BW CONSULTANT ENGINEER LTD.
Environmental and Ecological Consultants

Consultant's Report to the Inspectorate Ecologist
Prepared for An Bord Pleanála (ABP)
Case Ref. No.: ABP-313586
Date: November 2024

Development	The development consists of the construction of an extension to an existing wastewater treatment plant (WWTP) where the works include:- A) Demolition of an existing storage building (17.50m2) and construction of a new single-storey industrial type building to enclose the DAF unit granted planning permission under planning reference LB180300 and to provide new enclosed storage and control rooms (total floor area 119m2). B) Install a new sludge press at intake to WWTP, change aeration tank to anoxic tank, install 2 no. additional aeration tanks, alteration to perimeter berm to increase the footprint of WWTP, by 539m2 to that granted planning permission under planning permission LB180300. C) Treated wastewater rising main from the site of the proposed development to new discharge point at the River Boyne (distance 7.2km), where pipeline shall be laid along a section of Windmill Road, the L1013, Yellow Furze Road, the L1600 (Boyne Road), and the unnamed local road leading from the L1600 to the private lands abutting the River Boyne at the discharge point. This planning application is accompanied by an Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS).
Location	Painestown, Seneschalstown, Dollardstown, Hayestown-Carnuff Little & Ardmulchan, Navan, Co. Meath
Planning Authority	Meath County Council
Reg. Reference No.	21/424
Applicant(s)	Dawn Meats Ireland (Unlimited Company)

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This report was produced by BW Consultant Engineer Ltd. (BWCE Ltd.) Environmental & Ecological Consultants, on behalf of An Bord Pleanála, the client, with all reasonable skill, care and due diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client.

The information which we have provided is true and has been prepared in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct. We confirm that the opinions expressed are our true and professional bona fide opinions.

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Executive summary

On the 27th of April 2022, Meath County Council granted permission (Ref.: 21/424) (with conditions) for a development consisting of the construction of an extension to an existing wastewater treatment plant (WWTP), including a new discharge point at the River Boyne. This application was accompanied by Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) reports. An Bord Pleanála has since received 15 no. third-party appeals regarding the Local Authority's decision to grant permission for the development, of which 3 no. were deemed invalid. Multiple submissions were received by Meath County Council during the planning process, these included submissions from the Development Applications Unit (DAU), An Taisce, and Inland Fisheries Ireland (IFI).

In November of 2024, Dr Barry Walls, principal environmental and ecological consultant with BWCE Ltd., was engaged by An Bord Pleanála (ABP), to prepare a written report to the Inspectorate Ecologist, concerning the above planning appeal (Ref. No.: 313586) for the following:

1. Provide an independent appraisal of the assessment presented in the assimilative capacity and mixing models presented in the planning appeal documentation.

2. Provide an independent assessment of the implications for the water quality objectives set out for the River Boyne in line with the provisions of the Water Framework Directive (WFD) in view of current best practice.

3. Assessment of impacts on hydrology and aquatic ecology based on the information presented in the planning appeal, scientific evidence, and professional judgement of the Environmental Impact Assessment report (EIAR), Natura Impact Statement (NIS) and document titled Report to the Third-Party Appeal reasons (including revised NIS dated June 2022) as relevant to the assessment of impacts on Hydrology.

4. Review third-party appeal reasons and submissions as relevant to water quality and the Water Framework Directive including the appeal made by Inland Fisheries Ireland among others.

The findings are summarised as follows:

1. The results of the Assimilative Capacity Assessment and Mixing Model(s) were deemed to be *inconclusive*.

2. Following the independent assessment of the implications for the water quality objectives set out for the River Boyne, in line with the provisions of the Water Framework Directive, it *could not* be ruled out beyond reasonable scientific doubt, that the project (and its associated activities) would not result in the deterioration of the status of the River Boyne and/or jeopardize the attainment of *good* surface water quality status, within the prescribed timeframe.

3. Based on the information and scientific evidence provided within the planning appeal, potential detrimental impacts on hydrology and aquatic ecology *could not* be ruled out beyond reasonable scientific doubt. It is the Author's professional judgement that, the assessment presented of the impacts of the proposed development and its associated activities on hydrology, was *incomplete*.

4. The third-party appeal reasons and submissions, relevant to concerns regarding water quality and the Water Framework Directive, cannot be disregarded.

The results of the Assimilative Capacity Assessment and Mixing Model appraisal are attributed to the data gaps/lacunae regarding the proposed development and its activities, and the lack of representative environmental data relating to the receiving environment at the outfall location and the zone of influence (ZoI) (see Section 2.1). The latter related primarily to: 1) a lack of site-specific (flow and water quality) data relating to the outfall location and ZoI, 2) failure to provide adequate rationale for the 95%ile flow value used within analyses, 3) the water quality data frequency and source(s), and subsequent data processing methods, may not adequately represent conditions at the outfall location, nor allow adequate assessment of the effects of flow variations associated with the weirs and pool habitat near the outfall location, 4) the exclusion of upstream pollution sources, especially the Navan WwTP input from the modelling analysis, based on the rationale that low-frequency EPA monitoring data was deemed to represent the associated effects on ambient water quality at the proposed outfall location. Furthermore, other pollutant sources, including the documented water quality issues near the Dollardstown stream confluence, were not accounted for within the Assimilative Capacity Assessment and Mixing Model.

Based on the information provided by the applicant, and the lacunae and gaps highlighted in Section 2.1, it *could not* be ruled out, beyond reasonable scientific doubt, that the project (and its associated activities) would not result in deterioration of the status of a surface waterbody and/or jeopardize the attainment of *good* surface water quality status, within the prescribed timeframe (see section 2.2).

Finally, based on the information and scientific evidence provided within the planning appeal, and the conclusions reached concerning the Assimilative Capacity Assessment and Mixing Models, potential detrimental impacts on hydrology and aquatic ecology *could not* be entirely ruled out beyond reasonable scientific doubt (see section 2.3). Insufficient impact(s) characterization, and inadequate ecological and environmental data relating to the receiving environment, limited the assessment of the potential construction and operational impacts associated with the proposed development, on hydrology and aquatic ecology. It is the Author's professional judgement that, the assessment of the impacts on hydrology presented is *incomplete* (see section 2.4).

1. Introduction

1.1. Background

The proposed development is located at Painestown, Seneschalstown, Dollardstown, Hayestown-Carnuff Little & Ardmulchan, Navan, Co. Meath, approximately 8km east of Navan Town. Planning Permission, with conditions (Ref.: 21/424), was granted by Meath County Council on the 27th Of April 2022, for the following:

> *The development consists of the construction of an extension to an existing wastewater treatment plant (WWTP) where the works include:- A) Demolition of an existing storage building (17.50m^2) and construction of a new single-storey industrial type building to enclose the DAF unit granted planning permission under planning reference LB180300 and to provide new enclosed storage and control rooms (total floor area 119m^2). B) Install a new sludge press at intake to WWTP, change aeration tank to anoxic tank, install 2 no. additional aeration tanks, alteration to perimeter berm to increase the footprint of WWTP, by 539m^2 to that granted planning permission under planning permission LB180300. C) Treated wastewater rising main from the site of the proposed development to new discharge point at the River Boyne (distance 7.2km), where pipeline shall be laid along a section of Windmill Road, the L1013, Yellow Furze Road, the L1600 (Boyne Road), and the unnamed local road leading from the L1600 to the private lands abutting the River Boyne at the discharge point. This planning application is accompanied by an Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS). This application relates to a development which is for the purposes of an activity which holds an Industrial Emissions Licence (Reg No. P0811-02). Significant Further Information/Revised plans submitted on this application.*

The decision of the Local Authority to grant conditional permission (Ref.: 21/424) with attached conditions, was appealed to An Bord Pleanála (Ref.: PL17.313586) in May 2022; there are eleven active third party appeals. In November 2024, An Bord Pleanála engaged Dr Barry Walls of BW Consultant Engineer Ltd., to provide a written report to the Inspectorate Ecologist concerning the items listed in section 1.2.

1.2. Client brief and the report scope

The client brief received from An Bord Pleanála outlined the following requirements:

I. Prepare a written report to the Inspectorate Ecologist in relation to the above planning appeal (Ref. No.: 313586) concerning the following:

   a. Provide an independent appraisal of the assessment presented in the assimilative capacity and mixing models presented in the planning appeal documentation.

   b. Provide an independent assessment of the implications for the water quality objectives set out for the River Boyne in line with the provisions of the Water Framework Directive in view of current best practice.

c. Assessment of impacts on hydrology and aquatic ecology based on the information presented in the planning appeal, scientific evidence, and professional judgement of the Environmental Impact Assessment report (EIAR), Natura Impact Statement (NIS) and document titled Report to the Third-Party Appeal reasons (including revised NIS dated June 2022) as relevant to the assessment of impacts on Hydrology.

d. Review third-party appeal reasons and submissions as relevant to water quality and the Water Framework Directive including the appeal made by Inland Fisheries Ireland amongst others.

e. Undertake a site visit as necessary.

f. Be an authorised person for the purpose of section 252 of the Planning and Development Act, 2000 as amended.

1.3. Statement of authority

Dr Barry Walls is a Chartered Ecologist (CEcol) and Chartered Environmentalist (CEnv), and is the principal consultant with BW Consultant Engineer Ltd. Dr Walls is a full member of the Chartered Institute of Ecology and Environmental Management (MCIEEM) and has over 24 years of experience working within the planning and development, and research sectors.

