure and functions relating to the physical components of a habitat ("structure") and the ecological processes that drive it ("functions"). For aquatic habitats these include attributes such as vegetation and water quality;
- Altered species composition due to changes in abiotic conditions such as water quality;
- Reduced breeding success (e.g. due to disturbance, habitat alteration, pollution) possibly resulting in reduced population viability; and
- Impacts to surface water and groundwater and the species they support (changes to key indicators).

5.2.1 Construction Phase

The source-pathway-receptor approach has identified a number of impact pathways associated with the construction of orthophosphate treatment works at Athlone WTP. These will be evaluated with regard to the potential for likely significant effects on European Sites. These are potential effects and in the absence of pathways (which is evaluated in **Section 5.3.1** below) the construction phase may not give rise to these effects.

- Sediment laden run-off from excavation areas (trenches for dosing pipelines, carrier water pipework and electrical cables) and the introduction of fine sediments to watercourses connected to the works area causing a deterioration in water quality;
- Dust and noise emissions from excavation (trenches for dosing pipelines, carrier water pipework and electrical cables and transportation of material and equipment close to watercourses causing a deterioration in water quality or disturbance to species (e.g. birds);

- Environmental incident or accident during the construction phase e.g. spillage of a contaminant such as diesel or phosphoric acid causing a deterioration in water quality; and
- Groundwater level drawdown through the excavation of trenches for dosing pipelines, carrier water pipework and electrical cables.

5.2.2 Operational Phase

The source-pathway-receptor approach has identified a number of impact pathways associated with the operation of orthophosphate treatment works at Athlone WTP. These will be evaluated with regard to the potential for likely significant effects on European Sites in relation to:

- Excessive phosphate within an aquatic ecosystem may lead to eutrophication with a corresponding reduction in oxygen levels, reduction in species diversity and subsequent impacts on animal life;
- Groundwater dependent habitats include both surface water habitats (e.g. hard oligo-mesotrophic lakes) and Groundwater Dependent Terrestrial Ecosystems (GWDTEs, e.g. alkaline fens). Any change in the water quality of these systems may have subsequent impacts for these habitats and species;
- The discharge of additional orthophosphate loads to the environment (through surface and sub surface pathways) may have potentially negative effects on nutrient sensitive species such as the freshwater pearl mussel, Atlantic salmon and the white-clawed crayfish;
- Phosphorus in wastewater collection systems is the result of drinking water and derived from a number of other sources, including phosphorus imported from areas outside the agglomeration through import of sludges or leachates for treatment at the plant. The disposal and use of phosphorus removed in wastewater sludge is regulated (i.e. through nutrient management plans) and should not pose further threat of environmental impact;
- Leakage of phosphates from the drinking water supply network to the environment from use of orthophosphate;
- Direct discharges of increased orthophosphate to water bodies from the wastewater treatment plant licensed discharges; and
- Potential discharges to water bodies of untreated effluent potentially high in orthophosphate from Storm Water Overflows (SWOs).

5.3 ASSESSMENT OF IMPACTS

Article 6 of the Habitats Directive states that:

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications of the site in view of the site's conservation objectives.

The focus of this Screening to inform AA is the risk associated with the additional orthophosphate load due to orthophosphate dosing and the construction of treatment works at Athlone WTP.

5.3.1 Construction Phase

There are three possible locations for the orthophosphate dosing system all of which will be located within the confines of the existing WTP boundary. The assessment of impacts associated with construction of the corrective water treatment works was conducted taking the whole Athlone WTP into account and therefore included all possible locations. The assessment of impacts associated with the construction of the corrective water treatment works at Athlone WTP is presented in **Table 5-1** and is based on a desktop study using the following information:

- Design descriptions and drawings for the proposed corrective water treatment works at Athlone WTP;
- A review of hydrological connectivity between the proposed works and European sites using the EPA Mapping Resources: http://gis.epa.ie/; www.Catchments.ie;
- Ordnance Survey Ireland Map viewer: http://maps.osi.ie/publicviewer/#V1,591271,743300,0,10
- Site synopses, conservation objectives and qualifying interest data for European sites.

Table 5-1: Likely significant effects to European Sites arising as a result of the construction of the corrective water treatment works

Site Name (Code)	Contributing WB Code_Name	WB Type [12]	Evaluation
River Shannon Callows SAC (000216)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	The construction works will be located within the confines of the existing Athlone RWSS WTP. Athlone RWSS WTP is not located within a European Site. It does lie adjacent to the River Shannon. Lough Ree SAC & SPA are both located 670m upstream and River Shannon Callows SAC and Middle Shannon Callows SPA are located 1km downstream. **Surface water** There are no surface water bodies within the confines of Athlone RWSS WTP. However the footprint of the WTP adjoins the Shannon River (Shannon (Upper)_120 IE_SH_26S021800). Athlone WTP is c.15m from the River Shannon with scattered broadleaf trees, a strip of managed grass and narrow walking path between the WTP and the river. The Shannon River flows west of the WTP site and is connected downstream to the River Shannon Callows SAC, Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA, Middle Shannon Callows SPA, River Suck Callows SPA until it reaches Lough Derg, North-east Shore SAC and Lough Derg (Shannon) SPA *ca.* 90km downstream. The proximity of the proposed construction works to the Shannon River results in the potential for connectivity to European sites downstream of the Shannon River.
	Shannon (Upper)_130 (IE_SH_26S021920)	RWB	
	Shannon (Lower)_010 (IE_SH_25S012000)	RWB	
	Shannon (Lower)_020 (IE_SH_25S012060)	RWB	
	Shannon (Lower)_030 (IE_SH_25S012350)	RWB	
Pilgrim's Road Esker SAC (001776)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	
Mongan Bog SAC (000580)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	
Lough Derg, North-east Shore SAC (002241)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	
	Shannon (Upper)_130 (IE_SH_26S021920)	RWB	
	Shannon (Lower)_010 (IE_SH_25S012000)	RWB	
	Shannon (Lower)_020 (IE_SH_25S012060)	RWB	
	Shannon (Lower)_030 (IE_SH_25S012350)	RWB	
	Derg TN (IE_SH_25_191a)	LWB	
Mongan Bog SPA (004017)	Shannon (Upper)_120 (IE_SH_26S021800	RWB	

[12] Monitoring period is annual unless specified.

Site Name (Code)	Contributing WB Code_Name	WB Type [12]	Evaluation
Middle Shannon Callows SPA (004096)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	However, the proposed construction works are small scale in nature and will be undertaken within the confines of the existing built infrastructure associated with Athlone RWSS WTP. There will be no aspects of the proposed works that will result in the release of potential impacts sources identified in **Section 5.2.1.** The works will be localised and contained to the immediate development area which supports amenity grassland / buildings and artificial surfaces. Works such as excavations will be contained to the defined working area and necessary works with cast in place concrete will be undertaken within sealed shuttered units. Such works practices will retain all potential construction related pollutants at source. Owing to the small scale nature of the proposed works there is no potential for likely significant effects upon River Shannon Callows SAC, Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA, Middle Shannon Callows SPA, River Suck Callows SPA, Lough Derg North-east Shore SAC and Lough Derg (Shannon) SPA through sediment laden run-off, dust emissions or environmental incidents. Therefore, there is no potential for likely significant effects to these European sites. **Groundwater** The WTP overlies the Inny (IE_SH_G_110) groundwater body a sizeable groundwater body which crosses four counties: Co. Offaly, Co. Westmeath, Co. Longford and Co. Cavan. The excavation of trenches to install dosing pipelines, carrier water pipework and electrical cables to 700mm below ground level has the potential to interfere with the water table potentially causing groundwater drawdown. Potential connectivity for the European Sites overlying this GWB have been ruled out in **Table 4-1** above. Therefore, there is no potential for likely significant effects to the underlying groundwater body, the receiving surface water feature and subsequently those European Sites screened in for further assessment, as a result of the construction of the corrective water treatment works at Athlone RWSS WTP.
	Shannon (Upper)_130 (IE_SH_26S021920)	RWB	
	Shannon (Lower)_010 (IE_SH_25S012000)	RWB	
	Shannon (Lower)_020 (IE_SH_25S012060)	RWB	
	Shannon (Lower)_030 (IE_SH_25S012350)	RWB	
River Suck Callows SPA (004097)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	
	Shannon (Upper)_130 (IE_SH_26S021920)	RWB	
Lough Derg (Shannon) SPA (004058)	Shannon (Upper)_120 (IE_SH_26S021800)	RWB	
	Shannon (Upper)_130 (IE_SH_26S021920)	RWB	
	Shannon (Lower)_010 (IE_SH_25S012000)	RWB	
	Shannon (Lower)_020 (IE_SH_25S012060)	RWB	
	Shannon (Lower)_030 (IE_SH_25S012350)	RWB	
	Derg TN (IE_SH_25_191a)	LWB	

5.3.2 Operational Phase

In the case of the additional orthophosphate load due to dosing at Athlone WTP, the EAM conceptual model developed for orthophosphate transfer identified the surface and groundwater bodies that have the potential to be affected by the orthophosphate dosing and for which hydrological or hydrogeological pathways to the European Sites exist. These water bodies are listed in **Table 5-2.** The table identifies the following:

- European Sites included for assessment;
- Water bodies hydrologically or hydrogeologically connected to the European Sites;
- Existing orthophosphate indicative quality and trend of each water body as presented in the EPA's WFD APP;
- The baseline orthophosphate concentration of each water body;
- 75% of the upper threshold for the indicative quality;
- Cumulative orthophosphate load to surface from leakage, DWWTS and agglomerations;
- The modelled orthophosphate concentration following dosing at the WTP; and,
- The orthophosphate potential baseline concentration (mg/l) following dosing at the WTP.

The EAM has been undertaken assuming the capacity of a water body is a measure of its ability to absorb extra pressures before its indicative quality changes. In order to do this the indicative quality as presented in the EPA's WFD APP is used as the baseline concentration for the different monitoring points within a water body. For example, a river water body with Good orthophosphate indicative quality will have mean orthophosphate value in the range 0.025 to 0.035 mg/l. River water bodies with mean orthophosphate concentrations of 0.0275 mg/l have 75% capacity left, i.e. high capacity, while river water bodies with a mean of 0.0325 mg/l have lower capacity (25%) as the baseline concentrations are closer to the Good/Moderate indicative quality boundary.

When assessing the increase in orthophosphate concentrations as a result of proposed dosing, an increase which is <5% of the Good / High indicative quality boundary, i.e. 0.00125mg/l, is excluded from further assessment and is assumed to result in no significant impact to a water body. If the baseline orthophosphate concentration in addition to the potential increase in orthophosphate concentration as a result of dosing is less than the 75% upper threshold of the indicative quality band for a water body, this also results in an assessment of no significant impact. Where a water body does not have monitored orthophosphate concentrations, a conservative approach is used whereby the surrogate indicative quality is calculated based on the ecological status assigned to that water body by the EPA.

For significance threshold band (i.e. 75% of the upper threshold for the indicative quality band) in transitional and coastal water bodies, a sliding linear scale is used depending on median salinity. The EAM determines if the dosing will result in a baseline concentration that exceeds the relevant 75% threshold for the indicative quality bands (based on salinities) in order to evaluate whether there could be an increased risk of deterioration in indicative quality.

Where a water body is unassigned and therefore does not have monitored orthophosphate concentrations or salinity levels, a conservative approach is used whereby the surrogate indicative quality for orthophosphate is calculated based on the surrogate ecological status as defined by the

EPA for the purposes of classifying the status of the waterbody but the more conservative freshwater orthophosphate limits for the different indicative quality bands are applied[13].

Therefore, in assessing the additional loads from the proposed orthophosphate dosing, the capacity of the water body will be assessed. This information is available on the WFD App on a national basis using the "Distance to Threshold" parameter, where water bodies with high capacity are termed "Far" from the threshold and those with low capacity are "Near" the threshold.

It is predicted that orthophosphate dosing will not have a significant effect on water bodies (or the Conservation Objectives of a European Site) where it does not cause the P concentration to increase to a level within 25% of the remaining capacity left within the existing orthophosphate indicative quality band, i.e. cause a change in the distance to threshold from far to near. This assessment will be supported by trend analysis as outlined below to ensure the additional orthophosphate dosing and statistically significant trends for a water body will not result in deterioration in status even where the distance to threshold is currently assessed to be far. Where the water body baseline indicative quality concentration is "Near" to the threshold before the effect of orthophosphate dosing is considered, this does not cause an automatic fail for this test. If the predicted increase in concentration due to orthophosphate is very low (i.e. below 5% of the Good/Moderate indicative quality this test will pass as the orthophosphate dosing itself can be defined as having no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The identification of statistically and environmentally significant trends for water bodies is a specific requirement of the WFD and the Groundwater Daughter Directive. Guidance on trends in groundwater assessments (UKTAG 2009, EPA 2010) indicates that trends are environmentally significant if they indicate that the Good Ecological Status will not be achieved within one future river basin cycle, i.e. within the next 6 years.

This test applies only when the trend for orthophosphate concentration for the water body is considered statistically significant in the WFD App. For surface water bodies, the baseline with the additional concentration due to orthophosphate dosing is added and assessed as appropriate. If the new calculated predicted concentration prevents the achievement of good indicative quality then this test fails.

This assessment assumes a dosing rate of 0.8mg/l.

An additional test for groundwater bodies states that downward trends should not be reversed as a result of pollution. This test applies to GWB with statistically significant trends according to the WFD App and the Sens Slope provided is used to assess direction and strength of trend. If the trend is negative and the predicted increase in orthophosphate concentration is lower than the absolute value of the Sens Slope, then the test passes.

The initial assessment is automated using the most up to date baseline data from the WFD monitoring programme. If tests fail and more investigation is required, more recent data can be used and the assessment rerun. For example, if project monitoring provides more recent baseline concentrations than that available from the WFD monitoring programme these can be used instead of the WFD baseline information, particularly if the most recent WFD monitoring is not available.

[13] The conservative thresholds in transitional and coastal water bodies for orthophosphate indicative quality in unassigned water bodies i.e. upper limits are: High 0.025 mg/l; Good 0.04 mg/l; Moderate 0.06 mg/l; Poor 0.09 mg/l; Bad – N/A. The higher range for transitional and coastal water bodies with a median salinity ≤ 17mg/l are: High 0.03 mg/l; Good 0.06 mg/l; Moderate 0.1 mg/l; Poor 0.2 mg/l; Bad N/A.

Table 5-2: Surface and groundwater bodies within the WSZ with a hydrological or hydrogeological connection to European Sites

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
Lough Ree SAC (000440)	IE_SH_26G060300 Glassan Stream_010	RWB	*Moderate*	*0.046*	*0.051*	*5.3*	*0.0007*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021660 Shannon (Upper)_110	RWB	*Poor*	*0.077*	*0.087*	*28.9*	*0.0000*	*0.077*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021800 Shannon (Upper)_120	RWB Multiple monitoring points	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.012	0.019			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.016	0.019			0.016	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

[14] Monitoring period is annual unless specified.
[15] Surrogate Indicative Quality in italic.
[16] Distance to threshold.
[17] Baseline year is 2014 for surface water bodies and 2012 for groundwater bodies.
[18] Surrogate concentration is given in italic mg/l
[19] Values above 5% of Good / High indicative quality boundary (0.00125 mg/l) for SW or 5% of Good / Fail indicative quality boundary (0.00175 mg/l) for GW highlighted in yellow.
[20] Green cells signify that there is no risk of deterioration in indicative quality of the water body following dosing at the WTP.

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
			High Far	0.013	0.019			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100100 Breensford_010	RWB	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100400 Breensford_020	RWB	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_014 Athlone West	GWB	*Good*	*0.018*	*0.026*	*5.1*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_091 Funshinagh	GWB Multiple monitoring points	Good Upwards Far	*0.023*	0.026	0.2	0.0000	0.023	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	*0.007*	0.026			0.007	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	*0.020*	0.026			0.020	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
	IE_SH_G_246 Athlone Gravels	GWB	*Good*	*0.018*	*0.026*	*10.2*	*0.0010*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Mongan Bog SAC (000580)	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
River Shannon Callows SAC (000216)	IE_SH_26G060300 Glassan Stream_010	RWB	*Moderate*	*0.046*	*0.051*	*5.3*	*0.0007*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021660 Shannon (Upper)_110	RWB	*Poor*	*0.077*	*0.087*	*28.9*	*0.0000*	*0.077*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021800 Shannon (Upper)_120	RWB Multiple monitoring points	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.012	0.019			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.016	0.019			0.016	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.013	0.019			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
	IE_SH_26C460200 Cloonbonny Stream_010	RWB	High Near	0.022	0.019	4.1	0.0008	0.023	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled additional conc. is insignificant (0.0008mg/l) therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100100 Breensford_010	RWB	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100400 Breensford_020	RWB	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_014 Athlone West	GWB	*Good*	*0.018*	*0.026*	*5.1*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Carn Park Bog SAC (002336)	IE_SH_26B100100 Breensford_010	RWB	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100400 Breensford_020	RWB	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
									preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Crosswood Bog SAC (002337)	IE_SH_26S021800 Shannon (Upper)_120	RWB Multiple monitoring points	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.012	0.019			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.016	0.019			0.016	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.013	0.019			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Pilgrim's Road Esker SAC (001776)	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Lough Ree SPA	IE_SH_26G060300 Glassan	RWB	*Moderate*	*0.046*	*0.051*	*5.3*	*0.0007*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
(004064)	Stream_010								preventing the achievement of WFD objectives.
	IE_SH_26S021660 Shannon (Upper)_110	RWB	*Poor*	*0.077*	*0.087*	*28.9*	*0.0000*	*0.077*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021800 Shannon (Upper)_120	RWB Multiple monitoring points	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.012	0.019			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.016	0.019			0.016	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.013	0.019			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100100 Breensford_010	RWB	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100400 Breensford_020	RWB	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_014 Athlone West	GWB	*Good*	*0.018*	*0.026*	*5.1*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
									preventing the achievement of WFD objectives.
	IE_SH_G_091 Funshinagh	GWB Multiple monitoring points	Good Upwards Far	*0.023*	0.026	0.2	0.0000	0.023	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	*0.007*	0.026			0.007	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			Good Upwards Far	*0.020*	0.026			0.020	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_246 Athlone Gravels	GWB	*Good*	*0.018*	*0.026*	*10.2*	*0.0010*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Middle Shannon Callows SPA (004096)	IE_SH_26G060300 Glassan Stream_010	RWB	*Moderate*	*0.046*	*0.051*	*5.3*	*0.0007*	*0.046*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021660 Shannon (Upper)_110	RWB	*Poor*	*0.077*	*0.087*	*28.9*	*0.0000*	*0.077*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26S021800 Shannon	RWB Multiple	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
	(Upper)_120	monitoring points							WFD objectives.
			High Far	0.012	0.019			0.012	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.016	0.019			0.016	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
			High Far	0.013	0.019			0.013	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26C460200 Cloonbonny Stream_010	RWB	High Near	0.022	0.019	4.1	0.0008	0.023	The post dosing conc. exceeds the 75% upper indicative quality threshold; however this is due to the baseline ortho P conc. The modelled additional conc. is insignificant (0.0008mg/l) therefore there is no risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100100 Breensford_010	RWB	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_26B100400 Breensford_020	RWB	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of

Site Name (Code)	Contributing WB Code_Name	WB Type[14]	Ortho P Indicative Quality[15] and Trends[16]	Baseline[17] Ortho P Conc.[18] (mg/l)	75% of Indicative Quality Upper Threshold (mg/l)	Total Ortho P load to SW from Leakage, DWWTS & Agglom. (kg/yr)	Modelled Increase in Conc.[19] (mg/l)	Post-dosing Ortho P Potential Baseline Conc. (mg/l)[20]	Evaluation
									WFD objectives.
	IE_SH_G_014 Athlone West	GWB	*Good*	*0.018*	*0.026*	*5.1*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.
Mongan Bog SPA (004017)	IE_SH_G_110 Inny	GWB	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

‡ Load from WWTP / SWO following treatment added
*Trends are statistically significant
NB: Cumulative load assessment using 2014 baseline data has confirmed that the water bodies are not at Risk of failing WFD Objectives.