Dr Walls holds a Ph.D in Environmental Science (Ecology), a Masters degree in Environmental Management, and an Honours degree in Environmental Engineering. His areas of specialism and research background include ecology, geo-hydromorphology, hydrology, environmental science, GIS/remote sensing, and river restoration. Dr Walls' specialism includes Freshwater Pearl Mussel and he is licenced to carry out Stage 1 to 4 surveys within Ireland and Northern Ireland. He has led Freshwater Pearl Mussel monitoring programmes for NPWS's Article 17 (Habitats Directive) requirements. Dr Walls holds bat derogation, bat handling, and bat research licences, in Ireland and Northern Ireland.

Dr Walls has been employed by Trinity College Dublin as Lead Researcher on the Hydromusindex Project (Freshwater Pearl Mussel), contracted by The Department of Agricultural, Food and the Marine as an external specialist consultant, and is listed on An Bord Pleanála's Specialist Consultants panel (ecology, ornithology, hydrology and environmental science).

2. Results

2.1. Independent appraisal of the assessment presented in the assimilative capacity and mixing models presented in the planning appeal documentation.

2.1.1. Appraisal

Variation of river flow discharge in different seasons, notwithstanding long-term changes to the hydrological regime and temperatures associated with global warming, can modify the assimilation capacity of surface waters by up to 97%, in some cases, and cause exceedance of mandatory parameter targets (Torres-Bejarano *et al.*, 2022; Hashemi Monfared *et al.*, 2017). Wastewater in slaughter/meat plants can contain high loads of contaminants, whose levels may exceed several times the respective content in domestic wastewater (Makowska *et al.*, 2021).

Within the Preliminary Pumping Station Design report[1] provided by the Applicant, septicity calculations and conclusions stated were based on the daily minimum flow of 280 m^3/day (estimated at 70% of daily max flow), a 140mm internal pipe diameter, and a retention time of 6 hours. Within the latter report, the rising main pipe internal diameter was stated as 140mm, but within the EIAR the nominal bore stated was listed at 150mm (EIAR, 2022, attachment p. 86). The rising main length quoted within the various reports differs between 6.1km, 6.15km, and 7.2km.

The Effluent Dispersion Mixing Zone Analysis was carried out by McCloy Consulting (Document. Ref: M02171-01 WQ01) (EIAR, 2022, attachment 8.5). An Assimilative Capacity Assessment was carried out by PES Ltd (Ref.: AC 20 9684 R2) (EIAR, 2022, attachment 8.6) to predict the river's ability to accommodate treated effluent discharge of Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Molybdate Reactive Phosphorus (MRP), Nitrogen (N), Total Ammonia (TA), Unionised Ammonia (UiA), Total Suspended Solids (TSS) only, from the Dawn Meats (Slane) facility.

The applicant has confirmed the following details:

- The proposed treated final effluent quality following treatment on site (EIAR, 2022, table 2.2, p. 83).

- The proposed discharge outfall location (E292417, N271406) is c. 10m upstream of the confluence of the Dollardstown River (EIAR, 2022, attachment 8.6, p. 4-5).

- The EPA Office of Environmental Assessment had confirmed a 95%ile flow of 4.8 m^3/s at the closest hydrological gauge, c. 4 km downstream at Slane Castle (EIAR, 2022, attachment 8.6, p. 6)[2].

[1] Preliminary Pumping Station Design, 19/2/2020, P. 6 (Document Ref: - 1604-02-Doc-03 (Rev 0.0)).

[2] The applicant referred to the correspondence with the EPA Office of Environmental Assessment, regarding the EPA's advised 95%ile flow rate of 4.8 m^3/s, and stated that the correspondence was provided within appendix C of that report (i.e. EIAR, 2022, attachment 8.6 - Hydrological Assessment of Proposed Discharge to Watercourse: Ref.: AC 20 9684 R2). However, appendix C appeared to be absent and the method upon which the quoted figure is based cannot be further determined or appraised. Attached 8.7, titled consultation correspondence, does not contain reference to any such correspondence(s).

- All monitoring water quality values (except COD) used have been obtained from 'Broadboyne Bridge' EPA monitoring station (RS07B042000), which is located c. 0.65km upstream of the proposed outfall location. The water quality values used were recorded between 2007 – 2021, and averaged summer and winter values (only) were listed as ambient values for parameters (EIAR, 2022, attachment 8.6, p. 7); not all water quality parameters data sets spanned the 2007-2021 period stated.

- Monitored COD values (2008 to 2010) have been obtained from station 'Slane Bridge' (RS07B042100), located c. 5km downstream from the proposed outfall location (EIAR, 2022, attachment 8.6, p. 7). Again, averaged summer and winter values (only) were listed as ambient values.

- *Molybdate reactive phosphorus, total ammonia and nitrogen are found to exceed the EQS threshold level in the immediate vicinity of the outfall*. Based on the mixing model results, it was claimed that for each of these contaminants, after a short distance downstream of the discharge point (ranging from 3-6m) the pollutant was sufficiently dispersed, such that levels drop below the legislative limits.

- For all other parameters indicated, the concentrations *do not* exceed the relevant EQS threshold levels at any point within the study area.

Within tables 2.2, 2.3, and 2.4 (EIAR 2022, attachment 8.6, pp. 7-8), the applicant has outlined 1) the background water quality values for the receiving watercourse[3], 2) the proposed final effluent discharge limits, and 3) the maximum permissible concentrations (EQS) downstream of the discharge, respectively. The limits chosen for BOD_5 (2.6 mg/l), orthophosphate (0.075mg/l PO_4-P)[4], and total ammonia (0.14 mg/l N), were based on the 2019 Surface Water Regulations (S.I. 77 of 2019). Limits for COD (40 mg/l) and nitrogen (3.0 mg/l N) were based on the Surface Water Regulation (S.I. 294 of 1989). Those for unionised ammonia (0.0165 mg/l NH_3-N) and suspended solids (25 mg/l SS) were based on the Salmonid Water Regulations (S.I. 293 of 1988).

Historical final effluent data from the plant has not been provided, except for an average pH value (mean) value of 7 that was confirmed between 2020-2021 (EIAR, 2022, attachment 8.5, section 3.2.2, p. 17). Based on the latter, pH was excluded from further analysis. It was observed that the proposed final effluent quality values for some parameters (EIAR, 2022, table 2.2 p. 83) differed from value ranges presented within the 2005 BREF document 'Slaughterhouses and Animals By-products Industries' (EIAR, 2022, attachment 8.6, section 2.4.1, table 2.3, p. 8). Within section 3.5.4 of the Contingency Measure Summary (NIS, 2022, p. 94), the applicant has provided an expected effluent monitoring schedule and has stated that such monitoring programmes are typically included within an Industrial Emissions Licence condition (see Table 3.1, section 3.5.4). It is noted that, whilst the existing facility

[3] According to the EPA, data is available for 43 no. parameters at the Broadboyne Bridge sampling station (Ref.: RS07B042000) between 23/04/2007 to 14/10/2024 (source: https://www.catchments.ie/data/#/waterbody/IE_EA_07B042010?_k=pzsquq).

[4] Parameter concentrations for other parameters, including Total Phosphorus, do not appear to have been provided, or considered within the EIAR (2022), or NIS (2022).

currently holds an Industrial Emissions Licence, no existing monitoring data has been provided.

According to the applicant, the available water quality data used was recorded for the period 2007 – 2021. Water quality data was not provided for the River Boyne at the outfall location. It cannot be concluded that historical low-frequency data, including that relating to sampling location(s) c. 5km downstream and dated between 2008-2010, accurately represents either, the current baseline scenario at the outfall location, or any cumulative effects from development and/or land use, within the contributing catchment since that time period (EIAR, 2022, attachment 8.5, p. 15). The applicant confirmed that the Slane monitoring station was c. 5km downstream of the proposed outfall location, which is beyond the stated 2.4km study area limit (EIAR, 2022, attachment 8.5, p. 5). The reliance upon distant historical low-frequency data for establishing baseline conditions at the proposed outfall, and its use within subsequent analyses, is questionable.

Data processing included the production of averaged values for the sampling periods indicated for each parameter. These were subsequently used to produce averaged values for 'winter' and 'summer' seasons only, which were, in turn, re-averaged to produce the final data within analyses (EIAR, 2022, attachment 8.5, p. 15). The applicant does not appear to have provided data relating to other seasons (i.e. spring or autumn), and, at times, high values were excluded that were deemed to be outliers. The scale of data processing appears excessive; using the 'average of averages' can distort the original central tendency of data. Analysis based on heavily averaged data can limit the representativeness of parameter concentrations regarding the average and/or geometric mean values of an original dataset.

Within the Mixing Zone Model Report (EIAR, 2022, attachment 8.5, section 3.2.1, p. 15), the applicant has referred to high and low data outliers within the datasets. A limited review of the monitoring data was presented within Appendix B (EIAR, 2022, attachment 8.5), relating to the heavily averaged parameter values for winter and summer seasons only; statistical and/or graphical presentation of the original dataset range(s), outlier values, or interquartile ranges, have not been provided. Original datasets were not provided, thereby preventing the author from carrying out an appraisal of the raw data values used and evaluating the validity of any datum referred to as 'outliers'; at times the applicant has used parameter averages including alleged outliers, and at other times lower background levels have been used excluding alleged outliers (i.e. COD and N) (EIAR, 2022, attachment 8.5, table 3.2, p. 16 & unnumbered tables in Appendix B). The annual monitoring period range for each parameter differed and it is unknown whether the periods stated were inclusive of the years listed, or not. The original and final sample size (*n*) (including and excluding outliers) for the parameters used within analyses were not stated.

The results of the analysis confirmed that molybdate reactive phosphorus (0.08 mg/l), total ammonia (0.16 mg/l) and nitrogen (3.23 mg/l) levels were found to exceed the EQS thresholds in the vicinity of the outfall (EIAR, 2022, p. 113 & p. 226). It was stated that for each of these contaminants, after a short distance downstream of the discharge point (ranging from 3 - 6m), the pollutant(s) were sufficiently dispersed (EIAR, 2022, P. 226). However, it was later confirmed that the molybdate reactive phosphorus, total ammonia and nitrogen

concentrations exceeded the EQS thresholds for 8m, 7m and 20m, respectively, during estimated minimum-flow simulations (EIAR, 2022, attachment 8.5, section 4.5.2, p. 26).

On the 18th of May 2022, the IFI (ABP Ref.: 053569-22, p. 14) questioned the appropriateness of both, the hydrological dataset and the background concentration levels used within analysis. Several of the background concentration levels claimed by the applicant would be representative of between *good* and *high* WFD status thresholds (S.I. 272 of 2009/S.I. No. 77 of 2019). Due to the *moderate* WFD status of the River Boyne, IFI advised that the following average background concentrations should be used within analysis: 21.8°C for temperature, 4.0mg/l BOD, 0.11 mg/l Ortho-P and 0.13 mg/l Total Ammonia. IFI also confirmed that the area around the proposed discharge is valuable habitat for Atlantic Salmon (ABP Ref.: 053569-22, p. 14), which was also confirmed in 2022 (Ecofact, 2022, p. 2 & p. 12); pool habitats provide essential refugia for Salmonids and other aquatic species.

Within the Mixing Zone Model Report (EIAR, 2022, attachment 8.5, section 3.2.1, p. 16), it was deemed suitable to *omit* the upstream discharge from Navan WwTP from modelling analysis, based on the rationale that the low-frequency EPA monitoring data used would be 'representative of effects on ambient water quality'; the downstream outfall from the Slane WwTP discharge has also not been included within the assessment, as it was deemed to be beyond the study area (EIAR, 2022, attachment 8.5, p. 5). Water quality sampling carried out by the EPA can be limited and/or infrequent (i.e. a monthly sampling), at best, and data produced relates to water quality conditions at the time of sampling only. Low-frequency water quality sampling data (heavily averaged) may not adequately represent critical parameter concentration ranges, or water quality trends, nor account for episodic events and/or low-flow conditions that could result in detrimental cumulative and/or in-combination impacts and effects. Such data types are not an ideal substitute for high-frequency water quality monitoring data at the outfall location, especially where the receiving surface water WFD status requirement has not been reached, or is *At Risk*; episodic events can also result in the discharge of partially treated wastewater from WwTP, whereas low/baseflow conditions can result in increased flow propositional concentration(s).

Given that the proposed discharge flows may range up to 400m^3/day, any Assimilative Capacity Assessment and/or modelling inadequacies (lacunae), and/or associated failure(s) to achieve downstream legislative limits, significantly increases the risk of potential detrimental effects on the receiving water quality and receptors. The rationale stated for excluding the Navan WwTP input from modelling analysis, based on the use of low-frequency historical EPA monitoring data results, that have been heavily averaged, *is not accepted*. Based on the latter and the reasons previously highlighted, the results of the current Mixing Zone Model Report are deemed to be *inconclusive*.

Q values obtained by the EPA[5] confirmed a Q-value of 3-4 (*moderate*) in 2020, at the Dollardstown stream confluence (Plate 1 & Plate 2). Q values obtained from one minute sampling efforts (Ecofact, 2022) confirmed an initial Q-value of 3 (*poor*) at sampling points located upstream and downstream of the proposed outfall location; the macroinvertebrate sampling methodology included sampling at three points along/across the watercourse and

[5] Source: https://gis.epa.ie/EPAMaps/Water.

one minute duration vegetation sweeps (Ecofact, 2022, p. 5). Signs of eutrophication, high levels of siltation, and algal and bacterial growth, were reported near the proposed discharge location (Ecofact, 2022, p. 12); the source(s) and impacts (inc. cumulative impacts) of the observed water quality deterioration have not been considered within analyses.

The latter results highlight potential water quality issues near the Dollardstown stream confluence, that have not yet been accounted for within the Assimilative Capacity Assessment and Mixing Models presented; the source(s) and cause(s) of the documented water quality issues have not yet been identified, or quantified. As such, it cannot be ruled out that the background concentration levels recommended by the IFI are not appropriate; a site and project-specific high frequency multiparameter sampling program would be required to accurately evaluate multi-annual concentration levels and to identify trends, in order to produce accurate background concentration data relevant to the outfall location and the zone of influence (ZoI). Again, the reliance upon low-sampling frequency (heavily averaged) secondary data, which at times excluded higher (outlier) values within the Assimilative Capacity Assessment calculations and Mixing Models, is deemed *inadequate* for the proposed development. Moreover, the data sources used would not entirely account for: the suggested water quality deterioration reported near the location of the discharge point, the effects from the upstream Navan WwTP during varying flow conditions, the low flow effects associated with hydrological alteration caused by weirs within the ZoI, pollutant input(s) from other documented confluences, and the associated effects within the mixing plume(s). The results of Assimilative Capacity Assessment are deemed to be *inconclusive*.

Plate 1. The River Boyne at the Dollardstown stream confluence.

Plate 2. Upstream of the Dollardstown stream confluence at the River Boyne.

IFI (ABP Ref.: 053569-22, p. 14) have stated that the flow details (i.e. 95%ile) used are 'vague and include up to 2018' only, lacking consideration of 'droughts that occurred in 2018 and 2021', with subsequent implications for the Assimilative Capacity Assessment results; flow data has not been provided for the outfall location. The applicant indicated that the minimum 2018 flow (2.27 m^3/s) was adopted for use in the assessment (EIAR, 2022, attachment 8.5, p.

19 & p.26), based on data relating to the OPW's gauge near Slane[6]. In terms of climate change-related reductions for flow, the EPA recommended a 45% reduction for the River Boyne 95%ile flow, leading to a projected low flow value of 2.64 m^3/s, based on data relating to the Slane gauge (EIAR, 2022, attachment 8.5, p. 19). It was stated that the 'anticipated peak effluent flow rate from the facility would be 12.5 m^3/hour currently'. However, this only equates to a daily peak effluent flow rate of 300 m^3/day, as opposed to the 400 m^3/day listed (EIAR 2022, table 2.2 & table 2.3, pp. 83.).

The applicant has submitted Assimilative Capacity Assessment calculations based on an *estimated* 95%ile flow value of 4.8 m^3/s, but hydrological data has not been presented relating to the outfall location on the River Boyne; several weirs are located within the ZoI, which could result in modified hydrological conditions during low and/or base flow conditions, due to proportional effects associated with impoundment (EIAR, 2022, p. 229). The applicant confirmed that the *estimated* 95%ile flow value of 4.8 m^3/s related to the point of discharge, was based on data from the hydrological gauge station near Slane Castle (07012), which was scaled to account for the difference in catchment area compared to the downstream model extent only (EIAR, 2022, attachment 8.5, p. 19) (please refer to Appendix 1 for further details). According to the OPW, the long-term 95%ile flow value for the Slane Castle gauge (07012) between the 1954 to 2024 period, is approximately 4.46 m^3/s[7], which is based on a marginally larger contributing catchment area (i.e. c. 2408 m^2).

Within attachment 8.5 (EAIR, 2022) it was confirmed that under low-flow conditions, weirs (Plate 3) near the discharge location reach (upstream and downstream) will act as a sequence of stilling basins that will have a significant impact on flow velocities, affecting the dispersion of pollutants within the waterbody (EIAR, 2022, attachment 8.5, p. 20). Based on the low-frequency water quality monitoring results used, the lack of adequate high-frequency data relating to the outfall location, and the water quality issues highlighted near the Dollardstown Stream, it appears that any potential declining water quality associated with the upstream source during low-flow conditions have not been fully considered. Furthermore, it was stated that ('at least') 2 weirs downstream of the outfall appear to have been considered within analysis (EIAR, 2022, attachment 8.5, p. 20); according to the applicant, there are 5 no weir structures and several discharges to the River Boyne, upstream and downstream of the proposed outfall location (EIAR, 2022, attachment 8.5, p. 5). The author would stress the importance of considering the 'worst-case scenario' and the prevention of lacunae/gaps, given the source and scale of the proposed treated wastewater discharge, and the historical water quality issues documented for the River Boyne.

[6] The OPW indicate that more gauging is required at this location to confirm a suspected decrease in channel efficiency, and there are controls possibly affecting flows (source: https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/12235/Slane%20Castle/stationInfo.

[7] Source: https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/12235/Slane%20Castle/statistic

Plate 3. Example of the scale of a weir on the River Boyne, upstream of the proposed outfall location.

2.1.2. Summary

The results from the appraisal of the assessment presented in the assimilative capacity and mixing models as presented in the planning appeal documentation, are summarised as follows:

- The stated correspondence with the EPA, regarding the use of the 4.80 m^3/s 95%ile flow value, could not be located within EIAR attachment 8.6[8].