The assessment of discharges from the wastewater collection system and WWTPs and the loading from leakage and DWWTSs to lakes is based on the Vollenweider equation. This is an empirical equation which aims to predict the critical total P loading to a lake where eutrophic conditions can occur. It is calculated based on area, mean depth, and hydraulic outflow of lake (Vollenweider, 1968[21]) (see **Table 5-3**). The assessment indicates that the critical loading is being exceeded under the existing situation, however the existing orthophosphate levels in the Lough are indicative of good status and the increase in the critical loading is less than 0.1%. This increase is not considered to be significant and will not result in any further impact on the lake ecology which is already at moderate status due to macrophyte conditions.

Table 5-3: Vollenweider assessment of lakes within the WSZs

Site Name (Code)	ContributingWB Code_Name	TP Indicative Quality and Trends[22]	Baseline[23] Ortho P Conc.[24] (mg/l)	TP Total Dosing Load (kg/yr)	Est. Existing Areal Loading Based on Vollenveider (mg/m^2/yr)	Est. Post Dosing Areal Loading Based on Vollenveide (mg/m^2/yr)	Lc – Critical Load (mg/m2/yr)	Evaluation
Lough Ree SAC (000440)	IE_SH_26_750 Lough Ree Combined	Good Upwards Far	0.021	34.1	576.3	576.6	405	0.06%
River Shannon Callows SAC (000216)								
Lough Ree SPA (004064)								
Middle Shannon Callows SPA (004096)								

[21] Vollenweider, R. A. (1968) *Scientific fundamentals of stream and lake eutrophication with particular reference to nitrogen and phosphorus*. OECD Technical Report DAF/DST/88. Organisation of Economic Cooperation and Development, Paris.
[22] Distance to Threshold. Surrogate Status in *italic*
[23] Baseline year is 2011.
[24] Surrogate concentrations given in italic

5.3.3 Assessment of direct impacts from WWTPs and Storm Water Overflows

The conceptual model developed for P transfer identifies a number of pathways by which orthophosphate can reach receptors. In the case of these pathways, factors contributing to the environmental risk are:

- the quantitative increase in P loading to wastewater collecting systems;
- the efficiency of P removal at WWTPs;
- the increased P loading to surface waters via storm water overflows; and
- the sensitivity of receptors.

For the purposes of assessing the potential impact on the receiving environment a number of scenarios have been assessed at the agglomerations which receive water from the WSZ (**Table 5-4**). The existing baseline prior to orthophosphate dosing is established and compared to the potential impact on the receiving waters post-dosing. In-combination effects of the operation of the SWO and the continuous discharge from the WWTP were also assessed.

The pre-dosing scenario is based on a mass balance calculation of both the intermittent SWO discharges, in combination with the continuous discharge from the WWTP. A comparison of the pre- and post-dosing scenarios is made to identify changes in predicted concentrations downstream of the point of discharge. A summary of the results and evaluation of orthophosphate dosing downstream of each agglomeration is provided below.

Table 5-4 provides the data used for the WWTP continuous discharge, and the SWO intermittent discharge, to compare with the emission limit values (ELVs) from the waste water discharge licence (WWDL) (if it has been set) that are applicable to the agglomeration discharge to transitional waters or freshwaters. The resultant concentration in the waters downstream of the discharge point from the agglomerations is provided in **Table 5-5**, assuming mean flows.

The quantification of loads in a mass balance calculation was carried out using the standardised approach developed in the EAM which was devised using national data sets and applying a series of conservative and robust assumptions. The model was prepared in discussion with and utilises data supplied by the EPA, NPWS and the DHPLG to ensure that a robust model simulation is provided.

Table 5-4: Increased loading/concentration due to orthophosphate dosing – dosing rate = 0.8 mg/l

Agglom. and Discharge Type	ELV from WWDL (mg/l)	Scenario	TP Load Kg/Yr	Ortho P Concentration (mg/l) TP – Ortho P *conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	***0.4***	***0.68***
Athlone Primary Discharge	2 mg/l (TP) Compliant with ELV in the 2017 AER	**Existing**	1464.4	0.217	0.173	0.295
		Post Dosing	1464.4	0.217	0.173	0.295
Athlone SWOs (19 no.)	N/A	**Existing**	250.9	1.274	1.019	1.732
		Post Dosing	286.5	1.455	1.164	1.978

Table 5-5: Mass balance assessment based on 0.8 mg/l dosing using available background concentrations and mean flow information.

Agglom.	RWB Name / Code for Primary Discharge	Background Conc. (mg/l)[25]	Modelled conc. Existing (mg/l)	Modelled conc. Post Dosing (mg/l)	% Inc.
Athlone (D0007-01)	IE_SH_26_1448 Shannon (Upper)_120	0.0302	0.0305	0.0305	0.02%

Athlone Agglomeration

Athlone agglomeration receives tertiary treatment i.e. chemical dosing for orthophosphate removal, tertiary treatment is assumed to remove any additional load in the effluent due to orthophosphate dosing and is discharged into the Shannon (Upper)_120 (IE_SH_26_1448). This water body is hydrologically connected to Lough Ree SAC and SPA; River Shannon Callows SAC and Middle Shannon Callows SPA. The AER for the WWTP indicates the plant was compliant with ELV for TP in 2017 and the post-dosing orthophosphate concentration in the effluent is predicted to be compliant with the ELVs set by the WWDL. When mean flows are taken into account the increase in the receiving water is negligible (0.02%) **Table 5-5**. Therefore, there is no risk of failing to achieve WFD objectives for the Shannon (Upper)_120 (IE_SH_26_1448)., and its hydrologically connected European Sites as a result of dosing at Athlone WTP.

5.3.4 Assessment of indirect impact from subsurface flow

5.3.4.1 Sub surface flows from leakage and DWWTP

Step 4 the EAM model assesses the distributed inputs to river water bodies from sub-surface pathways. The modelled additional concentrations in the subsurface pathways are insignificant for all river water bodies (i.e. less than 0.00125 mg/l, which is 5% of the Good / High indicative quality boundary for surface water bodies), with the highest increase modelled as 0.0009 mg/l in Breensford_020 (IE_SH_26B100400).

[25] Annual mean from AER upstream monitoring point

Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds 75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l).

There are no transitional or coastal water bodies directly affected by this WSZ.

5.3.4.2 Groundwater Assessment

Table 3 of the EAM model illustrates the increased loadings and concentrations in groundwater bodies following dosing at Athlone WTP. The predicted loads to groundwater bodies are very low. Athlone West (IE_SH_G_014) and Inny (IE_SH_G_1100) have an additional concentration of 0.0003 mg/l. Athlone Gravels (IE_SH_G_246) has a additional concentration of 0.0010 mg/l while the concentration in Funshinagh (IE SH_G_091) is undetectable at 0.0000 mg/l. There is a statistically significant upward trend in the orthophosphate status of Funshinagh (IE SH_G_091). However, the the additional concentration is less than 5% of the Good / Fail boundary and the overlying surface water bodies are not at risk of failing WFD objectives for orthophosphate.

Therefore, there is no risk of deterioration in the orthophosphate indicative quality or of preventing the achievement of WFD objectives within the hydrogeologically connected groundwater bodies due to orthophosphate dosing as indicated in **Table 3, Appendix C**.

5.3.5 Combined Assessment

Table 4a of the EAM provides details of the combined orthophosphate inputs to river water bodies from direct discharges, DWWTSs and leakage. In the river water bodies Boor_020 (IE_SH_26B071200), Dungolman_020 (IE_SH_26D060200), Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800), the modelled additional concentrations are undetectable (i.e. 0.0000 mg/l). In Breensford_010 (IE_SH_26B100100) (0.0002 mg/l), Breensford_020 (IE_SH_26B100400) (0.0009 mg/l), Cloonbonny Stream_010 (IE_SH_26C460200) (0.0008 mg/l) and Glassan Stream_010 (IE_SH_26G060300) (0.0007 mg/l), the predicted post-dosing concentrations are deemed insignificant and are within 5% of the Good / High boundary (<0.00125 mg/l).

Table 4b of the EAM provides details of the combined orthophosphate inputs to the lake water bodies. There are three lake water bodies directly affected by this WTP. The lake water bodies are all part of the wider Lough Ree Lake complex and a Vollenweider assessment of the additional loading has been undertaken for the combined lake areas based on the outflows from Lough Ree and the sum of all loading to each of the individual lake water bodies, i.e. Lough Ree (IE_SH_26_750a), Lough Killinure (IE_SH_26_750b) and Ballaghkeeran Lough (IE_SH_26_750d).

The Vollenweider assessment indicates that the critical loading of the lake is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake are indicative of good status and the increase in the critical loading due to dosing at Athlone WTP is 0.06%. This increase is not considered to be significant and will not result in any further impact on the lake ecology which is already at moderate status due to macrophyte conditions.

There are no transitional or coastal water bodies directly affected by this WTP.

5.3.6 Assessment of cumulative impacts from other WSZs

The cumulative loads to the Shannon catchment (HAs 24,25,26 & 27) associated with the orthophosphate dosing have been assessed with the Athlone WSS WSZ. The common water bodies that are impacted by the WSZs supplied by these WTPs have been summarised in **Table 5-6** and **Table 5-7** below.

- 005 Clareville WTP – Limerick City Water Supply
- 012 Tuam WTP – Tuam RWSS
- 013 Portloman WTP – Ardonagh Reservoir
- 017 Drumcliffe WTP - Ennis PWS
- 019 New Doolough WTP - W.Clare RWS (New WTP)
- 020 Castle Lake WTP - Shannon/Sixmilebridge RWSS
- 021 Rossadrehid WTP – Galtee Regional
- 034 Lough Forbes WTP – Longford Central
- 040 Coolbawn – Nenagh RWSS
- 049 Ballany WTP – Ballany High Level Reservoir
- 058 Ballinasloe Town WTP - Ballinasloe Public Supply
- 068 Rockingham WTP - Boyle Regional WSS
- 081 Ballinagard Springs WTP - Roscommon Central Water Supply Scheme
- 128 Longford Springs WTP Future Supply - Castlerea WSS
- 140 Lisbrock WTP - SRRWSS Lisbrock
- 161 Freemount WTP – Zone 4 Allow Regional
- 178 Clavin's Bridge WTP – Kells/Oldcastle WS
- 184 Foileen WTP - CappamoreFoileen Water Supply
- 185 Ballinlough/ Loughglynn (Ballybane Springs) - Ballinlough/Loughglynn
- 190 Ironmills Pump Station - Ironmills
- 216 Kylebeg WTP – Borrisokane
- 237 Killadysert WTP - Killadysert PWS
- 238 Williamstown WTP - Williamstown PS3
- 246 Ballingarry Spring WTP - Ballingarry Water Supply
- 260 Kilcolman PS - Rathkeale Water Supply
- 267 Cloughjordan Pump Station – Cloughjordan
- 321 Ahascragh WTP - Ahascragh P.S.
- 355 Croom Bypass Pump Station - Croom Water Supply

The baseline concentration for the transitional waterbody; Upper Shannon Estuary (IE_SH_060_0800) (Summer) is above 75% of the upper orthophosphate indicative quality threshold. The modelled post dosing concentration is insignificant (0.0010mg/l) and will not cause a deterioration in the orthophosphate indicative quality of the water bodies or prevent their achievement of WFD objectives.

The modelled cumulative additional increase to the remaining receiving waters is also not significant given that predicted increased in orthophosphate as a result of dosing are all <5% of the Good / High indicative quality boundary i.e. 0.00125mg/l for the rivers and 0.9% increase for the lake and will not cause a deterioration in the orthophosphate indicative quality or prevent the achievement of the WFD objectives of the water bodies.

Table 5-6: Cumulative assessment of the increased loading and concentrations to receiving water bodies common to WSZs within the Shannon catchment where orthophosphate dosing is proposed.

NAME / EU_CD	WB Type/Period	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline Year 2014 and Conc. Surrogate Conc given in *italic* mg/l	75% of Ortho P Indicative Quality Upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Modelled increase in Conc. Using Flows (30%ile tidal or gauged) mg/l	PO4 Potential Baseline Conc. following dosing mg/l
IE_SH_26S021660 Shannon (Upper)_110	RWB	*Poor*	*0.077*	*0.087*	47.5	0.0000	0.077
IE_SH_26S021800 Shannon (Upper)_120	RWB Multiple monitoring points	High Upwards Far	0.012	0.019	611.7	0.0002	0.012
		High Far	0.012	0.019			0.012
		High Far	0.016	0.019			0.016
		High Far	0.013	0.019			0.013
IE_SH_26S021920 Shannon (Upper)_130	RWB	*Moderate*	*0.046*	*0.051*	*891.5*	*0.0003*	0.046
Shannon (Lower)_010 IE_SH_25S012000	RWB	High	0.011	0.019	1021.2	0.0002	0.012
Shannon (Lower)_020 IE_SH_25S012000	RWB	*High*	*0.015*	*0.019*	*1029.7*	*0.0002*	*0.015*
IE_SH_25S012350 Shannon (Lower)_030	RWB Multiple monitoring points	High	0.011	0.019	1040.8	0.0002	0.008
		High	0.011	0.019			0.009
		High	0.011	0.019			0.009
		High	0.011	0.019			0.007
		High	0.011	0.019			0.007
		High	0.011	0.019			0.008
		High	0.011	0.019			0.006
		High	0.011	0.019			0.007
		High	0.011	0.019			0.008

NAME / EU_CD	WB Type/Period	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline Year 2014 and Conc. Surrogate Conc given in *italic* mg/l	75% of Ortho P Indicative Quality Upper threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Modelled increase in Conc. Using Flows (30%ile tidal or gauged) mg/l	PO4 Potential Baseline Conc. following dosing mg/l
		High	0.011	0.019			0.008
		High	0.011	0.019			0.009
IE_SH_25S012500 Shannon (Lower)_050	RWB	High	0.012	0.019	1283.8	0.0002	0.012
IE_SH_25SO12600 Shannon Lower_060	RWB	High	0.013	0.019	2023.7	0.0003	0.021
		High	0.018	0.019			0.017
		Good	0.030	0.019			0.014
		High	0.014	0.019			0.010
		High	0.010	0.019			0.02
Limerick Dock IE_SH_060 _0900	TWB Summer	High (S) Far	0.008	0.019	7516.7	0.0010	0.008
	TWB Winter	High (W) Far	0.012	0.019			0.012
Upper Shannon Estuary IE_SH_060_ 0800	TWB Summer	High (S) Near	0.020	0.019	8848.1	0.0010	0.020
	TWB Winter	High (W) Near	0.011	0.019			0.011
Lower Shannon Estuary IE_SH_060_0300	TWB Summer	High (S) Far	0.012	0.020	12412.9	0.0002	0.012
	TWB Winter	Good (W) Far	0.025	0.036			0.025
Mouth of River Shannon IE_SH_060 _000	CWB Summer	High	0.008	0.019	13317.6	0.0001	0.008
	CWB Winter	*Good*	*0.030*	*0.040*			*0.033*

‡ Load from WWTP / SWO following treatment added

Table 5-7: Vollenweider assessment of cumulative load to Lakes within the WSZs

EU Code_ Name	Parameter	TP Indicative Quality and Trends (Distance to Threshold. Surrogate Indicative Quality in *italic*	Baseline 2014 Conc. Surrogate Conc. given in *italic* mg/l	TP Total Dosing Load (kg/yr)	EEstimated Existing Areal loading based on Vollenweider mg/m2/yr)	Estimated Post dosing Areal loading based on Vollenweider(mg/m 2/yr)	Lc (mg/m²/yr)	%Increase
IE_SH_26_7 50 Lough Ree (Combined)	TP	Good Upwards Far	0.021	34.1	576.3	576.6	405	0.06%

Conclusions

The modelled increased orthophosphate dosing concentrations do not result in a noticeable effect with orthophosphate concentrations in the receiving Shannon (Upper)_120 (IE_SH_26_1448) as fraction of 0.2%, as shown by the mass balance assessment in **Table 2 Appendix C**.

The modelled concentrations due to subsurface pathways are insignificant in all river water bodies, i.e. < 0.00125 mg/l (5% of the High / Good indicative quality boundary for surface water bodies). Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds 75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l).

The modelled increase in orthophosphate concentrations in groundwater bodies is less than 5% of the Good / Fail boundary in all cases. There is a statistically significant upward trend in the orthophosphate status of Funshinagh (IE SH_G_091). However, as the additional concentration is less than 5% of the Good / High boundary.

The predicted increase in orthophosphate concentration in river water bodies from direct discharges, DWWTSs and leakage is less than 5% of the Good / High boundary (0.00125 mg/l) in all cases.

The predicted increase in orthophosphate concentration in the lake water body from combined orthophosphate inputs is 0.06%. This increase is not considered to be significant and will not result in any further impact on the lake ecology which is already at moderate status (due to macrophyte conditions).

The cumulative assessment of dosing at Athlone WTP together with other WTPs which may be subject to dosing in the same catchments, has demonstrated that there will not be a significant effect on receiving water bodies. These WTPs are also subject to their own Screening for AA.

Therefore, there is no risk of deterioration in the orthophosphate indicative quality of the water bodies as a result of the proposed project and the dosing will not prevent the achievement of the WFD objectives for these water bodies.

6 EVALUATION OF LIKELY SIGNIFICANT EFFECTS

6.1 CONSTRUCTION PHASE

There are no surface water bodies within the confines of Athlone RWSS WTP. However, the footprint of the WTP adjoins the Shannon River (Shannon (Upper) _120; IE_SH_26S021800), with a distance of separation of approximately 15m. The Shannon River flows west of the WTP site downstream to the River Shannon Callows SAC, Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA, Middle Shannon Callows SPA, River Suck Callows SPA until it reaches Lough Derg, North-East Shore SAC and Lough Derg (Shannon) SPA *c.a.* 90km downstream. The proposed construction works will be localised and contained to the immediate development area which supports amenity grassland / buildings and artificial surfaces. Works such as excavations will be contained to the defined working area and necessary works with cast in place concrete will be undertaken within sealed shuttered units. Such works practices will retain all potential construction related pollutants at source.

The WTP overlies the Inny groundwater body (IE_SH_G_110), a sizeable groundwater body which crosses four counties: Co. Offaly, Co. Westmeath, Co. Longford and Co. Cavan. It intersects 20 European Sites: River Shannon Callows SAC, Lough Ree SAC, Pilgrim's Road Esker SAC, Crosswood Bog SAC, Moneybeg and Clareisland Bogs SAC, Carn Park Bog SAC, Ardaguillion Bog SAC, Garriskil Bog SAC, Derragh Bog SAC, Mongan Bog SAC, Mongan Bog SPA, Lough Derravaragh SPA, Glen Lough SPA, Lough Iron SPA, Lough Kinale and Derragh Lough SPA, Lough Ree SPA, Lough Sheelin SPA, Middle Shannon Callows SPA. River Suck Callows SPA and Garriskil Bog SPA. Potential source impact pathways have been ruled out for all 20 European Sites overlying the Inny groundwater body in **Table 4-1** above.

Therefore, it can be concluded on the basis of objective scientific information that the construction of the corrective water treatment works at Athlone WTP, individually or in combination with other plans or projects, will not have a significant effect on European Sites.

6.2 OPERATIONAL PHASE

The key pressure associated with the proposed orthophosphate dosing is the potential for increased orthophosphate levels in the receiving waters which support the qualifying interests (habitats and species) identified in **Table 4-3** that are both water dependent and nutrient sensitive (**Appendix B**). The likelihood of significant effects on these habitats and species, in view of their conservation objectives, are assessed in detail below.