- The mass balance calculations for all parameters could not be located within EIAR attachment 8.6, thereby preventing an appraisal by the author.

- The results of the analysis confirmed that molybdate reactive phosphorus (0.08 mg/l), total ammonia (0.16 mg/l) and nitrogen (3.23 mg/l) levels were found to exceed the EQS threshold in the immediate vicinity of the outfall, for between 3-6m downstream of the discharge point. However, exceedance distances differed for low-flow scenarios, with figures up to 20m quoted for nitrogen content.

[8] Source: https://www.pleanala.ie/publicaccess/EIAR-NIS/313586/313586%20-%20eiar%20attachments.pdf?r=56223040760363246228729 7.

- The IFI's concern regarding the background concentration levels used cannot be disregarded. Values recommended by IFI may be more appropriate for a *moderate* WFD status watercourse.

- The rationale stated for excluding the Navan WwTP input from modelling analysis, based on the use of low-frequency EPA monitoring data that was heavily averaged and deemed to represent the associated effects on ambient water quality at the outfall location, *is not accepted*.

- A limited review of the water quality data was presented in Appendix B (EIAR, 2022, attachment 8.5). However, this review contained only heavily averaged concentration values for the parameters listed, which prevented the author from reviewing the raw data values, and data ranges, or evaluating the validity of any values referred to as 'outliers'.

- In 2020, the EPA confirmed a Q-value of 3-4 (*moderate*) near the Dollardstown stream confluence. Q values obtained from one minute sampling efforts (Ecofact, 2022) confirmed an initial Q-value of 3 (*poor*) at sampling points located near the proposed outfall location. Signs of eutrophication, and high levels of siltation in addition to algal and bacterial growths, were reported at the proposed discharge location (Ecofact, 2022, p. 12). Suggested water quality issues highlighted near the Dollardstown stream confluence were not accounted for within analyses or impact assessment(s), the source of which remains to be identified and quantified.

- The use of limited period(s) and low-sampling frequency secondary (heavily averaged) data within the Assimilative Capacity Assessment calculations and subsequent modelling, is viewed as being *inadequate* for the proposed development. The latter would not account for: the suggested water quality deterioration reported near the location of the discharge point (Ecofact, 2022, p. 12), the effects from the upstream Navan WwTP (especially during low-flow and episodic conditions), the low flow effects associated with hydrological alteration caused by weirs within the ZoI, input(s) from other confluences and sources of pollutants, and the associated effects within the mixing plume(s).

- It was highlighted that under low-flow conditions, weirs near the discharge location reach (upstream and downstream) will act as a sequence of 'stilling basins' that will have a significant impact on flow velocities, affecting the dispersion of pollutants within the waterbody (EIAR, 2022, attachment 8.5, p. 20). Based on the low sampling frequency of the water quality monitoring results used and the lack of provision of any other high-frequency data relevant to the outfall location, it appears that potential water quality issues associated with upstream sources during such conditions (or base flow conditions) have not been fully considered.

Based on the appraisal of the assessment presented in the assimilative capacity assessment and mixing models presented in the planning appeal documentation, the results of the *Assimilative Capacity Assessment* and *Mixing Models* are deemed to be *inconclusive*, at this point.

An independent assessment of the implications for the water quality objectives set out for the River Boyne, in line with the provisions of the Water Framework Directive, is presented in section 2.2.

2.2. Independent assessment of the implications for the water quality objectives set out for the River Boyne in line with the provisions of the Water Framework Directive in view of current best practice.

2.2.1. Assessment

Within the previous section, it has been concluded that the results of both, the *Assimilative Capacity Assessment* and *Mixing Models*, were deemed to be *inconclusive* (please refer to section 2.1 for details).

The principal legislation governing the control of the ambient quality of surface waters under the Water Framework Directive (60/2000/EC) in Ireland, is the European Communities Environmental Objectives (Surface Waters) Regulations (S.I. No. 272 of 2009), as amended. This legislation sets out legal limits for water quality parameters in the form of thresholds for quality status. Under the Surface Water Regulations classification system, a waterbody is classified based on the lowest score attained for any of the parameters included (i.e. Q-rating, BOD, orthophosphate, ammonia, temperature, pH, heavy metals and priority substance).

The main objectives of the EU Water Framework Directive are to achieve *good* status in both surface and groundwater bodies within the period indicated, and to prevent deterioration of the status, or potential of surface waters and groundwater. For natural surface waters, these environmental objectives drive the requirement to achieve or maintain *good* or *high* ecological status and *good* chemical status for surface waters (Article 2(a), S.I. 272 of 2009, as amended). The assessment of ecological status is based on biological quality elements as well as supporting hydromorphological, chemical and physicochemical quality elements, whilst chemical status is assessed against a range of environmental quality standards (EQSs) (Annex V of the WFD, Schedule 5 of S.I. 272 of 2009, as amended).

Article 28 (2) (Part III, S.I. 272 of 2009, as amended) requires that for a surface water body whose status is determined to be less than *good* (or *good* ecological potential and *good* surface water chemical status, as the case may be) when classified by the Agency, in accordance with these Regulations, it *shall* be restored to at least *good* status (or good ecological potential and good surface water chemical status as the case may be) by not later than the date outlined.

The EU Directive (91/271/EEC) relates to Urban Wastewater Treatment and the principles listed in Annex 1.B (3, 4 & 5) should be further considered; discharges to sensitive areas subject to eutrophication, as identified in Annex II, shall in addition, meet the requirements in Table 2 of Annex I (as amended by Directive 98/15/EC). Annex I.C. (91/271/EEC) requires industrial wastewater collecting systems to, 1) ensure that discharges from the treatment plants *do not* adversely affect the environment, or prevent receiving water from complying with other Community Directives, and 2) ensure that sludge can be disposed of safely in an environmentally acceptable manner. Annex II (a) defines a sensitive area as: freshwater bodies, estuaries and coastal waters which are found to be eutrophic or *which in the near future may become eutrophic if protective action is not taken*. The Water Framework Directive integrated the Nitrates Directive (91/676/EEC), which outlined that nitrate concentrations should not exceed 50 mg/L in waters, to prevent pollution and protect

drinking water quality. Furthermore, elevated nitrate levels in water can result in severe human health issues (Ng *et al.*, 2022) i.e. "blue baby syndrome" (methaemoglobinaemia).

Wastewater derived from agricultural sources and/or abattoirs can contain numerous types of contaminants. Wastewater from these sources can include trace elements like copper, zinc and iron from previous feed additives, cleaning agents and disinfectants, priority substances, pharmaceutical and veterinary residues, and other emerging pollutants (Ng *et al.*, 2022). The applicant does not appear to have provided comprehensive details regarding any such substances that may be retained within treated effluent and discharged; reference to 'chemicals' kept within the site were referred to, but were not further described (NIS, 2022, attachment 3.1, section 3.5.2 (page number not listed), and hazardous substances were referred to, but were not further described (NIS, 2022, attachment 3.2, p. 12). Assimilative capacity is typically extremely limited when dealing with toxic substances and can potentially lead to aggregation in aquatic species (Hashemi Monfared *et al.*, 2017). Moreover, information is lacking concerning the UV treatment efficacy rates for *all* potential pathogens within the wastewater, especially during prolonged max. daily flow conditions and equipment failure scenarios that may result in prolonged retention within the rising main: treatment efficacy rates are provided for Cryptosporidium only.

As outlined in the accompanying EIAR (2022), "a deterioration in the water quality of the River Boyne has the potential to impact upon human beings by adversely affecting abstracted drinking water quality, the fishery industry and water-based leisure activities in the area" (EIAR 2022, section 4.4.7, p. 113). The Consolidated version of the Meath County Development Plan 2021-2027 (incl. variations 1 & 2) was adopted on the 13th of May 2024. It outlined the following relevant requirements, which were not referenced within the accompanying EIAR, or the NIS reports:

- **RD POL 51**: To ensure that direct discharge of effluent from on-site wastewater disposal systems to surface water is not permitted.

- **RD POL 52**: To ensure wastewater treatment plants discharging into the Boyne catchment or to coastal Natura 2000 sites are suitably maintained and upgraded in advance of any additional loadings *beyond their capacity,* in order to protect water quality, as required.

The River Boyne has been classified as being *At Risk* of not achieving *good* status between Navan Town and Slane Bridge. The main channel of the River Boyne was designated as a salmonid water under the European Commission (Quality of Salmonid Waters) Regulations 1988[9]. The applicant has stated that the subject stretch of the River Boyne is also a *nutrient sensitive water*[10], comprising a *nitrate vulnerable zone* designated under the Nitrates Directive (91/676/EEC), and it is designated as *sensitive* under the Urban Wastewater Treatment Directive (91/271/EEC) (as amended) (Ecofact, 2022, p. 8). The EPA has confirmed

[9] The Freshwater Fish Directive (FFD) was revoked on 22nd of December 2013 by the Water Framework Directive.

[10] The Boyne_150 and Boyne_160 are listed as nutrient sensitive areas (EPA, 2021, p. 12)

increased trends in nitrogen concentration (See Appendix 2, Figure 6) in the River Boyne since 2013 (O'Boyle *et al.*, 2019).

According to the EPA (2024)[11], 73 surface water bodies currently fail to meet the WFDs 'good status' requirement within the Boyne catchment; in 2021, 75 rivers were *At Risk* of not meeting their WFD objectives (EPA, 2021). The main significant pressures documented within the catchment relate to: nutrient pollution, organic pollution, altered morphology (habitat) and hydromorphology, and chemical quality diminution. Within the Boyne_SC_110 subcatchment, the significant pressures impacting *At Risk* waterbodies (7 no.) include domestic wastewater, agricultural, urban wastewater, hydromorphology and anthropogenic pressures[12]. The significant issues affecting the Boyne_150 (WFD status 2016/2021: *Moderate*) relate to: nutrient, organic and an 'unknown' impact type. Those of the Boyne_160 (WFD status 2016/2021: *Moderate*) relate to hydrology, morphology, and nutrients.

EPA data for the SW 2016-2021 monitoring period for the BOYNE_160 (IE_EA_07B042100) indicated 'medium confidence' of a *Moderate* ecological status, but the confirmed failed chemical surface water status was attributed to concentration levels of Benzo(g,h,i)perylene. EPA monitoring data for the Slane Bridge monitoring station (grid reference: 296399.86E; 273644.79N), between 2007 to 2021[13], indicated a slight downward trend for Ammonia-Total (as N) (Appendix 2: Figure 4) and ortho-Phosphate (as P) (Appendix 2: Figure 5). Mean values during that period ranged between 0.062 mg/l (2014) to 0.025 mg/l (2021) for Ammonia (as N), and between 0.045 mg/l (2009) and 0.014 mg/l (2012) for ortho-Phosphate (as P). During the same monitoring period, a notable upward trend was reported for Total Oxidised Nitrogen (as N) (Appendix 2: Figure 6); mean values ranged between 3.115 mg/l (2007) to 1.797 mg/l (2013).

A Water Framework Directive Assessment compliance report was not submitted (or requested) during the planning process (Ref.: 21/424). A pre-consent method statement, detailing the instream work(s) component at the proposed outfall, was not provided. Table 1 (p. 20) summarises the results of an assessment of the implications of the proposed development (and its associated activities) on the water quality objectives for the River Boyne, in line with the Water Framework Directive, based on the information presented only.

Within the planning file (Ref.: 21/424), comprehensive detail was lacking regarding the construction methodology and the design of the rising main discharge point, and the proposed 'diffuser' system (inc. invert and cover levels) and the precast concrete anchoring system (inc. invert and cover levels) that will be installed on the River Boyne streambed, near an outside bend. Information was also lacking regarding the assessment of the potential hydromorphological and hydrological impacts, including those relating to the stream bed and riverbank(s), within the ZoI; based on the information presented, the risk of armouring, scouring and associated sediment deposition within the ZoI during varying flow conditions, altered hydrological dynamics, and potential hydromorphological alteration, *cannot* be ruled out at this point, without scientific uncertainty.

[11] Source: https://www.catchments.ie/data/#/dashboard/waterquality?_k=9bn0yc.
[12] Source: https://www.catchments.ie/data/#/dashboard/pressure?_k=8y6ad6
[13] Source: https://www.catchments.ie/data/#/waterbody/IE_EA_07B042100?_k=jp6plp.

General details have been provided regarding the instream and bankside habitats near the location of the proposed discharge, based on visual observations only; riverine hydromorphological survey data, underwater survey data, and hydrological survey data, within the ZoI and at the discharge point, are lacking. Substrate sampling and analysis (and results) have not been undertaken within the ZoI to quantitatively determine the riverbed substrate composition and condition, or the required composition of any imported materials needed for reinstatement purposes, or the potential background contamination levels that could be released during the installation of the proposed Cofferdams and/or the proposed excavation of the riverbed within the River Boyne (i.e. colloidal-based contamination, endocrine disruptors associated with upstream WwTPs, etc.). Electrofishing survey data was not provided for the ZoI; IFI has confirmed that valuable habitat for Atlantic Salmon is located around the proposed discharge.

Based on the lacunae and data inadequacies previously highlighted, including those relating to the *Assimilative Capacity Assessment* and *Mixing Model(s)*, the risk of significant effects on River Boyne's hydromorphology, water quality, habitat, and biology, cannot be entirely ruled out without entailing scientific doubt. Similarly, significant impact(s) cannot be ruled out on the protected sites concerned and the Qualifying Interests (QIs/SCIs) for which they are designated.

The compliance of the proposed development with the environmental objectives of the WFD cannot be further determined, based on the lacunae and data inadequacies previously highlighted within the information presented.

Table 1. Impact assessment of the implications of the proposed development (and its associated activities) on the water quality objectives for the River Boyne, in line with the Water Framework Directive.

Receptor	Potential risk to the receptor?	Impact source	Adequate information provided (Yes/No)	Potential significant impact(s) can be ruled out without scientific doubt (Yes/No)
Hydromorphology	Yes	Potential impacts to stream bed and bank habitats, resulting from instream excavation and reinstatement using undefined material composition, and the construction of an instream diffuser and precast concrete anchor system. Potential impact sources include armouring of the stream bed, scouring and downstream deposition, and geo-hydromorphological alteration within erosional and depositional zones within ZoI	No	**No**. Design and construction methodology details, and characterisation data relating to the receiving habitat (inc. hydromorphology, hydrology, substrate composition and condition, etc.), are inadequate to rule out construction and operational impacts, without scientific uncertainty.
Biology – physical habitats	Yes	Potential impacts to stream bed and bank habitats, resulting from instream excavation and reinstatement using undefined material composition, and the construction of an instream diffuser and precast concrete anchor system. Potential impact sources include armouring of stream bed, scouring and downstream sedimentation, eutrophication, pathogens, algal levels, water quality issues (inc. dissolved oxygen content within interstitial voids within gravels).	No	**No**. Construction and operational impacts on biology (habitats) cannot be ruled out without scientific uncertainty. This is primarily due to the inadequacies previously highlighted above, including those associated with Assimilative Capacity Assessment and Mixing Models, and the lack of comprehensive details regarding the instream work component. Risks associated with potential eutrophication and habitat alteration cannot be ruled out.
Biology – fish	Yes	Potential disturbance to migrating fish species during the instream and bankside works phase, which will include channel confinement up to the midpoint of the River Boyne. Potential impact sources include instream habitat alteration, sedimentation, eutrophication, pathogens (bacteria, viruses, parasites), algal levels, and water	No	**No**. Construction and operational impacts on biology cannot be ruled out without scientific uncertainty. This is primarily due to the inadequacies previously highlighted, including those associated with Assimilative Capacity Assessment and Mixing Models. Impacts on biology from pathogens and potential chemicals/priority substances (inc.

		quality issues (inc. dissolved oxygen content within interstitial voids within gravels and the water column).		bioaccumulation and subsequent release during decomposition/predation), and/or pharmaceutical residue(s), cannot be ruled out at this point. Impacts on migrating fish during the instream work(s) component cannot be ruled out.
Water quality	Yes	Detrimental impacts to the receiving water quality at the River Boyne resulting from the proposed discharge, and construction and operational impacts. Cumulative impacts from upstream sources (i.e. point source and diffuse), including the Navan WwTP discharge, documented pollution at Dollardstown Stream, and pollutants from other confluences referred to. Potential impacts on downstream drinking water sources (inc. chemical and pharmaceutical residue in treated wastewater).	No	**No**. Construction and operational impacts on water quality (inc. dissolved oxygen, nutrient and chemical content) cannot be ruled out without scientific uncertainty. This is primarily due to the inadequacies previously highlighted, including those associated with Assimilative Capacity Assessment and Mixing Models, and the lack of assessment of relative impact sources. Details regarding potential chemicals, priority substances, pathogens, and/or pharmaceutical residue in discharge, are inadequate for impact assessment purposes.
Protected areas	Yes	Potential impacts on the integrity of the receiving N2K sites. Potential impact sources include disturbance, fragmentation, habitat loss (during construction), instream habitat alteration, sedimentation, eutrophication, pathogens (bacteria, virus, parasite), algal levels, water quality issues (inc. dissolved oxygen content within interstitial voids within gravels).	No	**No**. Construction and operational impacts on the N2k sites concerned cannot be ruled out without scientific uncertainty. This is primarily due to the inadequacies previously highlighted, including those associated with Assimilative Capacity Assessment and Mixing Models, and implications for receiving water quality and habitat conditions.
Invasive non-native species	Yes	Potential impacts resulting from the spread of IAS within the ZoI, and the introduction of materials that may be contaminated with IAS, including those used for the proposed reinstatement works within the River Boyne	No	**No**. Construction impacts on the N2k sites concerned cannot be ruled out without scientific uncertainty. The applicant has not provided adequate details regarding methods to ensure the prevention of IAS introduction within quarry-sourced imported materials, for the proposed instream substrate reinstatement works within the River Boyne.

Given the sensitivity of the receiving surface water at the River Boyne and the Natura 2000 sites concerned, and the ongoing documented failure to meet *good* WFD status[14], the precautionary principle should be applied regarding *any* potential deterioration(s) of the treated wastewater that could occur throughout the project lifetime and decommissioning (e.g. pump failures and development of anaerobic conditions/septicity, and subsequent increases in BOD_5). Given the considerable 400 m^3/day daily maximum flow rates quoted by the applicant, any notable deterioration of final effluent could result in a significant effect on the receiving water quality and habitats at the River Boyne, and consequently, to the Natura 2000 sites concerned.