6.2.1 River Shannon Callows SAC 000216

6.2.1.1 (6410) *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) and (6510) Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)

The River Shannon Callows SAC is mainly comprised of lowland wet grassland. Different plant communities occur depending on elevation, and therefore flooding patterns. Two habitats listed on Annex I of the Habitats Directive are well-represented within the site; *Molinia* meadows and lowland hay meadows (NPWS, 2013[26]). Both habitats are considered semi-natural grassland. *Molinia* meadows represent wet meadows and pasture communities on clay, loam and humus-rich gley soils that are generally not fertilised (Martin *et al*., 2007[27]). They are characterised by the presence of the Meadow Thistle (*Cirsium dissectum*) and Purple Moor-grass (*Molinia caerulea*) (NPWS, 2013). Lowland hay meadows are species-rich hay meadows on moderately fertile soils of river and tributary floodplains. Typical species of this habitat include Meadow Fescue (*Festuca pratensis*), Rough Meadow-grass (*Poa trivialis*), Downy Oat-grass (*Avenula pubescens*), Common Knapweed (*Centaurea nigra*), Ribwort Plantain (*Plantago lanceolata*) and Common Sorrel (*Rumex acetosa*). In places these two habitats grade into one another (NPWS, 2013[26]).

The SSCOs published for this SAC (NPWS 2022[28]) do not have water quality or nutrient specific targets for these habitats. Semi-natural grasslands are an extremely vulnerable habitat in Ireland. Areas of semi-natural grassland that are accessible to machinery are particularly vulnerable to agricultural improvement. They are nutrient sensitive with the addition of fertiliser to semi-natural grasslands resulting in a change of sward composition and a loss of plant species diversity (Martin *et al*., 2007). While the conservation designation of these areas of callow grassland aids their conservation, it is the regular flooding of callow grasslands that has protected these habitats from pressures such as commercial development in the past, and will continue to contribute to their protection in the future (Martin *et al*., 2007).

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to River Shannon Callows SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Breensford_010 (IE_SH_26B100100), Breensford_020 (IE_SH_26B100400), Cloonbonny Stream_010

[26] PWS 2013 River Shannon Calllows SAC 0002165 Site Synopsis
[27] Martin, J.R., Gabbett, M., Perrin, P.M., Delaney, A. (2007). Semi-natural grassland survey of Counties Roscommon and Offaly.
[28] NPWS 2022 River Shannon Callows SAC 000216 Conservation Objectives

(IE_SH_26C460200), Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800);

- The lake water body includes: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d); and
- The groundwater bodies include: Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110).

The habitats *Molinia* meadows and lowland hay meadows are located downstream of the WSZ and adjacent to the river water body Shannon (Upper)_120 (IE_SH_26S021800). This river water body receives inputs from all water bodies identified in **Table 5-2** as hydrologically or hydrogeologically connected to the SAC. *Molinia* meadows are also a groundwater dependent terrestrial ecosystem (GWDTE) and have low to moderate sensitivity to changes in groundwater quantity and quality[29].

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flow data. Full details of the assessment are provided in **Appendix C**.

The modelled increase in orthophosphate concentration in the river water bodies: Glassan Stream_010 (IE_SH_26G060300) (0.0007 mg/l); Breensford_010 (IE_SH_26B100100) (0.0002 mg/l); Breensford_020 (IE_SH_26B100400) (0.0009 mg/l); Cloonbonny Stream_010 (IE_SH_26C460200) (0.0008 mg/l) due to dosing are within 5% of the Good / High boundary (0.00125 mg/l). In the Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800), post-dosing concentrations are undetectable i.e. 0.0000 mg/l. Therefore, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**). Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds 75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l). Therefore, No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good status (due to macrophyte conditions).

The modelled increase in orthophosphate concentration in the groundwater bodies in Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110) is low, 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary (0.00175 mg/l) there is no risk of deterioration in the Good indicative quality of the groundwater bodies. In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of the habitat.

[29] Working Group on Groundwater (2005). WFD Pressures and Impacts Assessment Methodology - Guidance on the Application of Groundwater Risk Assessment Sheets SWRA 1-6 and GWDTERA 1-9 to Areas Designated for the Protection of Habitats and Species. Guidance Document no. GW11.

6.2.1.2 (91E0) Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*

Alluvial forest is a priority habitat and a qualifying interest in the River Shannon Callows SAC. There are no SSCOs published for this SAC (NPWS 2018[28]). A search of other SACs containing this habitat showed there is no water quality or nutrient specific target for this habitat. There is a target to maintain the appropriate hydrological regime necessary for maintenance of alluvial vegetation. Periodic flooding is essential to maintain alluvial woodlands along river floodplains. The supporting document for woodlands in the Lower Shannon SAC (NPWS 2012[30]) located downstream of the River Shannon Callows SAC, lists potential threats to this habitat type including an indirect threat from agriculture through fertiliser drift and water pollution, which may increase the trophic status of the wood leading to the stronger growth of nitrophilous species and loss of less vigorous species. However, as these are naturally eutrophic systems the impact is likely to be minimal. In addition, discharge of sewage effluent and slurry will pollute the water and have an indirect impact on the woodlands.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to River Shannon Callows SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Breensford_010 (IE_SH_26B100100), Breensford_020 (IE_SH_26B100400), Cloonbonny Stream_010 (IE_SH_26C460200), Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800);
- The lake water body includes: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d); and
- The groundwater bodies include: Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110).

Alluvial forest in the River Shannon Callows SAC, occurs on a series of alluvial islands just below the ESB weir near Meelick. Several of the islands are dominated by well-grown woodland consisting mainly of Ash (*Fraxinus excelsior*) and Willows (*Salix* spp.). The islands are prone to regular flooding from the river (NPWS, 2013[26]). The habitat is located downstream of the WSZ and the water bodies identified in **Table 5-2**.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled increase in orthophosphate concentration in the river water bodies: Glassan Stream_010 (IE_SH_26G060300) (0.0007 mg/l); Breensford_010 (IE_SH_26B100100) (0.0002 mg/l); Breensford_020 (IE_SH_26B100400) (0.0009 mg/l); Cloonbonny Stream_010 (IE_SH_26C460200) (0.0008 mg/l) due to dosing are within 5% of the Good / High boundary (0.00125 mg/l). In the Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800), post-dosing concentrations are undetectable i.e. 0.0000 mg/l. Therefore, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**). Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds

[30] NPWS 2012 Lower River Shannon SAC 002165 Supporting Document -Woodland Habitat

75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l). Therefore, No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality (due to macrophyte conditions).

The modelled increase in orthophosphate concentration in the groundwater bodies in Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110) is low, i.e. 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary (0.00175 mg/l) there is no risk of deterioration in the Good indicative quality of the groundwater bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of the habitat.

6.2.1.3 (1355) Otter (*Lutra lutra*)

The River Shannon Callows is a long and diverse site which consists of seasonally flooded, semi-natural, lowland wet grassland, along and beside the river between the towns of Athlone and Portumna. It is approximately 50 km long and averages about 0.75 km wide (reaching 1.5 km wide in places). There are no SSCOs published for this SAC (NPWS 2018[28]). A search of other SACs containing this species show there are no water quality or nutrient specific targets; however, there is a target to ensure that there should be no significant decline in fish biomass (NPWS, 2012[31]). The National Parks and Wildlife Service's Threat Response Plan for the Otter (NPWS 2009[32]), categorized three principal risks to otters: i) habitat destruction and degradation; ii) water pollution; and, iii) accidental death and/or persecution. Water pollution may influence otters either indirectly or directly. Indirect effects include damage to food supply or habitat thus lowering the carrying capacity of an affected area. Direct effects impact the animal itself, resulting in either rapid death (acute toxicity) or in lowered fitness (sub-lethal toxicity), reducing the animal's ability to reproduce successfully or to survive in inclement conditions. The diet of the species varies locally and seasonally; however, it is dominated by fish, in particular salmonids, eels and sticklebacks in freshwater and crayfish locally. Poorly treated effluents can wipe out fish populations for long distances downstream of the discharge, making otherwise ideal habitat unsuitable for otter.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to River Shannon Callows SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

[31] NPWS 2012 Lower River Shannon SAC 002165 Conservation Objectives
[32] NPWS 2009 Threat Response Plan: Otter Lutra lutra 2009-2011

- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Breensford_010 (IE_SH_26B100100), Breensford_020 (IE_SH_26B100400), Cloonbonny Stream_010 (IE_SH_26C460200), Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800);
- The lake water body includes: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d); and
- The groundwater bodies include: Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110).

The extent of otter habitat in the River Shannon Callows SAC has not been defined (NPWS 2018[28]). A review of the extent of otter habitat in the Lower River Shannon SAC (located downstream of River Shannon Callows SAC) defines the extent of the terrestrial habitat as 10m along the shoreline (above the high water mark (HWM) and along river banks) and the extent of the freshwater habitat as the river length, on the basis that otters use freshwater habitats from estuary to headwaters. Taking a precautionary approach, potential impacts to otter are assessed on the basis that they will interact with all water bodies identified in **Table 5-2** as hydrologically connected to the River Shannon Callows SAC. The groundwater bodies Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110) are assessed as they drain to Shannon (Upper)_120 (IE_SH_26S021800) and Lough Ree (Combined) (IE_SH_26_750) respectively located upstream of the SAC and therefore represent a potential source of orthophosphate from dosing.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled increase in orthophosphate concentration in the river water bodies: Glassan Stream_010 (IE_SH_26G060300) (0.0007 mg/l); Breensford_010 (IE_SH_26B100100) (0.0002 mg/l); Breensford_020 (IE_SH_26B100400) (0.0009 mg/l); Cloonbonny Stream_010 (IE_SH_26C460200) (0.0008 mg/l) due to dosing are within 5% of the Good / High boundary (0.00125 mg/l). In the Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800), post-dosing concentrations are undetectable i.e. 0.0000 mg/l. Therefore, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**). Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds 75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l). Therefore, No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality (due to macrophyte conditions).

The modelled increase in orthophosphate concentration in the groundwater bodies in Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110) is low, i.e. 0.0003 mg/l. As this concentration is within 5% of

the Good / Fail boundary (0.00175 mg/l) there is no risk of deterioration in the Good indicative quality of the groundwater bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on fish species, the main food source for the otter, can be excluded. Furthermore, dosing will not prevent the maintenance or restoration of its favourable conservation condition.

6.2.2 Lough Ree SAC 000440

6.2.2.1 (3150) Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation

Lough Ree is the third largest lake in Ireland and is situated in an ice-deepened depression in Carboniferous limestone on the River Shannon system between Lanesborough and Athlone. The site spans Counties Longford, Roscommon and Westmeath. Some of its features (including the islands) are based on glacial drift. It has a very long, indented shoreline and hence has many sheltered bays. Although the main habitat, by area, is the lake itself, interesting shoreline, terrestrial and semi aquatic habitats also occur. The lake has been classified as mesotrophic in quality, but the size of the system means that a range of conditions prevail depending upon, for example, rock type. This gives rise to local variations in nutrient status and pH, which in turn results in variations in the phytoplankton and macrophyte flora. Therefore species indicative of oligotrophic, mesotrophic, eutrophic and base-rich situations occur. The water of Lough Ree tends to be strongly peat-stained, restricting macrophytes to depths of less than 2 m, and as a consequence, macrophytes are restricted to sheltered bays, where a typical Shannon flora occurs. Species present include Intermediate Bladderwort (*Utricularia intermedia*), pondweeds (Potamogeton spp.), Quillwort (*Isoetes lacustris*), Greater Duckweed (*Spirodela polyrhiza*), stoneworts (Chara spp., including *C. pedunculata*) and Arrowhead (*Sagittaria sagittifolia*). The latter is a scarce species which is almost confined in its occurrence to the Shannon Basin (NPWS, 2016[33]).

The SSCO (NPWS, 2016[34]) for the site includes a nutrient specific attribute and target. The target is to maintain the concentration of nutrients in the water column at sufficiently low levels to support the habitat and its typical species. As a relatively productive habitat, mesotrophic and WFD 'good' status (or better) targets apply. Where a lake has nutrient concentrations that are lower than these targets, there should be no decline within class, i.e. no upward trend in nutrient concentrations. For this habitat, the annual average total phosphorus (TP) concentration should be ≤20 µg/l TP. Average annual total ammonia concentrations should be ≤ 0.065 mg/l N and annual 95th percentile for total ammonia should be ≤0.140 mg/l N. Lough Ree had 33 µg/l TP in 1980/1981 and 47 µg/l in 1993/1994, but had good nutrient condition in 2007-2009 and 2010-2012.

According to O'Connor (2015[35]), water quality is a key driver of lake ecology. Lakes have also been significantly impacted by anthropogenic activities, and eutrophication of freshwaters is one of the most significant environmental challenges globally. Annex I lake habitats are typically associated with high water quality and the absence of eutrophication impacts. This is demonstrated by naturally low dissolved nutrients, clear water and low algal growth. Nutrients are released to water from lands

[33] NPWS 2016 Lough Ree SAC 000440 Site Synopsis

[34] NPWS 2016 Lough Ree SAC 000440 Conservation Objectives.

[35] O Connor, Á. (2015) Habitats Directive Annex I lake habitats: a working interpretation for the purposes of site-specific conservation objectives and Article 17 reporting. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

throughout a lake's catchment. Natural ecosystems are highly parsimonious in their use of nutrients however; maximising nutrient re-cycling and minimising losses, meaning that, under natural conditions, very small nutrient loads reach rivers and lakes from their catchments (Moss, 2008[36]). Varied and widespread land-uses have, however, significantly disrupted natural processes and increased nutrient losses to water. Agriculture is the greatest exporter of phosphorus to surface waters in Ireland, followed by sewage discharges. Other important exporters of nutrients are industry, septic tanks (DWWTS) and forestry (O'Connor, 2015).

Nutrient enrichment in lentic environments increases primary production in phytoplankton, benthic, epiphytic and epipelic algae and in vascular plants (macrophytes). All of these can compete with the characteristic communities and species of the Annex I lake habitats for the available resources; notably light, carbon dioxide, nutrients and space/substratum. Charophytes, other algal species and communities and annual species, such as *Najas flexilis*, are particularly vulnerable; as well as most species/communities adapted to low productivity environments. Species and communities of the lower levels of the euphotic zone are often the most vulnerable to eutrophication. Enrichment of the sediment, as well as of the water column, is a significant concern (O'Connor, 2015).

The OECD fixed boundary system for lakes has been a model for assessing lake water quality since its development (OECD, 1982). It uses total phosphorus (TP), chlorophyll *a* and transparency (Secchi disk depth) to assess eutrophication impacts. Phosphorus is generally considered to be the limiting nutrient in freshwaters; hence TP concentration is the chosen indicator for nutrient enrichment. Chlorophyll *a* is a measure of phytoplankton biomass, while Secchi disk depth is an indicator of the reduction in transparency and shading caused by phytoplankton. Lakes are categorised, from lowest to highest productivity, as ultra-oligotrophic, oligotrophic, mesotrophic, eutrophic and hyper-eutrophic (O'Connor, 2015[35]).

O'Connor (2015[35]) suggests a target of 'good status' or better, is used for the rich pondweed lake habitat 3150; however, habitat sub-types with a range of variation in requirements may be identified over time. It is possible that some sub-types are tolerant of a degree of eutrophication, whilst others may require conditions that are close to the 'high-good' boundary. The specific targets for nutrient concentration vary among habitats and habitat sub-types. The target for rich pondweed lake habitat 3150 is at least mesotrophic or good status. These should be taken as indicative targets only and considerable among-site variability is likely. A precautionary approach must be adopted in setting lake-specific targets. There should be no decline within class, i.e. no upward trend in nutrient concentrations. No WFD standards have yet been set for total phosphorus in Irish lakes.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and

[36] Moss, B. (2008) The kingdom of the shore: achievement of good ecological potential in reservoirs. *Freshwater Reviews* 1 (1): 29-42.

- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

All three lake water bodies hydrologically connected to the site are characterised as natural eutrophic lake habitats.

- Breensford_010 (IE_SH_26B100100), Breensford_020 (IE_SH_26B100400) and a section of Shannon (Upper)_110 (IE_SH_26S021660) discharge to Ballaghkeeran (IE_SH_26_750d).
- Glassan (IE_SH_26G060300) and a section of Shannon (Upper)_110 (IE_SH_26S021660) discharge to Killinure (IE_SH_26_750b).
- Shannon (Upper)_110 (IE_SH_26S021660) discharges directly into Ree (IE_SH_26_750a).
- Shannon (Upper)_120 (IE_SH_26S021800) is located downstream of the habitat and therefore poses no risk in terms of water quality impacts.
- The groundwater bodies Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246) flow to Ree (IE_SH_26_750a) and therefore have the potential to influence orthophosphate concentrations in the lake water body and its associated habitats.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High indicative quality boundary. The concentrations ranged from undetectable (0.0000 mg/l) in Shannon (Upper)_110 (IE_SH_26S021660) to 0.0002 mg/l and 0.0009 mg/l in Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400), respectively. The concentration increase in Glassan Stream_010 (IE_SH_26G060300) was 0.0007 mg/l. As all concentrations are within 5% of the Good / High indicative quality boundary, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**).

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

Of the four groundwater bodies that are hydrogeologically connected to the SAC, three support connectivity with the habitat: Funshinagh (IE_SH_G_0910, Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246). The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively and in some cases [e.g. Funshinagh (IE_SH_G_091)] undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not result in deterioration of the favourable conservation condition of the habitat.

6.2.2.2 (6210) Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)

Dry calcareous grassland occurs scattered around the lake shore. This supports typical species such as Yellow-wort (*Blackstonia perfoliata*), Carline Thistle (*Carlina vulgaris*) and Quaking-grass (*Briza media*). Orchids also feature in this habitat e.g. Bee Orchid (*Ophrys apifera*) and Common Spotted-orchid (*Dactylorhiza fuchsii*) (NPWS, 2013[33]). Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco- Brometalia*) occurs in close association with other habitats, including other grassland habitats, outcropping rock, fen, swamp, heath and scrub. The Irish semi-natural grasslands survey (ISGS) (O'Neill *et al*., 2013[37]) surveyed several sites in the SAC; however, only two of these (ISGS 259 and 2012) contained large enough discrete areas of this Annex I habitat to be mapped (0.25ha in total). There are likely to be further small areas of the habitat throughout the SAC.

Semi-natural dry grasslands are not considered water-dependent, however, they are considered nutrient sensitive. There are no nutrient specific targets for the habitat in the SSCOs for the SAC (NPWS, 2016[34]); however, there is a target that negative indicator species collectively are not more than 20% cover, with cover by an individual species not more than 10%. According to O'Neill *et al*. (2013) the presence of negative species can indicate agricultural intensification, proximity of disturbed or agricultural habitats, and damaging activities including but not limited to drainage, dumping and afforestation. Given the proximity of the habitat to the lake water body IE_SH_26_750a_Ree (i.e. along the lake shore), there is potential for the orthophosphate concentration in the lake to reach the habitat during floods.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

As described, only two locations throughout the SAC contain large enough discrete areas of this habitat to be mapped (0.25 ha in total) but there are likely to be further small areas of the habitat throughout the SAC. Therefore, on a precautionary basis, it is assumed that all surface water bodies

[37] O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland. http://www.botanicalenvironmental.com/wp-content/uploads/2014/02/IWM-78-Irish-semi-natural-grassland-survey.pdf

identified in **Table 5-2** have the potential to interact with the habitat. In addition, the groundwater bodies Funshinagh (IE_SH_G_091); Inny (IE_SH_G_110); and Athlone Gravels (IE_SH_G_246) flow to Ree (IE_SH_26_750a) and therefore have the potential to influence orthophosphate concentrations in the lake water body and its associated habitats.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High indicative quality boundary. The concentrations ranged from undetectable in Shannon (Upper)_110 (IE_SH_26S021660) to 0.0002 mg/l and 0.0009 mg/l in Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400), respectively. The concentration increase in Glassan Stream_010 (IE_SH_26G060300) was 0.0007 mg/l. As all concentrations are within 5% of the Good / High indicative quality boundary, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**).

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively] and in some cases [e.g. Funshinagh IE_SH_G_091)] undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not result in deterioration of the favourable conservation condition of the habitat.