Article 4.a (I) of Part II of S.I. 272 of 2009 (*the Surface Water Regulations*, as amended), requires that Public Authorities shall undertake their functions to promote compliance to ensure that *surface water bodies comply with the relevant environmental quality standards specified in the Schedules contained in those Regulations*. Section 4.a (ii) of Part II of S.I. 272 of 2009 (as amended) requires that Public Authorities shall undertake their functions so that *protected areas achieve compliance with any standards and objectives laid down for such areas.* Article 4(1)(a)(i) of the WFD requires that Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water, subject to the application of paragraphs 6 and 7 and without prejudice to paragraph 8, of that Directive. Article 5 Part II of S.I. 272 of 2009 (as amended), states that *a public authority shall not, in the performance of its functions, undertake those functions in a manner that knowingly causes or allows deterioration in the chemical status or ecological status (or ecological potential as the case may be) of a body of surface water*.

Article 2 (C) of Part I of the 2009 Surface Water Regulations (S.I. 272 of 2009, as amended) includes a requirement for *measures that provide for the progressive reduction of pollution by priority substances in accordance with the provisions of Article 4(1)(a)(iv) and Article 16 of the Water Framework Directive.*

The lacunae and data gaps highlighted, especially those listed within section 2.1 and section 2.2, limit certainty regarding the assessment of the potential impacts (inc. cumulative impacts and interactions), and effects (inc. in-combination effects), on the River Boyne and the Natura 2000 sites concerned. Compliance with the 2009 Surface Water Regulations, the WFD (20/6000/EC), and indeed the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011), *cannot* be concluded beyond reasonable scientific doubt, based on the information presented.

In terms of potential implications for the water quality objectives defined by the WFD, it *cannot* be concluded that the proposed development and its associated activities *will not* result in deterioration of the status of the River Boyne, or prevent *good* status from being achieved, within the prescribed timeframe.

[14] A water body deteriorates in status when one WFD receptor (an "element") is affected, such that it drops from one WFD status class to another.

2.2.2. Summary

The 2016-2021 WFD Status of the River Boyne was *Moderate* and it was classified as being *At Risk* of not achieving *good* status. Significant issues for the River Boyne, downstream for the proposed outfall, have been confirmed by the EPA relating to hydrology, morphology, and nutrient.

The subject stretch of the River Boyne is listed as a nutrient sensitive water, comprising a nitrate vulnerable zone designated under the Nitrates Directive (91/676/EEC), and areas designated as sensitive under the Urban Wastewater Treatment Directive (91/271/EEC) (as amended). An increased trend in nitrogen concentration was noted in the River Boyne since 2013 (O'Boyle et al., 2019).

As indicated in section 2.1, the results of the Assimilative Capacity Assessment and Mixing Models presented, were deemed to be *inconclusive*. Based on the information provided by the applicant, and the lacunae highlighted in section 2.1 and above, it *cannot* be ruled out, beyond reasonable scientific doubt, that the project (and its associated activities) will not cause a deterioration of the status of a surface waterbody and/or jeopardize the attainment of *good* surface water quality status, within the prescribed timeframe.

The compliance of the proposed development with the environmental objectives of the WFD cannot be further determined, based on the lacunae and data inadequacies previously highlighted.

2.3. Assessment of impacts on hydrology and aquatic ecology based on the information presented in the planning appeal, scientific evidence, and professional judgement of the Environmental Impact Assessment report (EIAR), Natura Impact Statement (NIS) and document titled Report to the Third-Party Appeal reasons (including revised NIS dated June 2022) as relevant to the assessment of impacts on Hydrology.

2.3.1. Assessment of impacts on hydrology and aquatic ecology based on information presented in the planning appeal

Context

A sequential review of the information presented in the planning appeal documentation was undertaken, to determine any sources of lacunae and gaps[15]. This was followed by an assessment of impacts on hydrology and aquatic ecology[16] (only), based on the information provided within the current appeal, in accordance with the client brief (section 1.2).

A pre-consent Method Statement has not been included regarding the proposed works at and within the River Boyne (NIS 2022, p. 4 & p. 24), thereby preventing review by the author. The applicant has indicated that a Method Statement will be provided at a post-consent stage. Specific details regarding construction methodology (inc. the proposed instream works element), and the defined zones of impact for QIs/SCIs relating to construction and operational (and decommissioning) impacts are lacking, thereby limiting robust assessment of the direct, indirect, cumulative, and in-combination impacts (additive and/or synergistic) of the proposed development and its associated activities, in terms of the Conservation Objectives listed for the Natura 2000 sites concerned. Regarding the impact assessment process detailed within the reports presented, impact characterisation was found lacking at times; impacts have not been described adequately in terms of extent, magnitude, duration, reversibility, timing and frequency (CIEEM, 2018, vs 1.2).

Survey data relating to the QIs/SCIs, for which the concerned Natura 2000 sites are designated is limited, thereby preventing robust impact assessment, especially for Atlantic Salmon, River Lamprey and Kingfisher. Riverine hydromorphological survey data, underwater survey data, and hydrological survey data, within both the ZoI and at the discharge point, are lacking. Furthermore, based on reasons outlined within section 2.1, the results of the *Assimilative Capacity Assessment* and *Mixing Models* results were deemed to be *inconclusive*.

Within the screening conclusion presented in the NIS (2022), the applicant stated that during both the construction and operational phases, the proposed development has the potential to impact upon the Qualifying Interests (QIs/SCIs) of the River Boyne and River Blackwater SAC and SPA, Boyne Coast and Estuary SAC (Site Code: 001957) and Boyne Estuary SPA (Site Code: 004080), due to a *potential deterioration in water quality* and *spread of invasive species*, only (NIS, 2022, section 6.4, p. 45). Further sources of impact were not stated within the screening conclusion.

[15] It should be noted that the advised shelf-life guideline of 1 year is recommended for most ecological data (CIEEM, 2019).

[16] Kingfisher *Alcedo atthis* and Otter *Lutra lutra* were included in the assessment.

The proposed instream works will include provision of 3 no. temporary sandbag cofferdam; the first cofferdam will extend up to the midpoint of the River Boyne, with a second upstream cofferdam placed above the latter to deflect the river flow, and the third will be placed at the mouth of the Dollardstown Stream (NIS, 2022, attachment 3.2, p. 17) (Plate 1). The proposed instream works component within the River Boyne may extend to approximately 125m^2 (NIS, 2022, p. 16). It is stated that works near the River Boyne will be undertaken during the summer period, when lower flow conditions occur; instream works are proposed between the July to September period, but may extend beyond that (NIS, 2022, p 57). It does not appear that the potential impacts associated with the latter have been adequately assessed, given that fish migration (i.e. Grilse) could be affected by channel restriction and the associated disturbance.

The applicant has proposed to remove material from the riverbed during the construction phase within the River Boyne and to reinstate such materials if it would not cause significant sedimentation upon reinstatement, otherwise, the excavated substrate will be replaced with materials sourced from local quarries (NIS 2022, section 6.1, p. 42). Furthermore, it was stated that the finished bed profile will be re-instated to conform with the current bed profile, and the applicant subsequently claimed that there would be no significant impact upon the QIs due to habitat loss or habitat fragmentation (only) (NIS 2022, section 6.1, p. 42). The following lacunae are noted regarding the latter work element:

- A pre-consent Method Statement detailing the proposed habitat reinstatement and methodology has not been provided.

- Substrate sampling and analysis have not been undertaken to quantitively determine the current riverbed composition and its condition, which would be required to define the proportions of each substrate fraction necessary for the proposed reinstatement of the riverbed to its current composition and profile (Bunte and Abt, 2001).

- High sediment/fines substrate contents are common within depositing river pool mesohabitat features, especially where flows are impounded by weirs. The proposed reinstatement of excavated natural riverbed substrates is likely to result in significant sediment release, thereby increasing the volumetric requirement of the quarry-sourced replacement materials.

- The applicant has not stated how the proposed quarry-sourced materials will be ensured to be free of contaminants and/or Invasive Alien Species (IAS) (scheduled or otherwise).

- The period required for the 'deposition and retention of natural river substrate' has not been indicated, and the risk of subsequent scouring and armouring of the riverbed has not been considered.

- Hydromorphological and hydrological data for the outfall and the works area have not been provided, thereby limiting the assessment of associated impacts.

It was confirmed that *no* invasive species of concern were noted during the site walkover (NIS 2022, section 6.2, p. 43). However, it was later confirmed that third schedule (high impact) Indian Balsam (*Impatiens glandulifera*) was recorded along the L1013 road verge, and it was subsequently stated that that there would be a risk to protected habitats and species as a result of invasive species found along the proposed route (NIS 2022, section 6.2, p. 43). Furthermore, within the EIAR (2022, it was stated that two types of Waterweeds (*Elodea* sp.), considered as Third Schedule *High Impact invasive* Species, are present within the River Boyne (EIAR, section 8.9.1.2, P. 236); Canadian Waterweed (*Elodea canadensis*) and Nuttall's Waterweed (*Elodea nuttallii*).

It was stated that the hydrological analysis by McCloy Consulting included consideration of low flow conditions that corresponded with maximum discharge, as this represented the worst-case scenario (NIS 2022, section 6.2, p. 44). The flow conditions that corresponded to the period of the low-frequency water quality sample data used in analyses were not listed, thereby preventing review by the author.