6.2.2.3 (7120) Degraded raised bogs still capable of natural regeneration and (91D0) Bog woodland

Lough Ree SAC includes small examples of raised bog which are of interest in that they show a natural transition through wet woodland and/or swamp to lakeshore habitats. Also present are examples of degraded raised bog capable of regeneration, with the most extensive areas occurring at Clooncraff/Clonlarge, along the north-western shores of the lake. In general the vegetation of these degraded areas is dominated by typical raised bog species such as Cross-leaved Heath (*Erica tetralix*), Heather (*Calluna vulgaris*), Hare's-tail Cottongrass (*Eriophorum vaginatum*), Bog Asphodel

(*Narthecium ossifragum*) and Deergrass (*Scirpus cespitosus*). Typically the degraded bog areas have a low cover of peat-forming bog mosses (Sphagnum spp.) (NPWS, 2013[33]).

Active raised bog habitat on Clooncraff and Cloonlarge Bogs is estimated as 5.9ha in area in 2003. Area of degraded raised bog on the high bog has been modelled as 44.7ha. It is estimated that this entire area is potentially restorable to active raised bog by drain blocking. The total potential active raised bog on the high bog is therefore estimated to be 50.6ha. Ecohydrological assessments of the cutover estimates that an additional 19.5ha of bog forming habitats could be restored. The long term target for active raised bog is therefore 70.1ha (NPWS, 2016[34]).

Associated with the extensive raised bog system at Clooncraff/Clonlarge are areas of bog woodland. At least two small areas of woodland occur on the raised bog domes. However it would appear that this habitat is in the early stages of development. The largest area is dominated by low trees of Downy Birch and Lodgepole Pine (*Pinus contorta*). Occasional trees of Scots Pine (*Pinus sylvestris*) also occur. The ground layer is wet and quaking with a lush carpet of mosses present, including various species of *Sphagnum, Pleurozium schreberi* and *Aulocomium palustre*. The main vascular plant species in the ground flora are Bog-rosemary (Andromeda polifolia), Cranberry (*Vaccinium oxycoccos*), Bog-myrtle (*Vaccinium myrtillus*), Hare's-tail Cottongrass and Deergrass. Bog woodland is of particular conservation importance and is listed with priority status on the E.U. Habitats Directive.

At St. John's Wood located on the western shore of Lough Ree, there is an interesting area of woodland that grows on cut-away peat. This is dominated by Downy Birch and Alder Buckthorn (*Frangula alnus*). The occurrence of the latter species in such abundance is unusual in Ireland (NPWS, 2013[33]). St John's Wood is stated to be one of the most important woodlands in Ireland; it is recognised as the largest and most natural woodland in the Midlands (Alexander, 2011[38]).

According to the SSCOs for the habitats degraded raised bog and bog woodland, they are regarded as a component of the active raised bog habitat (7110) and thus, the conservation objective and supporting document for active raised bog (7110) are also relevant to these habitats and common attributes have not been repeated here (NPWS, 2016[34]). The SSCOs for the habitats (NPWS, 2016[34]) include a target for water quality. The target requires that water quality on the high bog and in transitional areas is close to natural reference conditions.

Water chemistry within raised bogs is influenced by atmospheric inputs (rainwater). However, within soak systems, water chemistry is influenced by other inputs such as focused flow or interaction with underlying substrates. Water chemistry in areas surrounding the high bog varies due to influences of different water types (bog water, regional groundwater and run-off from surrounding mineral lands) (NPWS, 2016[34]).

Ombrotrophic peat waters found on the surface of raised bogs are characterised by low pH values (pH < 4.5) and also have low values of Electrical Conductivity (EC). This is due to the fact that the raised bog system derives its mineral supply from precipitation, which is usually acidic and low in nutrients. Raised bog vegetation exchanges cations with protons to further reduce the pH. Hydrochemistry varies in the areas surrounding a raised bog. Locally, conditions may be similar to the high bog due to a dominance of water originating from the bog. However, elsewhere in the marginal areas, there may be increased mineral and nutrient content of the water due to regional

[38] Alexander, K. N. A. (2011) An invertebrate survey of Coill Eoin, St John's Wood, Co Roscommon. Irish Wildlife Manuals, No. 57. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Dublin, Ireland.

groundwater influences, runoff from surrounding mineral soils, and the release of nutrients through oxidation of peat resulting from reduced water levels.

In 2015, the hydrochemistry of Clooncraff and Cloonlarge Bogs was recorded as having relatively low EC values in most areas of the cutover (generally < 100µS/cm) which indicates little groundwater influence as these values are similar to those of rain water, reflecting the inert properties of the peat. Elevated EC values were identified in the cutover drains to the south-east of the bog, adjacent to the narrow section of high bog remaining in this area. This suggests there may be some upwelling of groundwater in to these drains (NPWS, 2016[39]).

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

The habitats degraded raised bog and bog woodland are located along the shore of the lake water body Ree (IE_SH_26_750a). The habitats are upstream of the surface water bodies identified in **Table 5-2** as hydrologically connected to the SAC; however, due to their location on the lake shore there is potential for orthophosphate concentrations in the river and lake water bodies discharging to Ree (IE_SH_26_750a) to reach the habitats during inundation. In addition, the groundwater bodies Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246) flow to Ree (IE_SH_26_750a) and therefore have the potential to influence orthophosphate concentrations in the lake water body and its associated habitats.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High indicative quality boundary. The concentrations ranged from: undetectable in Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800); 0.0002 mg/l in Breensford_010 (IE_SH_26B100100); 0.0007 mg/l in Glassan Stream_010 (IE_SH_26G060300); and 0.0009 mg/l in Breensford_020 (IE_SH_26B100400). As all concentrations are within 5% of the Good / High indicative quality boundary, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**).

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the

[39] NPWS 2016 Lough Ree SAC (site code 000440) Conservation Objectives Supporting Document - Raised Bog Habitats

basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively] and in some cases [e.g. Funshinagh IE_SH_G_091)] undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on these habitats can be excluded. Furthermore, dosing will not result in deterioration of the favourable conservation condition of the habitats.

6.2.2.4 (7230) Alkaline fens

Fens are wetland systems with a permanently high water level at or just below its surface. The substrate is an alkaline or slightly acidic peat soil. The vegetation is usually rich in or dominated by sedges. They receive nutrients from sources other than precipitation, usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement. In general they are poor in nitrogen and phosphorus, the latter of which tends to be the limiting nutrient in fen systems. Studies of wetlands in western Europe frequently show that nutrient enrichment (with nitrogen and phosphorus) leads to changes in species composition, decline in overall plant species diversity, and loss of rare and uncommon species. Organic matter is often accumulated as peat within a fen. A "poor" fen has very low concentrations of plant nutrients and floristically has similarities to a bog. A "rich" fen has relatively high concentrations of mineral nutrients, but is still characterised by the accumulation of peat (though this is likely to be primarily from the remains of plants other than sphagnum mosses, such as sedges and brown mosses). Where fens are characterised by alkaline conditions resulting from water draining from limestone and other calcareous soil formations, they are distinguished as "rich fen", though there is often a general understanding that a "fen" will be relatively eutrophic (nutrient rich) (Foss, 2007[40]).

The SSCOs for the habitat alkaline fens in Lough Ree SAC (NPWS, 2016[34]) include a nutrient specific target of appropriate water quality to support the natural structure and functioning of the habitat. Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus, with the latter tending to be the limiting nutrient.

[40] Foss, P.J. (2007) National Parks & Wildlife Service Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007. Internal report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

The full extent of alkaline fens in the SAC is currently unknown. The main area is considered to occur in the vicinity of St. John's Wood, on the western side of the lake but there are likely to be additional areas around the lake. Alkaline fens occur in association with other habitats such as wet grassland and marsh (NPWS, 2016[34]). Therefore, on a precautionary basis, it is assumed that all surface water bodies identified in **Table 5-2** have the potential to interact with the habitat. In addition, the groundwater bodies Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246) flow to Ree (IE_SH_26_750a) and therefore have the potential to influence orthophosphate concentrations in the lake water body and its associated habitats.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High indicative quality boundary. The concentrations ranged from: undetectable in Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800); 0.0002 mg/l in Breensford_010 (IE_SH_26B100100); 0.0007 mg/l in Glassan Stream_010 (IE_SH_26G060300); and 0.0009 mg/l in Breensford_020 (IE_SH_26B100400). As all concentrations are within 5% of the Good / High indicative quality boundary, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**).

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively] and in some cases [e.g. Funshinagh IE_SH_G_091)]

undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not result in deterioration of the favourable conservation condition of the habitat.

6.2.2.5 (1355) Otter (*Lutra lutra*)

A review of the SSCOs (NPWS, 2016[34]) found no specific attributes or targets relating to water quality. The NPWS 'Threat Response Plan for the Otter' (NPWS, 2009[41]) which comprised a review of and response to the pressures and threats to otters in Ireland, categorized three principal risks to otters: i) habitat destruction and degradation; ii) water pollution; and, iii) accidental death and/or persecution. Water pollution may influence otters either indirectly or directly. Indirect effects include damage to food supply or habitat thus lowering the carrying capacity of an affected area. Direct effects impact the animal itself, resulting in either rapid death (acute toxicity) or in lowered fitness (sub-lethal toxicity), reducing the animal's ability to reproduce successfully or to survive in inclement conditions. The diet of the species varies locally and seasonally; however, it is dominated by fish, in particular salmonids, eels and sticklebacks in freshwater and crayfish locally. Poorly treated effluents can wipe out fish populations for long distances downstream of the discharge, making otherwise ideal habitat unsuitable for otter.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

The extent of terrestrial otter habitat within the SAC includes all areas within a 10m terrestrial buffer along the shoreline and river banks. The extent of river habitat is calculated on the basis that otter will utilise freshwater habitats from estuary to headwaters, while the extent of lake habitat is based on the tendency of otter to forage within 80 m of the shoreline (NPWS, 2016[34]). Therefore, there is potential for otter to interact with all surface water bodies identified in **Table 5-2**. In addition, the groundwater bodies Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246) flow to Ree (IE_SH_26_750a) and therefore have the potential to influence orthophosphate concentrations in the lake water body and its associated QIs.

[41] NPWS (2009) Threat Response Plan: Otter (2009-2011). National Parks & Wildlife Service, Department of the Environment, Heritage & Local Government, Dublin.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment results are provided in **Appendix C** and discussed above in **Section 5**.

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High indicative quality boundary. The concentrations ranged from: undetectable in Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800); 0.0002 mg/l in Breensford_010 (IE_SH_26B100100); 0.0007 mg/l in Glassan Stream_010 (IE_SH_26G060300); and 0.0009 mg/l in Breensford_020 (IE_SH_26B100400). As all concentrations are within 5% of the Good / High indicative quality boundary, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**).

As described in **Section 6.2.2.1**, the lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex indicated that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively] and in some cases [e.g. Funshinagh IE_SH_G_091)] undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on fish species, the main food source for the otter, can be excluded. Furthermore, dosing will not result in deterioration of its favourable conservation condition.

6.2.3 Pilgrim's Road Esker SAC 001776

6.2.3.1 (6210) Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (* important orchid sites)*

Pilgrim's Road Esker SAC is a narrow esker ridge extending 2 km east from Clonmacnoise in Co. Offaly. The site is adjacent to the River Shannon Callows, to the north, and Mongan raised bog, to the south. The western area includes Bunthulla Hill (north of the road) and Hanging Hill (south of the road); the central area runs along both sides of the summit ridge before widening out eastwards to include a substantial area of esker grassland centred on the site of an old ring-fort (NPWS, 2014[42]).

Semi-natural dry grasslands are not considered water-dependent however, they are considered nutrient sensitive. In the case of Pilgrim's Road Esker SAC, the lack of fertiliser application has allowed localised species-rich flora to survive. If fertiliser application were ceased over the whole

[42] NPWS 2014 Pilgrim's Road Esker SAC 001776 Site Synopsis

area species-richness would gradually increase throughout (NPWS, 2014[42]). There are no SSCOs for the SAC (NPWS, 2018[43]). A review of SSCO's for other SACs with this habitat include a target that negative indicator species collectively are not more than 20% cover, with cover by an individual species not more than 10%. According to O'Neill *et al.* (2013[44]) the presence of negative species can indicate agricultural intensification, proximity of disturbed or agricultural habitats, and damaging activities including but not limited to drainage, dumping and afforestation.

Table 5-2 identifies the groundwater body which is hydrogeologically connected to Pilgrim's Road Esker SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP.

The groundwater body Inny (IE_SH_G_110) is hydrogeologically connected to the Pilgrim's Road Esker SAC. There are no surface waters connecting the WSZ to the SAC. The SAC is however, adjacent to the River Shannon Callows SAC which includes the river water body Shannon (Upper)_120 (IE_SH_26S021800). Given its location, there is potential for the transfer of orthophosphate from Shannon (Upper)_120 (IE_SH_26S021800) to the SAC during flooding. The potential impact of dosing on the habitat is therefore assessed in this regard.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree. The predicted load to this groundwater body is very low (0.0003 mg/l) which is within the 5% of the Good / Fail boundary, therefore there is no potential risk of deterioration in the indicative quality of this groundwater body.

The modelled increase in orthophosphate concentration in the river water body Shannon (Upper)_120 (IE_SH_26S021800) following dosing at Athlone WTP is undetectable i.e. 0.0000 mg/l. Therefore, there is no risk of impact to the indicative quality (High at four monitoring points, Poor at one) of the Shannon (Upper)_120 (IE_SH_26S021800) and no potential for the transfer of increased orthophosphate concentrations to the semi-natural dry grassland habitat in the adjacent Pilgrim's Road Esker SAC under flood conditions.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on this habitat can be excluded. Furthermore, dosing will not prevent the maintenance or restoration of the favourable conservation condition of the habitat.

[43] NPWS 2018 Pilgrim's Road Esker SAC 001776 Conservation Objectives

[44] O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland. https://www.npws.ie/sites/default/files/publications/pdf/IWM-78-Irish-semi-natural-grassland-survey.pdf

6.2.4 Crosswood Bog SAC 002337

6.2.4.1 (7110) Active raised bogs* and (7120) Degraded raised bogs still capable of natural regeneration

Crosswood Bog is situated approximately 5 km east of Athlone, Co. Westmeath, mainly in the townlands of Crosswood, Glenaghanvoneen and Creggan Lower. The site comprises a raised bog that includes both areas of high bog and cutover bog. The northern margin of the bog lies along the southern side of the Dublin-Galway railway line. Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The site consists of a quaking bog, with a well-developed sequence of pools, hollows and hummocks and a flush supporting woodland. Cutover areas occur on all margins of the bog (NPWS, 2014[45]). Based on the close ecological relationship between these habitat types, it is not necessary to set SSCOs for the habitats individually. It is considered that should favourable conservation condition for active raised bogs be achieved on the site, then, as a consequence, favourable conservation condition for the other habitat would also be achieved (NPWS, 2016[46]).

Ombrotophic peat waters found on the surface of raised bogs are characterised by low pH values (pH < 4.5) and also have low values of electrical conductivity. This is due to the fact that the raised bog system derives its mineral supply from precipitation, which is usually acidic and low in nutrients. Raised bog vegetation exchanges cations with protons to further reduce the pH. Hydrochemistry varies in the areas surrounding a raised bog. Locally, conditions may be similar to the high bog due to a dominance of water originating from the bog. However, elsewhere in the marginal areas, there may be increased mineral and nutrient content of the water due to regional groundwater influences, run-off from surrounding mineral soils, and the release of nutrients through oxidation of peat resulting from reduced water levels.

The hydrochemistry of Crosswood Bog has not been studied in any detail. However, data suggests that it is likely local discharge of regional groundwater within perimeter drains where elevated EC was recorded. The SSCOs for these habitats includes a target for the attribute water quality i.e. *Water quality on the high bog and in transitional areas close to natural reference conditions* (NPWS, 2016[46]).

Table 5-2 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Crosswood Bog SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The river water bodies include: Shannon (Upper)_120 (IE_SH_26S021800); and
- The groundwater body includes: Inny (IE_SH_G_110).

[45] NPWS 2014 Crosswood Bog SAC 002337 Site Synopsis
[46] NPWS 2016 Crosswood Bog SAC (site code 002337) Conservation Objectives Supporting Document - Raised Bog Habitats, Version 1.

The SAC is located upstream of the location where Shannon (Upper)_120 (IE_SH_26S021800) is intersected by the WSZ and therefore there is no risk of impact from this surface water body. There is potential for groundwater interaction between the habitats and Inny (IE_SH_G_110).

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**. The modelled increase in orthophosphate concentration in the groundwater body Inny (IE_SH_G_110) is 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary there is no risk of deterioration in the Good indicative quality of the groundwater body.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on these habitats can be excluded. Furthermore, dosing will not prevent the restoration of the favourable conservation condition of the habitats.

6.2.5 Carn Park Bog SAC 002336

6.2.5.1 (7110) Active raised bogs* and (7120) Degraded raised bogs still capable of natural regeneration

Carn Park Bog is situated 8 km east of Athlone, in the townlands of Tullywood, Carn Park, Cappaghbrack, Warren High and Moydrum, Co. Westmeath. The site comprises a raised bog that includes both areas of high bog and cutover bog. The margins of the site are bounded by roads on the north, west and southern margins and forestry on the east. Active raised bog comprises areas of high bog that are wet and actively peat forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration (NPWS, 2014[47]). Based on the close ecological relationship between these two habitat types, it is not necessary to set SSCOs for the habitats individually. It is considered that should favourable conservation condition for active raised bogs be achieved on the site, then, as a consequence, favourable conservation condition for degraded raised bog would also be achieved.

Ombrotophic peat waters found on the surface of raised bogs are characterised by low pH values (pH < 4.5) and also have low values of electrical conductivity. This is due to the fact that the raised bog system derives its mineral supply from precipitation, which is usually acidic and low in nutrients. Raised bog vegetation exchanges cations with protons to further reduce the pH. Hydrochemistry varies in the areas surrounding a raised bog. Locally, conditions may be similar to the high bog due to a dominance of water originating from the bog. However, elsewhere in the marginal areas, there may be increased mineral and nutrient content of the water due to regional groundwater influences, run-off from surrounding mineral soils, and the release of nutrients through oxidation of peat resulting from reduced water levels. The SSCOs for these habitats includes a target for the attribute

[47] NPWS 2014 Carn Park Bog SAC 002336 Site Synopsis

water quality i.e. *Water quality on the high bog and in transitional areas close to natural reference conditions* (NPWS, 2015[48]).

Table 5-2 identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Carn Park Bog SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The river water bodies include: Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater body includes: Inny (IE_SH_G_110).

The SAC is located upstream of where the river water bodies Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400) are intersected by the WSZ and therefore there is no risk of impact from these surface water body. There is potential for groundwater interaction between the habitats and Inny (IE_SH_G_110).

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**. The modelled increase in orthophosphate concentration in the groundwater body Inny (IE_SH_G_110) is 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary there is no risk of deterioration in the Good indicative quality of the groundwater body.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on these habitats can be excluded. Furthermore, dosing will not prevent the restoration of the favourable conservation condition of the habitats.

6.2.6 Mongan Bog SAC 000580

6.2.6.1 (7110) Active raised bogs, (7120) Degraded raised bogs still capable of natural regeneration and (7150) Depressions on peat substrates of the *Rhynchosporion*

Mongan Bog is a midland raised bog of medium size situated immediately east of the monastic site of Clonmacnoise, Co. Offaly, and 12 km south of Athlone. It is situated in a basin, surrounded on 95% of its perimeter by high ground on mineral soil. At two points in the north it shares a common boundary with Pilgrim's Road Esker SAC. The site is designated for the Annex I habitats active raised bogs; degraded raised bogs and depressions on peat substrates. Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The *Rhynchosporion* habitat occurs in wet depressions, pool edges and erosion channels where the vegetation includes White Beak-sedge (*Rhynchospora alba*) and/or Brown Beak-sedge (*R. fusca*), and at least some of the following

[48] NPWS 2015 Carn Park Bog SAC (site code 002336) Conservation Objectives Supporting Document - Raised Bog Habitats, Version 1.

associated species, Bog Asphodel (*Narthecium ossifragum*), sundews (*Drosera* spp.), Deergrass (*Scirpus cespitosus*) and Carnation Sedge (*Carex panicea*) (NPWS, 2013[49]). Based on the close ecological relationship between these three habitats types, it is not necessary to set SSCOs for all three habitats individually. It is considered that should favourable conservation condition for active raised bogs be achieved on the site, then, as a consequence, favourable conservation condition for the other two habitats would also be achieved (NPWS, 2016[50]). Moreover, as the SAC adjoins Pilgrim's Road Esker SAC (001776) the COs for this site should be used in conjunction with those for the adjacent site as appropriate. No SSCOs have been established for Pilgrim's Road Esker SAC (001776).

Ombrotophic peat waters found on the surface of raised bogs are characterised by low pH values (pH < 4.5) and also have low values of electrical conductivity. This is due to the fact that the raised bog system derives its mineral supply from precipitation, which is usually acidic and low in nutrients. Raised bog vegetation exchanges cations with protons to further reduce the pH. Hydrochemistry varies in the areas surrounding a raised bog. Locally, conditions may be similar to the high bog due to a dominance of water originating from the bog. However, elsewhere in the marginal areas, there may be increased mineral and nutrient content of the water due to regional groundwater influences, run-off from surrounding mineral soils, and the release of nutrients through oxidation of peat resulting from reduced water levels. There is some evidence of calcareous regional groundwater influences in cutover areas surrounding the high bog. The SSCOs for these habitats includes a target for the attribute water quality i.e. *Water quality on the high bog and in transitional areas close to natural reference conditions* (NPWS, 2016[50]).

Table 5-2 identifies the groundwater body, Inny (IE_SH_G_110), which is hydrogeologically connected to Mongan Bog SAC and will receive inputs from the proposed orthophosphate dosing at Athlone WTP. There are no surface waters connecting the WSZ to the SAC.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**. The modelled increase in orthophosphate concentration in the groundwater body Inny (IE_SH_G_110) is 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary, there is no risk of deterioration in the Good indicative quality of the groundwater body.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that the potential for likely significant effects on these habitats can be excluded. Furthermore, dosing will not prevent the restoration of the favourable conservation condition of the habitats.

6.2.7 Mongan Bog SPA 004017

Mongan Bog is a midland raised bog of medium size situated immediately east of the monastic site of Clonmacnoise, Co. Offaly, and 12 km south of Athlone. It is situated in a basin, surrounded on part of its perimeter by high ground on mineral soil. At the time this site was identified for SPA designation it was being utilised by Greenland White-fronted Goose from the internationally important River Suck population. Although Greenland White-fronted Goose does not currently

[49] NPWS 2013 Mongan Bog SAC 000580 Site Synopsis
[50] NPWS 2016 Mongan Bog SAC (site code 000580) Conservation Objectives Supporting Documetn - Raised Bog Habitats, Version 1.

utilise the site, this species is regarded as a SCI for this SPA. Mongan Bog is one of the raised bogs that was traditionally used as a feeding/roosting site by small numbers of the River Suck population of Greenland White-fronted Goose. These birds utilise the callows near the mouth of the Suck to Shannonbridge and as far as Clonmacnoise. The numbers of Greenland White-fronted Goose using this part of the range was always small (peak count of 26 in 1984/85) and geese have not been recorded using the site in recent years - the last record was 11 individuals in 1989/90 (NPWS, 2014[51]).

There are no SSCOs for this SPA (NPWS, 2018[52]) however, there is an overall objective to maintain or restore the favourable conservation condition of the bird species listed as SCIs for this SPA. In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water conditions that support Favourable Conservation Status. In preparing the RBMP (2018-2021) (DHPLG, 2018[53]) the risk assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES). GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS.

Table 5-2 identifies the groundwater body, Inny (IE_SH_G_110), which is hydrogeologically connected to Mongan Bog SPA and will receive inputs from the proposed orthophosphate dosing at Athlone WTP. There are no surface waters connecting the WSZ to the SAC.

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**. The modelled increase in orthophosphate concentration in the groundwater body Inny (IE_SH_G_110) is 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary there is no risk of deterioration in the Good indicative quality of the groundwater body.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that there is no risk of deterioration in the water quality indicative quality of the water bodies that support the structure and function of the SPA; therefore there will be no likely significant effect from the additional loading from the orthophosphate dosing on the maintenance or restoration of favourable conservation status of its SCIs.

6.2.8 Lough Ree SPA 004064

Situated on the River Shannon between Lanesborough and Athlone, Lough Ree is the third largest lake in the Republic of Ireland. It lies in an ice-deepened depression in Carboniferous Limestone. Some of its features (including the islands) are based on glacial drift. The main inflowing rivers are the Shannon, Inny and Hind, and the main outflowing river is the Shannon. The greater part of Lough Ree is less than 10 m in depth, but there are six deep troughs running from north to south, reaching a maximum depth of about 36 m just west of Inchmore. The lake has a very long, indented shoreline

[51] NPWS 2014 Mongan Bog SPA 004017 Site Synopsis
[52] NPWS 2018 Mongan Bog SPA 004017 Conservation Objectives
[53] DHPLG (2018) The River Basin Management Plan for Ireland (2018-2021).

and hence has many sheltered bays. It also has a good scattering of islands, most of which are included in the site.

The site is an SPA under the Birds Directive, of special conservation interest for the following species: Whooper Swan, Wigeon, Teal, Mallard, Shoveler, Tufted Duck, Common Scoter, Goldeneye, Little Grebe, Coot, Golden Plover, Lapwing and Common Tern. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds (NPWS, 2015[54]).

All 13 SCIs designated in Lough Ree SPA are considered nutrient sensitive and water dependent (see **Appendix B**). There are no SSCOs for the site; however, there is an overall objective to maintain or restore the favourable conservation condition of the bird species listed as SCIs for the SPA. To acknowledge the importance of Ireland's wetlands to wintering waterbirds, "Wetland and Waterbirds" may be included as a SCI for some SPAs that have been designated for wintering waterbirds and that contain a wetland site of significant importance to one or more of the species of SCIs. Thus, a second objective is included as follows: To maintain or restore the favourable conservation condition of the wetland habitat at Lough Ree SPA as a resource for the regularly-occurring migratory waterbirds that utilise it (NPWS, 2018[55]). In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water conditions that support Favourable Conservation Status.

In preparing the RBMP (2018-2021) (DHPLG, 2018[56]) the risk assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES). GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Lough Ree SPA and will receive inputs from the proposed orthophosphate dosing at Athlone WTP

- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d);
- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Shannon (Upper)_110 (IE_SH_26S021660), Shannon (Upper)_120 (IE_SH_26S021800), Breensford_010 (IE_SH_26B100100) and Breensford_020 (IE_SH_26B100400); and
- The groundwater bodies include: Athlone West (IE_SH_G_014), Funshinagh (IE_SH_G_091), Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246).

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

[54] NPWS 2015 Lough Ree SPA 004064 Site Synopsis
[55] NPWS 2018 Lough Ree SPA 004064 Conservation Objectives
[56] DHPLG (2018) The River Basin Management Plan for Ireland (2018-2021).

The modelled post-dosing concentration in each of the river water bodies hydrologically connected to the SAC was within 5% of the Good / High boundary. The concentrations ranged from undetectable in Shannon (Upper)_110 (IE_SH_26S021660) to 0.0009 mg/l in Breensford_020 (IE_SH_26B100400). As all concentrations are within 5% of the Good / High indicative quality boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

Of the four groundwater bodies that are hydrogeologically connected to the SAC, three support connectivity with the habitat: Funshinagh (IE_SH_G_0910, Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246). The main discharges from Inny (IE_SH_G_110) in the southwest will be to Lough Ree and overall groundwater flow in Funshinagh (IE_SH_G_091) will be towards Lough Ree. The predicted loads to groundwater bodies are very low [0.0003 mg/l and 0.0010 mg/l in Inny (IE_SH_G_110) and Athlone Gravels (IE_SH_G_246), respectively] and in some cases [e.g. Funshinagh (IE_SH_G_091)] undetectable. As all concentrations are within 5% of the Good / Fail boundary, there is no potential risk of deterioration in the indicative quality of the water bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that there is no risk of deterioration in the water quality indicative quality of the water bodies that support the structure and function of the SPA; the additional loading from the orthophosphate dosing will therefore not have a likely significant effect on the maintenance or restoration of favourable conservation status of its SCIs, either in terms of individual bird species or wetland habitats.

6.2.9 Middle Shannon Callows SPA 004096

The Middle Shannon Callows SPA is a long and diverse site which extends for approximately 50 km from the town of Athlone to the town of Portumna; it lies within Counties Galway, Roscommon, Westmeath, Offaly and Tipperary. The site averages about 0.75 km in width though in places is up to 1.5 km wide. Water levels on the site are greatly influenced by the very small fall between Athlone and Portumna and by the weir at Meelick. The site has extensive areas of callow, or seasonally flooded, semi-natural, lowland wet grassland, along both sides of the river. There are seven bird species of SCI; Whooper Swan, Wigeon, Corncrake, Golden Plover, Lapwing, Black-tailed Godwit and Black-headed Gull. It is also of SCI for holding an assemblage of over 20,000 wintering waterbirds and wetland habitat. All SCIs are considered nutrient sensitive (**Appendix B**) and water dependent.

The callow grasslands provide optimum feeding grounds for various species of waterfowl, while many of the birds also roost or rest within the site. Black-tailed Godwit, a very rare breeding species in Ireland, nests or attempts to nest in small numbers each year within the site. A further scarce breeding species, Shoveler, also nests in small numbers each year. The Middle Shannon Callows SPA supports a breeding population of Corncrake. They require the cover of tall vegetation throughout

their breeding cycle and are strongly associated with meadows which are harvested annually, where they nest and feed. Annual cutting of these meadows creates a sward which is easy for the birds to move through.

There are no SSCOs for this SPA (NPWS 2018[57]); however, there is an overall objective to maintain or restore the favourable conservation condition of the bird species listed as SCIs for this SPA. In addition, wetlands form part of this SPA and there is an objective to maintain or restore the favourable conservation condition of the wetland habitat at Middle Shannon Callows SPA as a resource for the regularly-occurring migratory waterbirds that utilise it.

In relation to protected water-dependent habitats and species under the Birds and Habitats Directive, the river basin management planning process contributes towards achieving water conditions that support Favourable Conservation Status. In preparing the draft RBMP (2018-2021) (DHPLG, 2018[53]) the risk assessment carried out by the EPA for these water dependent European Site protected areas has focussed on looking at the risks to the water standards/objectives established for the purpose of supporting Good Ecological Status (GES). GES, which is the default objective of the WFD, is considered adequate for supporting many water dependent European Site protected areas where site specific environmental supporting conditions have not been defined within SSCOs by the NPWS.

Table 5-2 and **Table 5-3** identifies the surface and groundwater bodies which are hydrologically or hydrogeologically connected to Middle Shannon Callows SPA and will receive inputs from the proposed orthophosphate dosing at Athlone WTP:

- The river water bodies include: Glassan Stream_010 (IE_SH_26G060300), Breensford_010 (IE_SH_26B100100), Breensford_020 (IE_SH_26B100400), Cloonbonny Stream_010 (IE_SH_26C460200), Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800);
- The lake water bodies include: Lough Ree (Combined) (IE_SH_26_750) i.e. Ree (IE_SH_26_750a), Killinure (IE_SH_26_750b) and Ballaghkeeran (IE_SH_26_750d); and
- The groundwater bodies include: Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110).

The EAM has assessed the potential for impact on water quality and nutrient conditions and has based this assessment on a conservative basis using all available riverine flows. Full details of the assessment are provided in **Appendix C**.

The modelled increase in orthophosphate concentration in the river water bodies: Glassan Stream_010 (IE_SH_26G060300) (0.0007 mg/l); Breensford_010 (IE_SH_26B100100) (0.0002 mg/l); Breensford_020 (IE_SH_26B100400) (0.0009 mg/l) and Cloonbonny Stream_010 (IE_SH_26C460200) (0.0008 mg/l) due to dosing are within 5% of the Good / High indicative quality boundary (0.00125 mg/l). In the Shannon (Upper)_110 (IE_SH_26S021660) and Shannon (Upper)_120 (IE_SH_26S021800), post-dosing concentrations are undetectable i.e. 0.0000 mg/l. Therefore, there is no risk of deterioration in the current indicative quality of the water bodies due to dosing at Athlone WTP (**Appendix C**). Cloonbonny Stream_010 (IE_SH_26C460200) displays a post dosing concentration which exceeds 75% of the indicative quality upper threshold. However, this is a result of the baseline concentration as the modelled increase in Ortho P is insignificant (0.0008mg/l). Therefore, No risk of deterioration in the Ortho P indicative quality or of preventing the achievement of WFD objectives.

[57] NPWS 2018 Middle Shannon Callows SPA 004096 Conservation Objectives

The lake water bodies are all part of the wider Lough Ree lake complex. A Vollenweider assessment of the additional orthophosphate loading to the combined lake complex was undertaken on the basis of outflows from Lough Ree and the sum of all loadings to each of the individual lake water bodies i.e. Ree (IE_SH_26_750a); Killinure (IE_SH_26_750b); Ballaghkeeran (IE_SH_26_750d). The assessment indicates that the critical loading is being exceeded under the existing situation; however, the existing orthophosphate levels in the lake complex are indicative of Good indicative quality and the increase in the critical loading due to dosing at Athlone WTP is less than 0.1%. This increase will not result in any further impact on the lake ecology which is currently at Good indicative quality due to macrophyte conditions.

The modelled increase in orthophosphate concentration in the groundwater bodies in Athlone West (IE_SH_G_014) and Inny (IE_SH_G_110) is low, 0.0003 mg/l. As this concentration is within 5% of the Good / Fail boundary there is no risk of deterioration in the Good indicative quality of the groundwater bodies.

In light of the EAM assessment results, which evaluate the additional orthophosphate loading from dosing at Athlone WTP, it has been demonstrated that there is no risk of deterioration in the water quality indicative quality of the water bodies that support the structure and function of the SPA; the additional loading from the orthophosphate dosing will therefore not result in a likely significant effect on the maintenance or restoration of favourable conservation status of its SCIs, either in terms of individual bird species or wetland habitats.

6.3 ASSESSMENT OF IN-COMBINATION EFFECTS WITH OTHER PLANS OR PROJECTS

In order to ensure all potential impacts upon European sites within the project's ZoI were considered, including those direct and indirect impacts that are a result of cumulative or in-combination impacts, the following steps were completed:

1. Identify projects/ plans which might act in combination: identify all possible sources of effects from the project or plan under consideration, together with all other sources in the existing environment and any other effects likely to arise from other proposed projects or plans;
2. Impacts identification: identify the types of impacts that are likely to affect aspects of the structure and functions of the site vulnerable to change;
3. Define the boundaries for assessment: define boundaries for examination of cumulative effects; these will be different for different types of impact and may include remote locations;
4. Pathway identification: identify potential cumulative pathways (e.g., via water, air, etc.; accumulations of effects in time or space);
5. Prediction: prediction of magnitude/ extent of identified likely cumulative effects, and
6. Assessment: comment on whether or not the potential cumulative impacts are likely to be significant.

A search of Westmeath County Council's planning enquiry system was conducted for developments that may have in-combination effects on European Sites with the ZoI. Plans and projects relevant to the area were searched in order to identify any elements of the plans and projects that may act cumulatively or in-combination with the proposed development.

Based on this search and the Project Teams knowledge of the study area a list of those projects and plans which may potentially contribute to cumulative or in-combination impacts with the proposed project was generated as listed in **Table 6-1** below.

Table 6-1: In-Combination Impacts with Other Plans, Programmes and Policies

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
Westmeath County Development Plan 2021 - 2027 **<u>Objectives for Water Supply and Water Quality</u>** **Water Supply** **CPO 10.72-** Support Irish Water [Uisce Éireann] in the implementation of their capital investment programme to ensure the timely delivery of water and waste-water infrastructure for the County. **CPO 10.73-** Collaborate with Irish Water [Uisce Éireann] in relation to the preparation of their Investment Plans in order to align the supply of water services with the County Settlement Hierarchy. **CPO 10.74**- Ensure the efficient and sustainable use and development of water resources and water services infrastructure, in order to manage and conserve water resources in a manner that supports a healthy society, economic development requirements and a cleaner environment. **CPO 10.75**- Assist Irish Water [Uisce Éireann] in their commitment to water conservation and support efforts to tackle leakage through find and fix (active leakage control) and water mains rehabilitation. **CPO 10.76-** Support Irish Water [Uisce Éireann] in the implementation of Capital Projects to strengthen the Regional Water Supply Scheme, subject to environmental assessment. **CPO 10.77-** Support the implementation of the Water Supply Project for the Eastern and Midland Region, subject to environmental assessment. **CPO 10.78-** Support the implementation of the Rural Water Programme. **CPO 10.79-** Minimise wastage of water supply and promote water conservation measures by requiring, where appropriate, water conservation measures and the installation of water meters in all new developments.	▪ N/A	The Westmeath County Development Plan emphasises the objectives of their water services which include the enhancement and improved quality of the service to its consumers. The plans also outline the importance of compliance with the River Basin Management Plan (2022-2027) and emphasises compliance with environmental objectives. The Plan also seeks to ensure the protection, integrity and conservation of European Sites and Annex I and II species listed in EU Directives. There is no potential for cumulative impacts with these plans.

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
CPO 10.80- Ensure that delivery and phasing of water services are subject to the required appraisal, planning and environmental assessment processes and avoid adverse impacts on the integrity of the Natura 2000 network. **CPO 10.81-** Protect, safeguard and strictly control development within the water catchment areas of Lough Owel and Lough Lene, and other major sources of public water supply that would give rise to pollution of these water sources. **CPO 10.82-** Ensure that new development proposals connect into the existing public water mains, where available. **Water Quality** **CPO 10.83**- Support the implementation of the relevant recommendations and measures as outlined in the relevant River Basin Management Plan 2018-2021, and associated Programme of Measures, or any such plan that may supersede same during the lifetime of the plan. Development proposals shall not have an unacceptable impact on the water environment, including surface waters, groundwater quality and quantity, river corridors and associated woodlands. **CPO 10.84-** Collaborate with Irish Water [Uisce Éireann] in contributing towards compliance with the European Union (Drinking Water) Regulations Drinking Water Regulations 2014 (as amended) and compliance of water supplies with the parameters identified in these Regulations. **CPO 10.85**- Contribute towards, as appropriate, the protection of existing and potential water resources, and their use by humans and wildlife, including rivers, streams, wetlands, groundwater and associated habitats and species in accordance with the requirements and guidance in the EU Water Framework Directive 2000 (2000/60/EC), the European Union (Water Policy) Regulations 2003 (as amended), the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended), the Groundwater Directive 2006/118/EC and the European Communities Environmental		

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
Objectives (groundwater) Regulations 2010 (as amended) and other relevant EU Directives, including associated national legislation and policy guidance (including any superseding versions of same). **CPO 10.86**- In conjunction with Irish Water [Uisce Éireann], have regard to the EPA 2019 publication "Drinking Water Report for Public Water Supplies 2018" (and any subsequent update) in the establishment and maintenance of water sources in the County. **CPO 10.87**- In conjunction with Irish Water [Uisce Éireann], support recommendations made by the EPA arising from any failure to meet drinking water standards and any enlistment on the EPA's Remedial Action List. **CPO 10.88**- Ensure that in assessing applications for developments, that consideration is had to the impact on the quality of surface waters having regard to targets and measures set out in the River Basin Management Plan for Ireland 2018-2021 and any subsequent local or regional plans. **CPO 10.89**- Ensure that development would not have an unacceptable impact on water quality and quantity including surface water, ground water, designated source protection areas, river corridors and associated wetlands. **CPO 10.90**- Discourage the over-concentration of individual septic tanks and treatment plants to minimise the risk of groundwater pollution. **CPO 10.91-** Support the preparation and development of Water Safety Plans / Drinking Water Protection Plans and Source Protection Plans to protect sources of public water supply, in accordance with the requirements of the Water Framework Directive. **CPO 10.92-** New development proposals shall ensure that full consideration is given to the level of investment that will be required in the provision of water services, particularly in environmentally sensitive areas to ensure that the provision of water services does not negatively impact on habitat quality, species diversity or other		

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
environmental considerations.		
River Basin Management Plan For Ireland 2022 – 2027 The Third Cycle Draft River Basin Management Plan 2022-2027 Consultation Report has been published. This report presents a summary of the issues raised in the submissions reviewed from the public consultation on the draft River Basin Management Plan for Ireland 2022-2027. The 3rd cycle of River Basin Management Plan (RBMP) for the period of 2022-2027 is currently being prepared by Department of Housing, Local Government and Heritage (DHLGH) in line with the EU Water Framework Directive (WFD) (2000/60/EC). The document (Chapter 3) sets out the condition of waters in Ireland and a summary of status for all monitored waters in the 2013 – 2018 period, including a description of the changes since 2007 – 2009 and 2010-2015. A large number of river waterbodies are still declining and unless this is addressed, sustained and progressive improvements in water quality will be difficult to achieve. Overall, 53% of surface waters are in good or high ecological status while the remaining 47% are in unsatisfactory ecological status. For groundwater bodies, 92% are in good chemical and quantitative status. Chapter 3 of the RBMP presents results of the catchment characterisation process, which identifies the significant pressures on each water body that is *At Risk* of not meeting the environmental objectives of the WFD. Importantly, the assessment includes a review of trends over time to see if conditions were likely to remain stable, improve or deteriorate by 2027. This work was presented in the RBMP for 4,842 water bodies nationally. 1,603 water bodies were classed *At Risk* or 33%. An assessment of significant environmental pressures found that agriculture was the most significant pressure in 1,000 water bodies that are *At Risk*. Urban waste water, hydromorphology and	▪ N/A	The objectives of the RBMP are to • Prevent deterioration; • Restore good status; • Reduce chemical pollution; and • Achieve water related protected areas objectives The implementation of the RBMP seeks compliance with the environmental objectives set under the plan, which will be documented for each water body. This includes compliance with the European Communities (Surface Waters) Regulations S.I. No. 272 of 2009 (as amended). The implementation of this plan will have a positive impact on biodiversity and the Project will not affect the achievement of the RBMP objectives given the detailed assessment of the effects of dosing on water body environmental objectives under the EAM.