The NIS submitted alludes to a low risk of *significant* in-combination effects on water quality. The assessment of in-combination effects (and cumulative impacts) relating to other plans and projects within the contributing catchment is deemed *inadequate*. The applicant has correctly highlighted that an increase in sediment has the potential to adversely impact fish, which consequently would affect predators, including Otters and Kingfisher. Also, an increase in sediments can increase the level of nutrients (which can bind to the suspended solids) in the water, which can result in excessive eutrophication, leading to deoxygenation of surface water (NIS 2022, section 6.3, p. 44).

It was confirmed that the UV filtration unit would be installed on the final effluent line before the final sump (NIS 2022, section 6.3, p. 44). As highlighted earlier, treatment efficiency rates are claimed for the removal rate for Cryptosporidium only, and no further manufacturer details are provided regarding removal efficiency rates for all other pathogens (inc. bacteria, viruses and parasites). Given the position of the UV filtration plant at the final discharge sump, the pathogenic content(s) at the point of discharge has not been described, nor have the implications been determined for breakdown/maintenance scenarios that would result in increased retention within the rising main (i.e. increased risk of septicity and elevated BOD content). Bacteria break down the protein content of wastewater into various nitrogen compounds including nitrate, nitrite, ammonia and ammonium, the potential implications of which do not appear to have been fully considered; ammonia (NH_3) is considered toxic to freshwater fish at low concentrations.

It is correctly stated that an increase in sediments has the potential to impact fish species by damaging gravel beds required for spawning, smothering fish eggs and in extreme cases, interfering with the gills of fish. An increase in suspended solids also has the potential to reduce water clarity, which can impact the light penetration of water and may also affect certain behaviours of aquatic fauna and foraging success (NIS 2022, section 7.0, p. 46). There is no evidence of surveys having been completed to evaluate the suitability of potential spawning habitat within the Dollardstown stream or any relevant tributary of the River Boyne (Plate 4 & Plate 5). IFI has stated that such watercourses can provide spawning habitat and serve as a valuable food source for fish.

Plate 4. The Dollardstown stream approximately 70m upstream of the River Boyne confluence.

Plate 5. The Dollardstown stream approximately 150m upstream of the River Boyne confluence.

A significant increase in nutrients (particularly phosphorus), can result in severe eutrophication, whereby an increase in nutrient content causes significant growth of aquatic plants and algae. As plant growth increases, oxygen depletion occurs due to increased photosynthesis and through the decomposition of plant organic material. The increase in plant growth can also limit the availability of sunlight through the water column to the riverbed (NIS 2022, section 7.0, p. 47). As highlighted in section 2.1, signs of eutrophication, and high levels of siltation in addition to algal and bacterial growth have been confirmed near the proposed discharge location (Ecofact, 2022, p. 12). The suggested water quality issues near the Dollardstown stream confluence do not appear to have been accounted for within either the Assimilative Capacity Assessment or Mixing Model results, upon which conclusions were based within the current EIAR and NIS reports; the source(s) and effects of the documented pollution near the Dollardstown stream confluence, remain to be identified and quantified.

Within an untitled table located on pages 48-53 of the NIS (2022), it was stated that River Lamprey (*Lampetra fluviatilis*) were found in 2005 throughout the River Boyne catchment (O'Connor, 2006), with the highest densities of Lamprey recorded on the Lower Boyne at Slane Bridge, approximately 5.6 km downstream of the proposed discharge point. Within the IFI appeal (ABP LDG ref.: 053569-22), it was confirmed that River (and Brook) larvae were recorded during semi-quantitative surveying at 18 of 22 locations surveyed (average density was 7.1 larvae per m^2), between Edenderry and Drogheda Town. Survey data relating to the presence/absence of River Lamprey (*Lampetra fluviatilis*), appears to be confined to a 1-minute duration (kick) sweep sampling efforts at 3 no. points along/across the River Boyne, within a stated 600m survey stretch, only (Ecofact, 2022, p. 5). Non-optimal habitat for River Lamprey (*Lampetra fluviatilis*) was reported at the proposed discharge location, as well as suitable (holding) habitat for Adult Salmon (Ecofact, 2022, p. 12). The applicant has confirmed there is potential for impacts upon the qualifying interest species River Lamprey (*Lampetra fluviatilis*) and Atlantic Salmon (Salmo salar), due to a potential deterioration in water quality

associated with the proposed discharge, suspended solids content, hydrocarbons and uncured concrete during the construction phase (NIS 2022, pp. 49-50); impacts relating to the proposed instream substrate removal and reinstatement works were not discussed.

It was stated that an absence of signs of Otter (*Lutra lutra*) activity and holts were confirmed within a 500m survey stretch (Ecofact, 2022, p. 6), but that Otter are likely within the vicinity of the development (NIS 2022, pp. 50). Furthermore, whilst banks and the nearby woodland were surveyed for signs of potential Otter activity, the respective distance searched from the riverbank was not indicated. The applicant has stated that a significant impact on water quality could indirectly impact upon Otter (*Lutra lutra*), by causing a reduction in prey populations and availability (NIS 2022, pp. 50); the impacts of the proposed instream substrate excavation, removal and reinstatement with quarry sourced materials, were not adequately assessed within the EIAR or the NIS reports presented.

The applicant indicated that the Dollardstown stream may contain foraging habitat for Kingfisher (NIS 2022, section 6.1, p. 42). The applicant has stated that the proposed outfall location would not offer suitable habitat for breeding Kingfisher (*Alcedo atthis*), but details are lacking for the remaining ZoI (EIAR 2022, section 8.9.1.3, p. 238). It was confirmed that the location of the proposed discharge is located within proximity to 2 no. Kingfisher territories, within which 9 no. historical Kingfisher sightings were confirmed over three visits before 2010 (Cummins *et al*., 2010) (NIS, 2022, p. 51).

Within the NIS (2022), it was confirmed that Kingfisher (*Alcedo atthis*) was observed at the Dollardstown Stream during a site visit (NIS, 2022, p. 51). Furthermore, based on a review of a nearby existing culvert and the bank at the immediate discharge location, an absence of suitable nesting habitat was confirmed by the applicant at those locations (NIS, 2022, p. 51). However, details are lacking regarding the suitability of other habitats within the ZoI, which are predominantly targeted by nesting Kingfisher; Kingfisher also nest in burrows in riverbanks within tunnels, which can extend to 140cm, leading to a nest chamber (Boag, 1982). Within sections 3.3 and 4.2 (NIS, 2022, p. 8), it was stated that 'Bird species and signs of fauna activity and dwellings were noted during site walkovers conducted for *site characterisation purposes*, that were undertaken on the 28th February 2020, 22nd July 2021, 6th August 2021, 10th August 2021, 23rd August 2021, 2nd September 2021 and 15th January 2022'. However, only 1 of the site visits undertaken was listed within the breeding season (May-July) for Kingfisher i.e. 22nd July 2021. The NIS (section 5.2, p. 32) does not refer to a specific Breeding Bird Survey having been undertaken in accordance with the established methodology for Kingfisher (*Alcedo atthis*), within the ZoI.

2.3.1.1. Assessment of impacts on hydrology and aquatic ecology, based on information presented

Table 2 provides a summary of the potential impacts on hydrology and aquatic ecology (only), based on the information presented in the planning appeal and scientific evidence. The eight QIs habitats, for which the Boyne Coast and Estuary SAC is designated, do not fall under the remit of aquatic ecology and therefore are not considered further in this section. Similarly, the twelve SCIs for which the Boyne Estuary SPA is designated, do not fall under the remit of aquatic ecology and therefore are not considered further in this section. Potential impacts

have been assessed for the QIs/SCIs, for which the concerned Natura 2000 sites are designated, based on the respective attribute targets, and the information presented in the planning appeal and scientific evidence.

Hydrology

Based on the details presented regarding the proposed instream construction of the discharge pipe and the precast anchoring block system required, potential long-term significant hydrological and hydromorphological impacts cannot be ruled out, at this point. The applicant has not provided a robust assessment of the potential hydrological and hydromorphological impacts, localised or otherwise, associated with the latter. Such impacts could include alterations to the local flow dynamics and increased contaminant concentrations, especially during lower flow conditions, scouring and downstream deposition, debris buildup on the riverbed (i.e. jams), and potentially, long-term hydromorphological alteration of the riverine and bankside habitats.

Given the lack of site-specific environmental and flow data, and any quantitative sampling data regarding the existing river substrate composition(s) and condition, it is not currently possible to robustly assess the hydrological (or hydromorphological) impacts on the riverbed following the proposed instream excavation and reinstatement works; the proposed works area within the River Boyne is listed at approximately 125m^2, with excavations up to a depth of c. 150mm. Habitat reinstatement would require robust quantification of the original substrate composition and condition, to prevent post-works destabilization of the substrate matrix during hydrological events, and potential bed armouring, scouring and downstream sedimentation.

Aquatic ecology

River Lamprey *Lampetra fluviatilis* [1099]

The Conservation Objective for River Lamprey *Lampetra fluviatilis* is to restore the favourable conservation condition of River Lamprey *Lampetra fluviatilis* in the River Boyne and River Blackwater SAC (NPWS, 2021). The results of the impact assessment (Table 2), in line with the respective attribute targets (NPWS, 2019, pp. 13-14), confirmed that *significant impacts cannot be ruled out at this stage* without scientific uncertainty; this is attributed largely to the lacunae and gaps previously highlighted within the information presented in the planning appeal. These inadequacies relate primarily to potential (direct, indirect, cumulative and in-combination) impacts associated with water quality deterioration, disturbance, and potential riverine habitat degradation within the ZoI.