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
forestry were also significant pressures amongst others.		
Catchment based Flood Risk Assessment and Management (CFRAM) Programme, under the Floods Directive The Office of Public Works (OPW) is responsible for the implementation of the Floods Directive 2007/60/EC which is being carried out through a Catchment based Flood Risk Assessment and Management (CFRAM) Programme. As part of the directive Ireland is required to undertake a Preliminary Flood Risk Assessment, to identify areas of existing or potentially significant future flood risk and to prepare flood hazard and risk maps for these areas. Following this, flood risk management plans are developed for these areas setting objectives for managing the flood risk and setting out a prioritised set of measures to achieve the objectives. The CFRAM programme is currently being rolled out and Draft Flood Risk Management Plans have been prepared. These plans have been subject AA.	▪ Habitat loss or destruction; ▪ Habitat fragmentation or degradation; ▪ Alterations to water quality and/or water movement; ▪ Disturbance; ▪ In-combination impacts within the same scheme	CFRAM Studies and their product Flood Risk Management Plans, will each undergo appropriate assessment. Any future flood plans will have to take into account the design and implementation of water management infrastructure as it has the potential to impact on hydromorphology and potentially on the ecological status and favourable conservation status of water bodies. The establishment of how flooding may be contributing to deterioration in water quality in areas where other relevant pressures are absent is a significant consideration in terms of achieving the objectives of the WFD. The AA of the plans will need to consider the potential for impacts from hard engineering solutions and how they might affect hydrological connectivity and hydromorphological supporting conditions for protected habitats and species. There is no potential for cumulative impacts with the CFRAMS programme as no infrastructure is proposed as part of this project.
Foodwise 2025 Foodwise 2025 strategy identifies significant growth opportunities across all subsectors of the Irish agri-food industry. Growth Projection includes increasing the value added in the agri-food, fisheries and wood products sector by 70% to in excess of €13 billion.	▪ Land use change or intensification ▪ Water pollution ▪ Nitrogen deposition ▪ Disturbance to habitats / species	Foodwise 2025 was subject to its own AA[58]. Growth is to be achieved through sustainable intensification to maximise production efficiency whilst minimising the effects on the environment however there is increased risk of nutrient discharge to receiving waters and in turn a potential risk to biodiversity and Europe Sites if not controlled. With the required mitigation in the Food Wise Plan, no significant in-combination impacts are predicted. Mitigation measures included cross compliance with 13 Statutory Management Requirements, EIA Agricultural Regulations 2011, GLAS, and AA Screening of licencing and permitting in the forestry and seafood sectors.
Rural Development Programme 2014 – 2020	• Overgrazing;	The RDP for 2014 – 2020 has been subject to SEA[59], and AA[60].

[58] http://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/environmentalanalysis/AgriFoodStrategy2025NISDRAFT300615.pdf

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
The agricultural sector is actively enhancing competitiveness whilst trying to achieve more sustainable management of natural resources. The common set of objectives, principles and rules through which the European Union co-ordinates support for European agriculture is outlined in the Rural Development Programme (RDP) 2014-2020 under the Common Agricultural Policy. The focus of the programme is to assist with the sustainable development of rural communities and while improvements are sought in relation to water management. Within the RDP are two targeted agri-environment schemes; Green Low Carbon Agri-Environment Scheme (GLAS) and Targeted Agriculture Modernisation Scheme (TAMS). They provide the role of a supportive measure to improve water quality and thus provide direct benefits in achieving the measures within the RBMP. The achievement of the objectives outlined within GLAS, to improve water quality, mitigate against climate change and promote biodiversity will be of direct positive benefit in achieving the measures within the RBMP and the goals of the Natura Directives. The scheme has an expected participation for 2014-2020 of 50,000 farmers which have to engage in specific training and tasks in order to receive full payment. Farmers within the scheme must have a nutrient management plan which is a strategy for maximising the return from on and off-farm chemical and organic fertilizer resources. This has a direct positive contribution towards protecting water bodies from pollution through limiting the amount of fertiliser that is placed on the land. The scheme prioritises farms in vulnerable catchments with 'high status' water bodies and also focuses on educating farmers on best practices to try and improve efficiency along with environmental outcomes. The TAMS scheme is open to all farmers and is focused on supporting productive investment for modernisation. This financial grant for farmers is focused on the pig and poultry sectors, dairy equipment and the storage of slurry and other farmyard manures. Within the TAMS scheme are two further schemes; the Animal Welfare, Safety and Nutrient Storage Scheme and the Low Emission Slurry Spreading Scheme. Both schemes are focused on	• Land use change or intensification; • Water pollution; • Nitrogen deposition; • Disturbance to habitats / species;	The AA assessed the potential for impacts from the RDP measures e.g. for the GLAS scheme to result in inappropriate management prescriptions; minimum stocking rates under the Areas of Natural Constraints measure leading to overgrazing in sensitive habitats with dependent species, and TAMS supporting intensification. Mitigation included project specific AA for individual building, tourism or agricultural reclamation projects, consultations with key stakeholders during detailed measure development, and site-based monitoring of the effects of RDP measures. With such measures in place, it was concluded that there would be no significant in-combination impacts on Natura 2000 sites.

[59] https://www.agriculture.gov.ie/media/migration/ruralenvironment/ruraldevelopment/ruraldevelopmentprogramme2014-2020/StrategEnvironmAssessSumState090615.pdf
[60] https://www.agriculture.gov.ie/media/migration/agarchive/ruralenvironment/preparatoryworkfortherdp2014-2020/RDP20142020DraftAppropriateAssessmentReport160514.pdf

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
productivity for farmers but have the ability to contribute towards a reduction in point and diffuse source pollution through improved nutrient management.		
National Nitrates Action Programme Ireland is obliged under the Nitrates Directive 91/676/EEC to prepare a National Nitrates Action Programme which is designed to prevent pollution of surface and ground waters from agricultural sources. This will directly contribute to the improvement of water quality and thus the objectives within the RBMP. Ireland's third Nitrates Action Programme came into operation in 2014 and has a timescale up to 2017. The Agricultural Catchments Programme is an ongoing programme that monitors the efficiency of various measures within the nitrate regulations. It is spread across six catchments and encompasses approximately 300 farmers.	• Land use change or intensification • Water pollution • Nitrogen deposition • Disturbance to habitats / species	This programme has been subject to a Screening for Appropriate Assessment and it concluded that the NAP will not have a significant effect on the Natura 2000 network and a Stage 2 AA was not required[61]. It concluded that the NAP was an environmental programme which imposes environmental constraints on all agricultural systems in the state. It therefore benefits Natura 2000 sites and their species. In terms of in-combination effects, it stated that the Food Wise 2025 strategy would have to operate within the constraints of the NAP.
Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) / Forestry Programme 2014 - 2020 Ireland's forestry sector is striving to increase forestry cover and one of the recommended policy actions in the Forest Policy Review: Forests, Products and People – A Renewed Vision (2014) is to increase the level of afforestation annually over time and support afforestation and mobilisation measures under the Forestry Programme 2014-2020. Two key objectives within the Forestry Programme 2014-2020 that will influence the RBMP are to increase Ireland's forest cover to 18% and to establish 10,000 ha of new forests and woodlands per annum. As part of this programme there are a number of schemes that promote sustainable forest management and they include the Afforestation Scheme, the Woodland Improvement Scheme, the Forest Road Scheme and the Native Woodland Conservation Scheme. Under the Native Woodland Conservation Scheme funding is provided to restore existing native woodland which promotes Ireland's native woodland resource and associated biodiversity. Native woodlands provide wider ecosystem functions and services which once restored can contribute to the protection and enhancement of water quality and aquatic habitats. New guidance and plans	• Habitat loss or destruction; • Habitat fragmentation or degradation; • Water quality changes; • Disturbance to species.	Ireland's Forestry Programme 2014 – 2020 has undergone AA[62]. A key recommendation is that all proposed forestry projects should be subject to an assessment of their impacts and the proximity of Natura 2000 habitats and species should be taken into account when proposals are generated. In-combination effects will therefore be assessed at the project specific scale. Adherence to this recommendation will ensure that there is no potential for cumulative impacts with the proposed project.

[61] http://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/Environment/Water/FileDownLoad,35218,en.PDF
[62] https://www.agriculture.gov.ie/media/migration/forestry/publicconsultation/newforestryprogramme2014-2020/nis/ForestryProgrammeNaturalImpactStatement290914.pdf

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
are also being developed to address forestry adjacent to water bodies, Freshwater Pearl Mussel Plans for 8 priority catchments and a Hen Harrier Threat Response Plan (NPWS). The mitigation measures within these plans will be particularly important in terms of protecting sensitive habitats and species from such forestry increases.		
Water Services Strategic Plan (WSSP, 2015) Uisce Éireann has prepared a Water Services Strategic Plan (WSSP, 2015), under Section 33 of the Water Service No. 2 Act of 2013 to address the delivery of strategic objectives which will contribute towards improved water quality and WFD requirements. The WSSP forms the highest tier of asset management plans (Tier 1) which Uisce Éireann prepare and it sets the overarching framework for subsequent detailed implementation plans (Tier 2) and water services projects (Tier 3). The WSSP sets out the challenges we face as a country in relation to the provision of water services and identifies strategic national priorities. It includes Uisce Éireann's short, medium and long term objectives and identifies strategies to achieve these objectives. As such, the plan provides the context for subsequent detailed implementation plans (Tier 2) which will document the approach to be used for key water service areas such as water resource management, wastewater compliance and sludge management. The WSSP also sets out the strategic objectives against which the Uisce Éireann Capital Investment Programme is developed. The current version of the CAP outlines the proposals for capital expenditure in terms of upgrades and new builds within the Uisce Éireann owned asset and this is a significant piece of the puzzle in terms of the expected improvements from the RBMP.	• Habitat loss and disturbance from new / upgraded infrastructure; • Species disturbance; • Changes to water quality or quantity; • Nutrient enrichment /eutrophication.	The overarching strategy was subject to Appropriate Assessment and highlighted the need for additional plan/project environmental assessments to be carried out at the tier 2 and tier 3 level. Therefore, no likely significant in-combination effects are envisaged.
National Wastewater Sludge Management Plan (2016) The National Wastewater Sludge Management Plan was prepared in 2015, outlining the measures needed to improve the management of wastewater sludge.	• Habitat loss and disturbance from new / upgraded infrastructure; • Species disturbance; • Changes to water quality or quantity; • Nutrient enrichment /eutrophication.	The plan was subject to both AA and SEA and includes a number of mitigation measures which were identified in relation to transport of materials, land spreading of sludge and additional education and research requirements. This plan does not specifically address domestic wastewater loads, only those relating to Uisce Éireann facilities. In relation to the plan as it stands, no in-combination effects are expected with the implementation of proposed mitigation measures.

Plan / Programme/Policy	Key Types of Impacts	Potential for In-combination Effects and Mitigation
National Water Resources Plan (in prep.) This Framework will deliver a sustainable water supply on a catchment and water resource zone basis, meeting growth and demand requirements through drought and critical periods. The resources plan will need to take account of WFD objectives and the programme of measures proposed in the relevant catchments and water resource zones. Specific measures in the plan with relevance to Uisce Éireann include those for urban wastewater and urban runoff and also as part of other measures in relation to the lead in drinking water.	• Increased abstractions leading to changes / pressure on existing hydrology / hydrogeological regimes.	The plan will seek to develop sustainable water supplies but must consider particularly critical drought periods when assimilation capacity for diffuse runoff may be reduced. The potential for in-combination impacts are unclear as the plan is not sufficiently developed at this stage.
Integrated Pollution Control (IPC) Licensing There are no IPC licenced facilities operating within the Athlone WSZ. There are however, IPC facilities operating close to the WSZ in Monksland Industrial Estate in Athlone. There are further IPC licenced facilities along the Shannon including facilities in Shannonbridge, Limerick and Shannon Airport. Under the Industrial Emissions Directive 2010/75/EU and Environmental Protection Agency Act, 1992 (as amended) industrial activities (e.g. pharmaceutical) are licenced by the EPA to prevent or reduce emissions to air, water and land, reduce water and use energy/resources efficiently. An IPC licence is a single integrated licence which covers all emissions from the facility and its environmental management. All related operations that the licence holder carries in connection with the activity are controlled by this licence.	▪ Changes to water quality or quantity; ▪ Nutrient enrichment /eutrophication.	The EPA is responsible for monitoring emissions and dealing with any infringements on IPC licences. All emissions must be within set limits which must not be contravened. Limits are set for phosphorus where relevant. Compliance with the limits set for phosphorus will ensure that there will be no significant in-combination impacts on Natura 2000 sites.
Planning Applications There are a number of planning applications pending or recently approved within the ZoI. The Westmeath County Council planning systems were searched for applications predominately in Athlone town. The applications are primarily for the construction of new infrastructure or renovations to existing infrastructure. In the case of new infrastructure these included the construction of agricultural buildings; domestic dwellings, a 68 unit residential development; 18 X two bedroomed apartments, domestic houses with DWWTSs, and, new sewers throughout the town.	• Habitat loss and disturbance from new / upgraded infrastructure; • Species disturbance; • Changes to water quality or quantity; • Nutrient enrichment /eutrophication.	Adherence to the overarching policies and objectives of the Westmeath County Development Plans will ensure that local planning applications and subsequent grant of planning will comply with the core strategy of proper planning and sustainability, including consideration of the requirements of relevant environmental Directives. There is no potential for significant adverse in-combination effects.

7 SCREENING CONCLUSION STATEMENT

This Screening to inform the AA process has considered whether the proposed construction works and operational orthophosphate dosing at the Athlone WTP, within the Athlone WSS WSZ, in combination with other plans or projects, is likely to have a significant effect on European Sites.

The appraisal undertaken in this Screening assessment has been informed by an EAM (see **Appendix C**) with reference to qualifying interests/special conservation interests for the European Sites potentially affected by the proposed project, in order to provide a scientific basis for the evaluations.

During the construction phase of the corrective water treatment works at Athlone WTP, the potential for direct, indirect and cumulative impacts affecting European Sites within the ZoI including the River Shannon Callows SAC, Lough Derg North-East Shore SAC, Lough Derg (Shannon) SPA, River Suck Callows SPA, Middle Shannon Callows SPA, Pilgrim's Road Esker SAC, Mongan Bog SAC, Mongan Bog SPA have been assessed. There will be no significant direct, indirect or cumulative impacts that will result in likely significant effects to the qualifying interests/special conservation interests of the European Sites within the ZoI.

During the operational phase, the potential for direct, indirect and cumulative impacts affecting European Sites within the ZoI including; Lough Ree SAC, Lough Ree SPA; River Shannon Callows SAC, Pilgrims Road Esker SAC, Crosswood Bog SAC, Carn Park Bog SAC, Mongan Bog, SAC, Mongan Bog SPA and Middle Shannon Callows SPA have been assessed. Due to the low orthophosphate inputs following dosing at Athlone WTP and no risk of deterioration in the orthophosphate indicative quality of the receiving water bodies or of preventing the achievement of WFD objectives, there will be no significant direct, indirect or cumulative impacts that will result in likely significant effects to the qualifying interests/special conservation interests of the European Sites within the ZoI. This is concluded with regard to the range, population densities and overall conservation status of the habitats and species for which these sites are designated (i.e. Conservation Objectives).

The screening has been carried out on the basis of the information presented in the Project Description. It has been concluded that the project it is not connected or necessary to the management of any European Site. It can be concluded on the basis of objective scientific information and in view of best scientific knowledge, the proposed orthophosphate dosing and associated construction works at the Athlone WTP; individually or in combination with other plans or projects, will not have a significant effect on any European Sites. Therefore, AA is not required.

8 REFERENCES

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APPENDIX A

European Sites- Conservation Objectives

A full listing of the COs and QIs/ SCIs for each European Site, as well as the attributes and targets to maintain or restore the QIs/ SCIs to a favourable conservation condition, are available from the NPWS website www.npws.ie. Links to the COs for the European Sites relevant to this Screening are provided below.

Site Name (Code)	Conservation Objectives Source
Lough Ree SAC (000440)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000440.pdf
River Shannon Callows SAC (000216)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000216.pdf
Mongan Bog SAC (000580)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO000580.pdf
Pilgrim's Road Esker SAC (001776)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO001776.pdf
Carn Park Bog SAC (002336)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002336.pdf
Crosswood Bog SAC (002337)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO002337.pdf
Lough Ree SPA (004064)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004064.pdf
Middle Shannon Callows SPA (004096)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004096.pdf
Mongan Bog SPA (004017)	https://www.npws.ie/sites/default/files/protected-sites/conservation_objectives/CO004017.pdf

APPENDIX B

Nutrient Sensitive Qualifying Interests

Water dependant and nutrient sensitive SAC species

Code	Qualifying Interest	Water dependant	Nutrient sensitive
1013	Whorl snail (Vertigo geyeri)	Yes	Yes
1014	Whorl snail (Vertigo angustior)	Yes	Yes
1016	Whorl snail (Vertigo moulinsiana)	Yes	Yes
1024	Kerry Slug (Geomalacus maculosus)	No	Yes
1029	Freshwater Pearl mussel (Margaritifera margaritifera)	Yes	Yes
1065	Marsh Fritillary (Euphydryas aurinia)	Yes	No
1092	White-clawed crayfish (Austropotamobius pallipes)	Yes	Yes
1095	Sea lamprey (Petromyzon marinus)	Yes	Yes
1096	Brook lamprey (Lampetra planeri)	Yes	Yes
1099	River lamprey (Lampetra fluviatilis)	Yes	Yes
1103	Twaite shad (Alosa fallax)	Yes	Yes
1106	Atlantic salmon (Salmo salar (freshwater only))	Yes	Yes
1303	Lesser Horseshoe bat (Rhinolophus hipposideros)	No	Yes
1349	Bottlenose dolphin (Tursiops truncatus)	Yes	Yes
1351	Harbour porpoise (Phocoena phocoena)	Yes	Yes
1355	Otter (Lutra lutra)	Yes	Yes
1364	Grey seal (Halichoerus grypus)	Yes	Yes
1365	Common seal (Phoca vitulina)	Yes	Yes
1393	Shining sickle moss (Drepanocladus vernicosus)	Yes	No
1395	Petalwort (Petalophyllum ralfsii)	Yes	Yes
1421	Killarney fern (Trichomanes speciosum)	Yes	Yes
1528	Marsh saxifraga (Saxifraga hirculus)	Yes	Yes
1833	Slender naiad (Najas flexilis)	Yes	Yes
1990	Nore freshwater pearl mussel (Margaritifera durrovensis)	Yes	Yes
5046	Killarney shad (Alosa fallax killarnensis)	Yes	Yes

Water dependant and nutrient sensitive SAC habitats

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
1110	Sandbanks which are slightly covered by sea water all the time	Yes		Yes
1130	Estuaries	Yes		Yes
1140	Mudflats and sandflats not covered by seawater at low tide	Yes		Yes
1150	Coastal lagoons	Yes		Yes
1160	Large shallow inlets and bays	Yes		Yes
1170	Reefs	Yes		Yes
1180	Submarine structures made by leaking gases	No		No
1210	Annual vegetation of drift lines	Yes		Yes
1220	Perennial vegetation of stony banks	Yes		No
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	Yes		Yes
1310	Salicornia and other annuals colonising mud and sand	Yes		Yes
1320	Spartina swards (Spartinion maritimae)	No		No
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Yes	Yes	Yes
1410	Mediterranean salt meadows (Juncetalia maritimi)	Yes	Yes	Yes
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	Yes		Yes
2110	Embryonic shifting dunes	Yes		Yes
2120	Shifting dunes along the shoreline with Ammophila arenaria (white dunes)	Yes		Yes
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	Yes		Yes
2140	Decalcified fixed dunes with Empetrum nigrum	Yes		Yes
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	Yes		Yes
2170	Dunes with Salix repens ssp. argentea (Salicion arenariae)	Yes	Yes	Yes
2190	Humid dune slacks	Yes	Yes	Yes
21A0	Machairs (* in Ireland)	Yes	Yes	Yes
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	Yes		Yes
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea	Yes		Yes
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	Yes		Yes
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation	Yes		Yes
3160	Natural dystrophic lakes and ponds	Yes		Yes
3180	Turloughs	Yes	Yes	Yes
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	Yes		Yes
3270	Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation	Yes	Yes	Yes
4010	Northern Atlantic wet heaths with Erica tetralix (Flushes only)	Yes	Yes	Yes
4030	European dry heaths	No		Yes
4060	Alpine and Boreal heaths	No		No
5130	Juniperus communis formations on heaths or calcareous grasslands	No		No

Code	Qualifying Interest	Water dependant	GWDTE	Nutrient sensitive
6130	Calaminarian grasslands of the Violetalia calaminariae	No (flood risk)*		Yes
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)	No (flood risk)*		Yes
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)	No		No
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	Yes	Yes	Yes
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	Yes	Yes	Yes
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	No (flood risk)*		Yes
7110	Active raised bogs	Yes	Yes	Yes
7120	Degraded raised bogs still capable of natural regeneration	Yes	Yes	Yes
7130	Blanket bogs (* if active bog)	Yes	Yes	Yes
7140	Transition mires and quaking bogs	Yes	Yes	Yes
7150	Depressions on peat substrates of the Rhynchosporion	Yes	Yes	Yes
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	Yes	Yes	Yes
7220	Petrifying springs with tufa formation (Cratoneurion)	Yes	Yes	Yes
7230	Alkaline fens	Yes	Yes	Yes
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	No		No
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	No		No
8210	Calcareous rocky slopes with chasmophytic vegetation	No		No
8220	Siliceous rocky slopes with chasmophytic vegetation	No		No
8240	Limestone pavements	No		Yes
8310	Caves not open to the public	Yes	Yes	Yes
8330	Submerged or partially submerged sea caves	Yes		Yes
91A0	Old sessile oak woods with Ilex and Blechnum in the British Isles	No		Yes
91D0	Bog woodland	Yes	Yes	Yes
91E0	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)	Yes	Yes	Yes
91J0	Taxus baccata woods of the British Isles	No		No

*While this habitat is determined to be non-water dependent, it may be incuded in the assessment in terms of flood risk

Water dependant and nutrient sensitive SPA

Code	Species of special conservation interest	Water dependant	Nutrient sensitive
A001	Red-throated Diver (Gavia stellata)	Yes	Yes
A003	Great Northern Diver (Gavia immer)	Yes	Yes
A004	Little Grebe (Tachybaptus ruficollis)	Yes	Yes
A005	Great Crested Grebe (Podiceps cristatus)	Yes	Yes
A009	Fulmar (Fulmarus glacialis)	Yes	Yes
A013	Manx Shearwater (Puffinus puffinus)	Yes	Yes
A014	Storm Petrel (Hydrobates pelagicus)	Yes	Yes
A015	Leach's Storm-petrel (Oceanodroma leucorhoa)	Yes	Yes
A016	Gannet (Morus bassanus)	Yes	Yes
A017	Cormorant (Phalacrocorax carbo)	Yes	Yes
A018	Shag (Phalacrocorax aristotelis)	Yes	Yes
A028	Grey Heron (Ardea cinerea)	Yes	Yes
A037	Bewick's Swan (Cygnus columbianus bewickii)	Yes	Yes
A038	Whooper Swan (Cygnus cygnus)	Yes	Yes
A043	Greylag Goose (Anser anser)	Yes	Yes
A045	Barnacle Goose (Branta leucopsis)	Yes	Yes
A046	Light-bellied Brent Goose (Branta bernicla hrota)	Yes	Yes
A048	Shelduck (Tadorna tadorna)	Yes	Yes
A050	Wigeon (Anas penelope)	Yes	Yes
A051	Gadwall (Anas strepera)	Yes	Yes
A052	Teal (Anas crecca)	Yes	Yes
A053	Mallard (Anas platyrhynchos)	Yes	Yes
A054	Pintail (Anas acuta)	Yes	Yes
A056	Shoveler (Anas clypeata)	Yes	Yes
A059	Pochard (Aythya ferina)	Yes	Yes
A061	Tufted Duck (Aythya fuligula)	Yes	Yes
A062	Scaup (Aythya marila)	Yes	Yes
A063	Eider (Somateria mollissima)	Yes	Yes
A065	Common Scoter (Melanitta nigra)	Yes	Yes
A067	Goldeneye (Bucephala clangula)	Yes	Yes
A069	Red-breasted Merganser (Mergus serrator)	Yes	Yes
A082	Hen Harrier (Circus cyaneus)	Yes	Yes
A098	Merlin (Falco columbarius)	Yes	Yes
A103	Peregrine (Falco peregrinus)	Yes	Yes
A122	Corncrake (Crex crex)	Yes	Yes
A125	Coot (Fulica atra)	Yes	Yes
A130	Oystercatcher (Haematopus ostralegus)	Yes	Yes
A137	Ringed Plover (Charadrius hiaticula)	Yes	Yes
A140	Golden Plover (Pluvialis apricaria)	Yes	Yes
A141	Grey Plover (Pluvialis squatarola)	Yes	Yes

Code	Species of special conservation interest	Water dependant	Nutrient sensitive
A142	Lapwing (Vanellus vanellus)	Yes	Yes
A143	Knot (Calidris canutus)	Yes	Yes
A144	Sanderling (Calidris alba)	Yes	Yes
A148	Purple Sandpiper (Calidris maritima)	Yes	Yes
A149	Dunlin (Calidris alpina) (non-breeding)	Yes	Yes
A156	Black-tailed Godwit (Limosa limosa)	Yes	Yes
A157	Bar-tailed Godwit (Limosa lapponica)	Yes	Yes
A160	Curlew (Numenius arquata)	Yes	Yes
A162	Redshank (Tringa totanus)	Yes	Yes
A164	Greenshank (Tringa nebularia)	Yes	Yes
A169	Turnstone (Arenaria interpres)	Yes	Yes
A179	Black-headed Gull (Larus ridibundus)	Yes	Yes
A182	Common Gull (Larus canus)	Yes	Yes
A183	Lesser Black-backed Gull (Larus fuscus)	Yes	Yes
A184	Herring Gull (Larus argentatus)	Yes	Yes
A188	Kittiwake (Rissa tridactyla)	Yes	Yes
A191	Sandwich Tern (Sterna sandvicensis)	Yes	Yes
A192	Roseate Tern (Sterna dougallii)	Yes	Yes
A193	Common Tern (Sterna hirundo)	Yes	Yes
A194	Arctic Tern (Sterna paradisaea)	Yes	Yes
A195	Little Tern (Sterna albifrons)	Yes	Yes
A199	Guillemot (Uria aalge)	Yes	Yes
A200	Razorbill (Alca torda)	Yes	Yes
A204	Puffin (Fratercula arctica)	Yes	Yes
A229	Kingfisher (Alcedo atthis)	Yes	Yes
A346	Chough (Pyrrhocorax pyrrhocorax)	Yes	Yes
A395	Greenland White-fronted Goose (Anser albifrons flavirostris)	Yes	Yes
A466	Dunlin (Calidris alpina schinzii) (breeding)	Yes	Yes

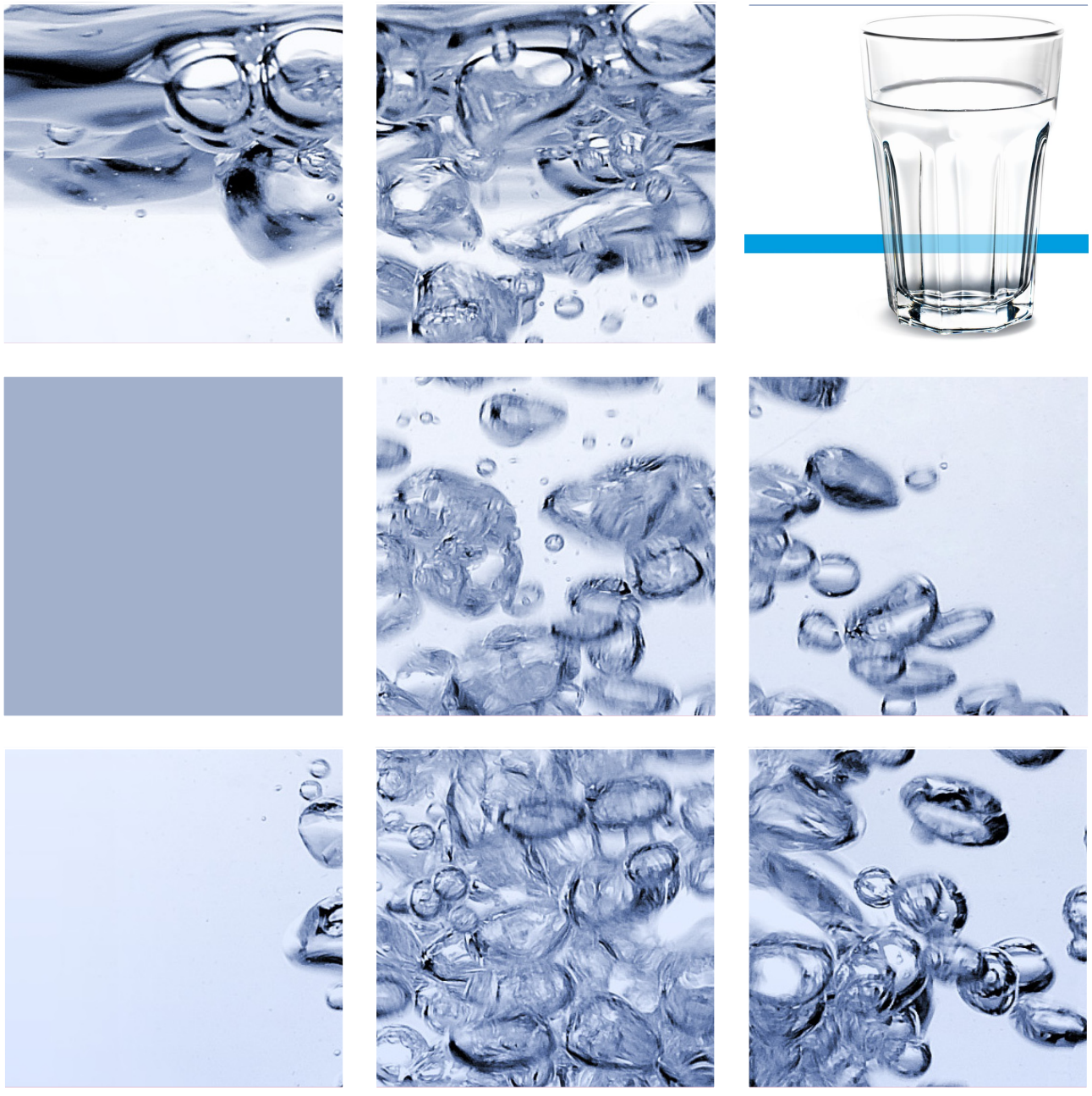
APPENDIX C

EAM Summary Report

Uisce Éireann - Lead in Drinking Water Mitigation Plan

Environmental Assessment Methodology (EAM) Summary Report

027 Athlone WTP – Athlone WSS (3200PUB1001)



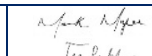
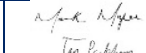
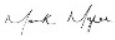
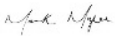
National Lead in Water Mitigation Strategy

Environmental Assessment Methodology Report: 027 Athlone WTP – Athlone WSS (3200PUB1001)

Document Control Sheet

Client:	Uisce Éireann
Project Title:	National Lead in Water Mitigation Strategy
Document Title:	Environmental Assessment Methodology Report: 027 Athlone WTP - Athlone WSS (3200PUB1001)
Document No:	MDW0766RP_5.1_EAM_027_Athlone_F04

Text Pages:	11	Appendices:	-

Rev.	Status	Date	Author(s)		Reviewed By		Approved By	
F01	Final	16th Aug 2018	YE		MJM, IP		DC	
F02	Final	11th Sep 2018	YE		MJM, IP		DC	
F03	Final	10th May 2019	MH		IP		MJM	
F04	Final	25th Jan 2023	YE		IP		MJM	

027 Athlone WTP - Athlone WSS (3200PUB1001)

Supporting spreadsheet: 027 Athlone WTP - Athlone WSS V18

This EAM report should be read in conjunction with the Uisce Éireann Lead in Drinking Water Mitigation Plan – Environmental Assessment Methodology report (MDE1218Rp0005 F02).

Athlone WTP supplies Athlone on the border of Roscommon and Westmeath and rural areas to the east of the town. The distribution input for the Athlone WSS is 10,946 m^3/day (47% of which is accounted for, with the remainder assumed to be lost through leakage) serving a population of approximately 19,000. The non-domestic demand is 16% of the distribution input. The area is served by Athlone WWTP (ref D0007-01) which is licenced in accordance with the requirements of the Waste Water Discharge (Authorisation) Regulations 2007 as amended; there are no other WWTPs within this WSZ. There are an estimated 1,518 properties across the WSZ that are serviced by a DWWTS.

This assessment has been undertaken for the WSZ in isolation. However, if corrective water treatment is proposed for WTPs in the same catchment area, the cumulative impact from the combined loads to downstream water bodies are assessed (see Summary, Mitigation, and Tables 5-A and 5-B).

Water Treatment Plant	**Athlone WTP**	
Water Supply Zone	**Athlone WSS (3200PUB1001)** **See Figure 4.1 / 4.2 of the AA Screening for a map of the WSZ and ZoI**	
Step 1 Appropriate Assessment Screening	**European Sites within Zone of Influence**	
	SACs	
	Lough Gash Turlough SAC River Shannon Callows SAC Barroughter Bog SAC Cloonmoylan Bog SAC Loughatorick South Bog SAC Mount Brandon SAC Slieve Bloom Mountains SAC Lough Ree SAC Fortwilliam Turlough SAC All Saints Bog And Esker SAC Mongan Bog SAC Lough Croan Turlough SAC Lough Funshinagh SAC Ballyduff/Clonfinane Bog SAC Kilcarren-Firville Bog SAC Pilgrim's Road Esker SAC Lough Forbes Complex SAC Tralee Bay and Magharees Peninsula, West to Cloghane SAC Lower River Shannon SAC Blasket Islands SAC Lough Derg, North-East Shore SAC Magharee Islands SAC Slieve Bernagh Bog SAC Crosswood Bog SAC Ballynamona Bog And Corkip Lough SAC	Ardgraigue Bog SAC Ratty River Cave SAC Danes Hole, Poulnalecka SAC Kerry Head Shoal SAC Ridge Road, SW of Rapemills SAC Lisduff Fen SAC Island Fen SAC Derrycrag Wood Nature Reserve SAC Pollnaknockaun Wood Nature Reserve SAC Rosturra Wood SAC Liskeenan Fen SAC Glenloughaun Esker SAC Killeglan Grassland SAC Ballymore Fen SAC Ballinturly Turlough SAC Glenomra Wood SAC Ferbane Bog SAC Carn Park Bog SAC Ardagullion Bog SAC Castlesampson Esker SAC Sharavogue Bog SAC Garriskil Bog SAC Derragh Bog SAC Scohaboy (Sopwell) Bog SAC Arragh More (Derrybreen) Bog SAC Fin Lough (Offaly) SAC

	Moneybeg And Clareisland Bogs SAC Corbo Bog SAC Redwood Bog SAC	Moyclare Bog SAC Silvermine Mountains SAC Bolingbrook Hill SAC Silvermines Mountains West SAC
	SPA	
	Mongan Bog SPA Lough Derravaragh SPA Glen Lough SPA Lough Iron SPA Lough Derg (Shannon) SPA Lough Kinale and Derragh Lough SPA Lough Ree SPA Lough Sheelin SPA River Shannon and River Fergus Estuaries SPA River Little Brosna Callows SPA Middle Shannon Callows SPA River Suck Callows SPA Ballykenny-Fisherstown Bog SPA	Garriskil Bog SPA All Saints Bog SPA Loop Head SPA Magharee Islands SPA Dovegrove Callows SPA Lough Croan Turlough SPA Dingle Peninsula SPA Slieve Bloom Mountains SPA Slievefelim to Silvermines Mountains SPA Slieve Aughty Mountains SPA Kerry Head SPA River Shannon and River Fergus Estuaries SPA
	Appropriate Assessment Required – see AA screening report for details	

Step 2 – Direct Inputs to Surface Water

Table 1: Increased loading/concentration to agglomerations due to Orthophosphate Dosing – Dosing rate = 0.8 mg/l

Agglom. and discharge type	ELV (Ortho P unless otherwise stated) from WWDL (mg/l)	Scenario	TP Load kg/yr	Ortho P concentration mg/l *TP – Ortho P Conversion factor varied for sensitivity analysis (40%, 50%, 68%)*		
				0.5	*0.4*	*0.68*
Athlone Primary Discharge	2 (TP ELV)	Existing	1464.4	0.217	0.173	0.295
		Post Dosing	1464.4	0.217	0.173	0.295
Athlone SWOs (19 no.)	n/a	Existing	250.9	1.274	1.019	1.732
		Post Dosing	286.5	1.455	1.164	1.978

**TP – Total Phosphorus ELV*

The predicted effluent concentrations are compliant with ELVs.
As Athlone WWTP (D0007-01) receives tertiary treatment, i.e. chemical dosing for nutrient removal, the EAM assumes that the additional orthophosphate loading to the plant can be dealt with and managed within the treatment process therefore there is no impact on the existing effluent quality.

Step 3 – Potential impact of Direct Inputs on Receiving Water Bodies

Table 2: Mass balance assessment based on 0.8 mg/l dosing using available background concentrations and mean flow information

Agglom.	RWB Name / Code for Primary Discharge	Background Conc. (mg/l) (annual mean from AER u/s monitoring point)	Modelled Conc. existing (mg/l)	Modelled Conc. Post Dosing (mg/l)	% Inc.
Athlone	SHANNON (Upper)_120 - IE_SH_26_1448_1	0.0302	0.0305	0.0305	0.02%

Surface Assessment

Athlone (IE_SH_26S021800) – The effluent concentrations are compliant with ELVs. Tertiary treatment is assumed to remove any additional orthophosphate from the effluent due to dosing and impact due to SWOs is negligible as shown by the mass balance assessment in Table 2.

The dosing will therefore not have a significant impact on the direct discharges to surface water from agglomerations within the WSZ.

Step 4 Distributed Inputs to River Water Bodies

Subsurface Assessment

The modelled increases in concentrations in the subsurface pathways are insignificant for all river water bodies (less than 0.00125 mg/l, which is 5% of the Good/High boundary for surface water bodies), with highest increase equal to 0.0009 mg/l, taking place in IE_SH_26B100400 Breensford_020.

There are no transitional water bodies directly affected by this WSZ.

Step 5 and 6: Combined Inputs to Ground Water Bodies

Groundwater Bodies as receptors connected to WSZ

Table 3: Increased loadings and concentrations in Groundwater bodies (*note where existing monitoring data not available, a surrogate Indicative Quality is derived from chemical status of the GWB or Ortho P / Groundwater status of the Group GWBS, the mid-range of that indicative quality is used as Baseline Concentration)*

EU_CD / NAME	Ortho P Indicative Quality and Trends (distance to threshold) *[Surrogate Indicative Quality indicated in italic]*	Baseline Ortho P Conc. mg/l *[Surrogate Conc. given in italic]*	75% of Indicative Quality threshold mg/l	Ortho P load to GW due to dosing kg/yr	Potential Increase in Ortho P Conc. due to Dosing mg/l	Potential Baseline for Ortho P Conc. following dosing mg/l	Notes
IE_SH_G_014 Athlone West	*Good*	*0.018*	*0.026*	*5.1*	*0.0003*	*0.018*	
IE_SH_G_091 Funshinagh	Good Upwards Far	*0.023*	0.026	0.2	0.0000	0.023	* MP1
	Good Upwards Far	*0.007*	0.026			0.007	MP2
	Good Upwards Far	*0.020*	0.026			0.020	MP3
IE_SH_G_110 Inny	*Good*	*0.018*	*0.026*	*56.0*	*0.0003*	*0.018*	
IE_SH_G_246 Athlone Gravels	*Good*	*0.018*	*0.026*	*10.2*	*0.0010*	*0.018*	

*Trends are statistically significant
MP: multiple Monitoring Points given for waterbody

The predicted increase in concentrations to groundwater bodies are insignificant (below 5% of the Good / Fail Ortho P Indicative Quality for groundwater - 0.00175 mg/l), as shown in Table 3. The subsurface assessment takes into account the groundwater/surface water interaction and as there is no risk of impact on groundwater receptors due to orthophosphate dosing, the potential for surface water impact is therefore not significant.

IE_SH_G_091 fails to reverse the upward trend, but since the potential increase in concentration due to dosing is undetectable (0.0000 mg/l) there is no risk of failing WFD objectives.

Step 5 and 6: Combined Inputs to Surface Water Bodies

Combined Assessment

Table 4-A gives the loads and modelled concentrations for the combined assessment to rivers. The increased concentrations due to orthophosphate dosing are not predicted to be significant (i.e. below 5% of the Good / High boundary for Ortho P Indicative Quality – 0.00125 mg/l). The increased load due to the WWTP in IE_SH_26S021800 (SHANNON Upper_120) also has a negligible impact as a result of the nutrient removal included in the treatment process.

Table 4-A: Increased loading and concentrations to water bodies connected to the WSZs ***(note: where existing monitoring data not available, a surrogate Indicative Quality is derived from ecological status of the WB or Ortho P / Ecological status of neighbouring WBS, the mid-range of that indicative quality is used as Baseline Concentration)***

EU_CD / NAME	Ortho P Indicative Quality and Trends (distance to threshold) *[Surrogate Indicative Quality indicated in italic]*	Baseline Ortho P Conc. mg/l *[Surrogate Conc. given in italic]*	75% of Indicative Quality threshold mg/l	Ortho P load to GW due to dosing kg/yr	Potential Increase in Ortho P Conc. due to Dosing mg/l	Potential Baseline for Ortho P Conc. following dosing mg/l	Notes
IE_SH_26B071200 BOOR_020	*Good*	*0.030*	*0.033*	*0.0*	*0.0000*	*0.030*	
IE_SH_26B100100 BREENSFORD_010	*Good*	*0.030*	*0.033*	*3.2*	*0.0002*	*0.030*	
IE_SH_26B100400 BREENSFORD_020	*Good*	*0.030*	*0.033*	*19.5*	*0.0009*	*0.031*	
IE_SH_26C460200 CLOONBONNY STREAM_010	High Near	0.022	0.019	4.1	0.0008	0.023	
IE_SH_26D060200 DUNGOLMAN_020	*Poor*	*0.077*	*0.087*	*0.0*	*0.0000*	*0.077*	
IE_SH_26G060300 GLASSAN STREAM_010	*Moderate*	*0.046*	*0.051*	*5.3*	*0.0007*	*0.046*	
IE_SH_26S021660 SHANNON (Upper)_110	*Poor*	*0.077*	*0.087*	*28.9*	*0.0000*	*0.077*	
IE_SH_26S021800 SHANNON (Upper)_120	High Upwards Far	0.012	0.019	100.1	0.0000	0.012	MP1 ‡
	High Far	0.012	0.019		0.0000	0.012	MP2 ‡
	High Far	0.016	0.019		0.0000	0.016	MP3 ‡
	High Far	0.013	0.019		0.0000	0.013	MP4 ‡

‡ Load from WWTP / SWO following treatment added
MP: multiple Monitoring Points given for waterbody

There are three lake water bodies directly affected by this WTP. The Lakes water bodies are all part of the wider Lough Ree Lake complex and a vollenweider assessment of the additional loading has been undertaken for the combined lake areas based on the outflows from Lough Ree and the sum of all loading to each of the individual lake water bodies, i.e. IE_SH_26_750a Lough Ree, IE_SH_26_750b, Lough Killinure and, IE_SH_26_750d, Ballaghkeeran Lough. Table 4-B shows the results of the assessment.

Table 4-B: Vollenweider assessment of Lakes within the WSZ

EU_CD / NAME Lakes	Parameter	TP Indicative Quality and Trends (Distance to Threshold. Surrogate Indicative Quality in italic	Baseline Conc. Surrogate Conc. given in italic mg/l	TP Total Dosing Load kg/yr	Estimated Existing Areal loading based on Vollenweider mg/m2/yr)	Estimated Post dosing Areal loading based on Vollenweider(mg/m2/yr)	Lc (mg/m2/yr)	% Increase
IE_SH_26_750 Lough Ree COMBINED	TP	Good Upwards Far	0.021	34.1	576.3	576.6	405	0.06%

The assessment indicates that the critical loading is being exceeded under the existing situation, however the existing orthophosphate levels in the Lough are indicative of good status and the increase in the critical loading is less than 0.1%. This increase is not considered to be significant and will not result in any further impact on the lake ecology which has is at Good status, the OECD Trophic Assessment confirms the lake as Oligotrophic.

There are no transitional water bodies directly affected by this WTP.

Summary and Mitigation Proposed

Assessment of Athlone WTP in isolation suggests minimal impact on the receiving waterbodies due to orthophosphate dosing. The modelled increases in load and concentrations to both groundwater and surface water receptors are insignificant.

The breakdown from source to pathway is shown in Figure 1 and fate of P loads from Athlone WTP is depicted in the Figure 2.

The cumulative impacts on Shannon Catchment (HAs 24, 25, 26, and 27) associated with phosphate dosing from following additional WTPs are assess in combination with Athlone WTP and summarised in Table 5.A and Table 5.B below. Additional loads due to dosing in the Boyne catchment (HA7) are also included.

- 005 Clareville WTP – Limerick City Water Supply
- 012 Tuam WTP – Tuam RWSS
- 013 Portloman WTP – Ardonagh Reservoir
- 017 Drumcliffe WTP - Ennis PWS
- 019 New Doolough WTP - W.Clare RWS (New WTP)
- 020 Castle Lake WTP - Shannon/Sixmilebridge RWSS
- 021 Rossadrehid WTP – Galtee Regional

- 034 Lough Forbes WTP – Longford Central
- 040 Coolbawn – Nenagh RWSS
- 049 Ballany WTP – Ballany High Level Reservoir
- 058 Ballinasloe Town WTP - Ballinasloe Public Supply
- 068 Rockingham WTP - Boyle Regional WSS
- 081 Ballinagard Springs WTP - Roscommon Central Water Supply Scheme
- 128 Longford Springs WTP Future Supply - Castlerea WSS
- 140 Lisbrock WTP - SRRWSS Lisbrock
- 161 Freemount WTP – Zone 4 Allow Regional
- 178 Clavin's Bridge WTP – Kells/Oldcastle WS
- 184 Foileen WTP - CappamoreFoileen Water Supply
- 185 Ballinlough/ Loughglynn (Ballybane Springs) - Ballinlough/Loughglynn
- 190 Ironmills Pump Station - Ironmills
- 216 Kylebeg WTP – Borrisokane
- 237 Killadysert WTP - Killadysert PWS
- 238 Williamstown WTP - Williamstown PS3
- 246 Ballingarry Spring WTP - Ballingarry Water Supply
- 260 Kilcolman PS - Rathkeale Water Supply
- 267 Cloughjordan Pump Station – Cloughjordan
- 321 Ahascragh WTP - Ahascragh P.S.
- 355 Croom Bypass Pump Station - Croom Water Supply

Table 5-A: Cumulative assessment of the increased loading and concentrations to receiving water bodies common to the WSZs within the Shannon catchment where orthophosphate dosing is proposed

EU_CD / NAME	Ortho P Indicative Quality and Trends (distance to threshold) Surrogate Indicative Quality indicated in *italic*	Baseline Conc. Surrogate Conc. given in *italic* mg/l	75% of Indicative Quality threshold mg/l	Cumulative Ortho P load to SW from leakage, DWWTS & agglomerations kg/yr	Conc. using 30%ile flows mg/l	PO4 Potential Baseline Conc. following dosing mg/l	Notes
IE_SH_26S021660 SHANNON (Upper)_110	*Poor*	*0.077*	*0.087*	47.5	0.0000	0.077	
IE_SH_26S021800 SHANNON (Upper)_120	High Upwards Far	0.012	0.019	611.7	0.0002	0.012	‡
	High Far	0.012	0.019			0.012	
	High Far	0.016	0.019			0.016	

		High Far	0.013	0.019			0.013	
	IE_SH_26S021920 SHANNON (Upper)_130	*Moderate*	*0.046*	*0.051*	*891.5*	*0.0003*	0.046	‡
	IE_SH_25S012000 SHANNON (LOWER)_010	High	0.011	0.019	1021.2	0.0002	0.012	‡
	IE_SH_25S012060 SHANNON (LOWER)_020	*High*	*0.015*	*0.019*	*1029.7*	*0.0002*	*0.015*	‡
	IE_SH_25S012350 SHANNON (LOWER)_030	High	0.011	0.019	1040.8	0.0002	0.008	MP1 ‡
		High	0.011	0.019			0.009	MP2 ‡
		High	0.011	0.019			0.009	MP3 ‡
		High	0.011	0.019			0.007	MP4 ‡
		High	0.011	0.019			0.007	MP5 ‡
		High	0.011	0.019			0.008	MP6 ‡
		High	0.011	0.019			0.006	MP7 ‡
		High	0.011	0.019			0.007	MP8 ‡
		High	0.011	0.019			0.008	MP9 ‡
		High	0.011	0.019			0.008	MP10 ‡
		High	0.011	0.019			0.009	MP11 ‡
	IE_SH_25S012500 SHANNON (LOWER)_050	High	0.012	0.019	1283.8	0.0002	0.012	‡
	IE_SH_25S012600 SHANNON (LOWER)_060	High	0.013	0.019	2023.7	0.0003	0.021	MP1 ‡
		High	0.018	0.019			0.017	MP2 ‡
		Good	0.030	0.019			0.014	MP3 ‡
		High	0.014	0.019			0.010	MP4
		High	0.010	0.019			0.02	MP5
	IE_SH_060_0900 Limerick Dock	High (S) Far	0.008	0.019	7516.7	0.0010	0.008	‡
		High (W) Far	0.012	0.019			0.012	‡

IE_SH_060_0800 Upper Shannon Estuary	High (S) Near	0.020	0.019	8848.1	0.0010	0.020	‡
	High (W) Near	0.011	0.019			0.011	
IE_SH_060_0300 Lower Shannon Estuary	High (S) Far	0.012	0.020	12412.9	0.0002	0.012	‡
	Good (W) Far	0.025	0.036			0.025	‡
IE_SH_060_0000 Mouth of River Shannon	High	0.008	0.019	13317.6	0.0001	0.008	‡

‡ Load from WWTP / SWO following treatment added
*Trends are statistically significant
MP: multiple Monitoring Points given for waterbody
(S) = Summer monitoring period, (W) = Winter monitoring period

Table 5-B: Vollenweider assessment of cumulative load to Lakes within the WSZs

EU_CD / NAME Lakes	Parameter	TP Indicative Quality and Trends (Distance to Threshold. Surrogate Indicative Quality in *italic*	Baseline Conc. Surrogate Conc. given in *italic* mg/l	TP Total Dosing Load kg/yr	Estimated Existing Areal loading based on Vollenweider mg/m²/yr)	Estimated Post dosing Areal loading based on Vollenweider(mg/m²/yr)	Lc (mg/m²/yr)	% Increase
IE_SH_26_750 Lough Ree COMBINED	TP	Good Upwards Far	0.021 *	529.5	576.3	581.4	405	0.9%

*baseline from 2017 WFD

The increase in areal loading to the Lough Ree complex of lakes is less than 1% and this is still considered insignificant. The OECD trophic status of the lake remains at oligotrophic post dosing.

The cumulative assessment has demonstrated that there will not be a significant impact on these water bodies.

MITIGATION OPTION – None required

RAG STATUS – GREEN

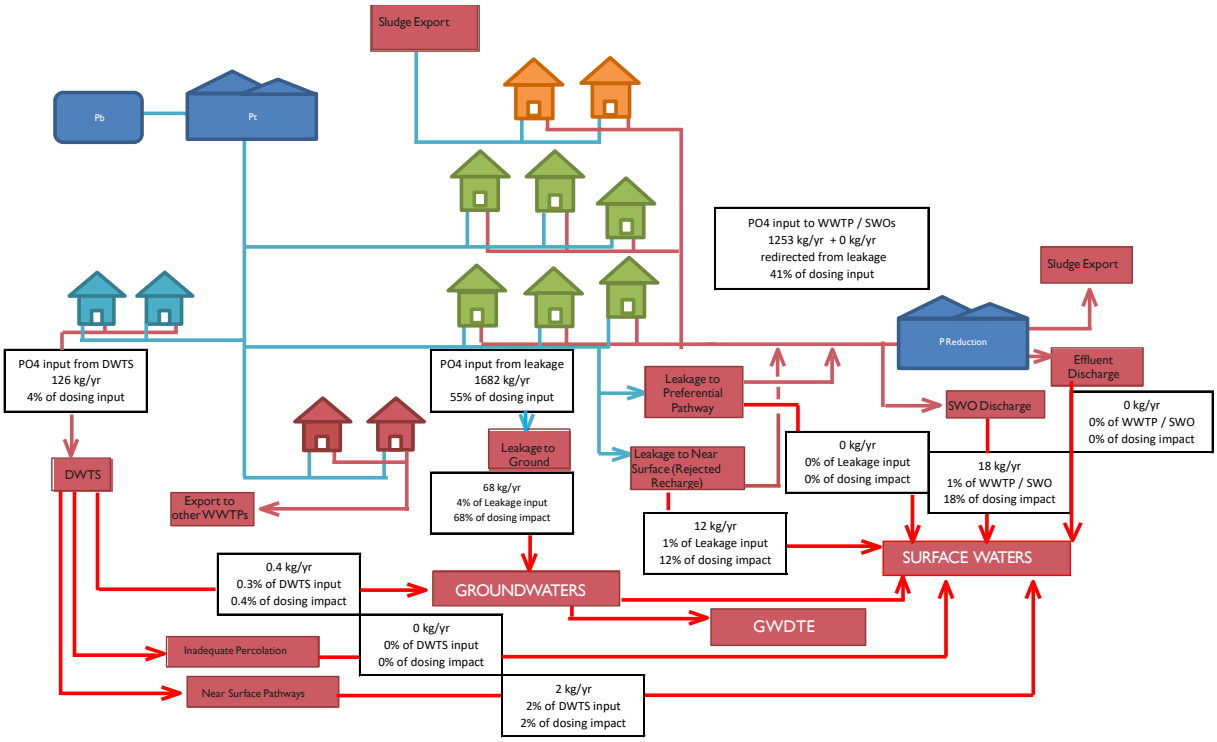
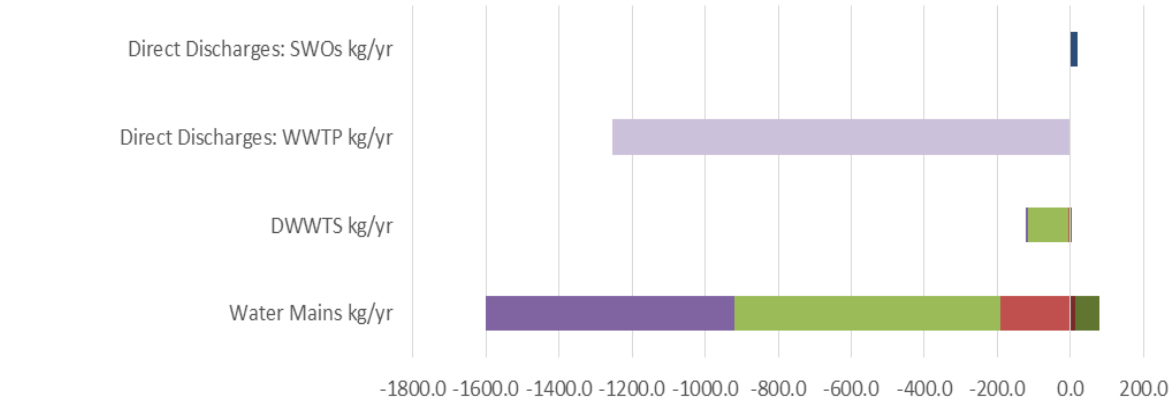


Figure 1 – Source Pathway Receptor model for Athlone WTP illustrating key sources and pathways to the associated WSZs.



	Water Mains kg/yr	DWWTS kg/yr	Direct Discharges: WWTP kg/yr	Direct Discharges: SWOs kg/yr
Load attenuated in Preference (inadequate percolation) pathway	0.0	0.0		
Load attenuated in Near Surface Pathway	-192.0	-4.7		
Load attenuated in 1m below trench	-729.3	-112.2		
Load attenuated in Subsurface Pathway	-680.7	-6.5		
Load intercepted by gravity main in Preference Pathway	0.0			
Load intercepted by gravity main in Near Surface Pathway	0.0			
Load reaching SW direct or via Preference (inadequate percolation) Pathway	0.0	0.0	0.0	18.2
Load reaching SW via Near Surface Pathway	11.9	1.9		
Load reaching SW via Subsurface Pathway	67.6	0.4		
Load treated in WWTP			-1252.9	

Figure 2 – Fate of orthophosphate loads modelled for Athlone WTP impacting on IE_SH_26S021800 (SHANNON (Upper)_120) and downstream waterbodies due to dosing by source type, indicating levels of attenuation in pathways and relative impact on the surface water receptor.