Atlantic Salmon *Salmo salar* [1106]

The Conservation Objective for Atlantic Salmon *Salmo salar* is to restore the favourable conservation condition of Atlantic Salmon *Salmo salar* in the River Boyne and River Blackwater SAC. The results of the impact assessment (Table 2), in line with the respective attribute targets (NPWS, 2019, pp. 15-16), confirmed that *significant impacts cannot be ruled out at this stage* without scientific uncertainty; this is attributed largely to the lacunae and gaps previously highlighted within the information presented in the planning appeal. These inadequacies are related primarily to potential (direct, indirect, cumulative and in-

combination) impacts associated with water quality deterioration (including impacts on prey) and riverine habitat degradation within the ZoI.

Based on the information presented and the conclusions outlined in Section 2.1, it is unlikely that the proposed development will aid the attainment of the water quality attribute target of 'at least Q4 at all sites sampled by EPA', listed for Salmon [1106] (please refer to section 2.1 for further details regarding the appraisal of the Assimilative Capacity Assessment and Mixing Model).

Otter Lutra lutra [1355]

The Conservation Objective for Otter *Lutra lutra* is to maintain the favourable conservation condition of Otter *Lutra lutra* in the River Boyne and River Blackwater SAC. The results of the impact assessment (Table 2), in line with the respective attribute targets (NPWS, 2019, pp. 13-14), confirmed that *significant impacts cannot be ruled out at this stage* without scientific uncertainty; this is attributed largely to the lacunae and gaps previously highlighted within the information presented in the planning appeal. These inadequacies are related primarily to potential (direct, indirect, cumulative and in-combination) impacts associated with water quality deterioration, fish biomass availability, fragmentation, and disturbance, within the ZoI.

Kingfisher *Alcedo atthis* [A229]

The Conservation Objective for Kingfisher *Alcedo atthis* is to maintain the favourable conservation condition of Kingfisher in the River Boyne and River Blackwater SPA. Q-values of ≥4 represent satisfactory water quality for Kingfisher (NPWS, 2024). Based on the information presented, it is unlikely that the proposed development will aid the attainment of the Q4 water quality within the ZoI. The proposed development and its associated activities could result in a reduced abundance of prey items.

The applicant has confirmed that Kingfisher were sighted at the Dollardstown Stream during a site visit. Nesting records can be located over 250m from foraging waters (Crowe *et al*., 2010), often in a stream or tributary of the main watercourse (Morgan and Glue, 1977). Suitable soil banks (vertical/overhanging) for nesting are necessary to support breeding pairs, however, holes in walls, rotten tree stumps, concrete tunnels in canal banks, or burrows of Sand Martin (*Riparia riparia*) can be used. A Breeding Bird Survey for Kingfisher has *not* been provided by the applicant, thereby limiting the assessment of the potential impacts. *Significant impacts cannot be ruled out at this stage* without scientific uncertainty; this is attributed largely to the lacunae and gaps previously highlighted within the information presented in the planning appeal.

Impact Assessment (based on information presented)

Table 2 provides the results of an impact assessment, in line with the respective QI/SCI attribute targets regarding ecology and hydrology, based on the information presented only.

The author concludes that, based on the information provided, potential significant effects on hydrology and/or ecology *cannot* be ruled out at this stage, beyond reasonable scientific doubt. The latter conclusion is attributed to the inadequacies and lacunae associated with

the information presented in the planning appeal, including those highlighted within sections 2.1 and 2.2 (above). These inadequacies are attributed primarily to potential impacts (direct, indirect, cumulative and in-combination) associated with: direct species mortality, water quality deterioration (inc. eutrophication), pollution, disturbance (inc. species migration and foraging), displacement, habitat loss, habitat degradation (inc. potential hydromorphological and hydrological conditions), fragmentation, and factors affecting foraging habitat condition (i.e. water quality, siltation, water depth, turbidity, speed of flow, etc.) and species carrying capacity. Factors taking into account the nature, scale, intensity, frequency, timing and duration of (direct or indirect) potential impacts were generally lacking and should be taken into account when determining potential effects upon receptors.

Table 2. Summary of the potential impacts on aquatic ecology (inc. Kingfisher), based on the information presented in the planning appeal.
QI/SCI in **Bold** are considered likely to be affected, in line with the respective conservation objective attribute targets.

European Site	Aquatic Qualifying Interests (QIs)/ Special Conservation Interests (SCIs)	Potential impacts	Significance of Effects on QI within the ZoI	Information presented adequate for assessment (Y/N)	Comments
River Boyne and River Blackwater SAC (002299)	• **River Lamprey *Lampetra fluviatilis*.** • **Atlantic Salmon *Salmo salar*.** • **Otter *Lutra lutra*.**	• Potential for habitat loss and/or disturbance and/or localised displacement during construction and operation (and decommissioning). • Potential for habitat loss and degradation due to siltation, pollution, during construction and/or operational activities. • Potential for cumulative and in-combination adverse impacts on water and habitat quality, including spawning habitat within the ZoI. • Potential for adverse impacts on water quality during construction and operation, which can affect habitats, species, and prey availability. • Potential for eutrophication and habitat degradation. • Potential for fragmentation, hydrological impacts and disturbance regarding species migrating and foraging. • Potential for pollution associated with chemicals and hazardous substances (NIS, 2022, attachment 3.2, p. 12). • Potential for hydrological and hydromorphological impacts associated with the instream component of the project. • Potential for the instruction and spread of IAS during the construction and operational phases.	Potentially Significant at an International Scale	No	The information presented was not adequate for robust impact assessment purposes. Lacunae noted related primarily to the potential for: direct species mortality, water quality deterioration, pollution, disturbance, displacement, fragmentation, habitat loss, habitat degradation, and factors affecting foraging habitat conditions, and species carrying capacity. Please refer to section 2.1 for the results of the appraisal of the assessment presented in the Assimilative Capacity Assessment and Mixing Model. Information regarding in-combination and cumulative impacts assessment was lacking, preventing conclusive findings. Flow containment, hydrological alteration, and disturbance resulting from the proposed cofferdam could impede the passage of migrating fish species. Cumulative and in-combination impact assessment should include consideration of effects associated with all relevant weirs. There is a risk of long-term significant hydrological and geo-hydromorphological

					impacts due to the instream placement of the discharge pipes and precast concrete anchoring system.
River Boyne and River Blackwater SPA (004232)	• **Kingfisher *Alcedo atthis***	• Direct habitat loss and/or disturbance and/or localised displacement during construction and operation (and decommissioning). • Potential for cumulative and in-combination adverse impacts on water quality, and foraging habitat quality. • Potential for adverse impacts on water quality during construction and operation, which can affect habitats and prey availability.	Potentially Significant at an International Scale	no	The information presented was not adequate for robust impact assessment purposes. Lacunae noted related primarily to the potential for water quality deterioration, disturbance, foraging conditions, habitat loss and degradation (i.e. extent and quality of nesting banks and other suitable nesting features), and the lack of survey data for Kingfisher and habitat suitability within the entire ZoI. Kingfisher were sighted at the Dollardstown Stream during a site visit. A Breeding Bird Survey for Kingfisher was *not* provided. Observations provided relate to site visits carried out, of which only 1 (22nd July 2021) was within the established breeding season (i.e. May to July).

2.3.1.2. Summary

Based on the information and scientific evidence provided within the planning appeal, it is concluded that potential detrimental impacts on hydrology and aquatic ecology *cannot* be entirely ruled out beyond reasonable scientific doubt.

Data gaps and lacunae have been highlighted within the information and scientific evidence provided, which prevented robust assessment of the potential impacts on hydrology and aquatic ecology, without entailing scientific uncertainty. The latter gaps and lacunae relate to inadequate characterization of construction and operational impacts, the lack of adequate data relating to the receiving environment, and limited assessment of impacts (and effects) to the QI/SCI species listed, in terms of their respective attribute targets.

Furthermore, significant concerns have been outlined regarding the Assimilative Capacity Assessment and Mixing Models (section 2.1) presented, and the implications for the water quality objectives set out in line with the provisions of the Water Framework Directive (section 2.2). Conclusions derived within the planning appeal documents are heavily weighted on the results of the Assimilative Capacity Assessment and Mixing Models, both of which have been deemed to be *inconclusive*.

2.3.2. Professional judgement of the EIAR, NIS and document titled response to the third party appeal reasons within NIS 2022, as relevant to the impacts on hydrology.

Following a systematic review of the EIAR, NIS, and the document titled response to the third party appeal reasons within NIS 2022, it is concluded that lacunae and gaps exist that limit a robust assessment of potential impacts on hydrology.

It is the Author's professional judgement that, the assessment of the impacts on hydrology presented is *incomplete*, in terms of the proposed development and its associated activities. This conclusion is based on the following:

- The 95%ile flow rate (4.8 m^3/s) used within the analysis was reportedly based on advice received during correspondence with the EPA. The applicant stated that the latter correspondence was located within 'Appendix c' of EIAR attachment 8.6, which could not be located within that report.

- Site-specific environmental data (inc. flow data) was lacking within the EIAR (2022) and the NIS (2022). This prevented a robust assessment of the hydrology impacts at both, the point of discharge, and within the ZoI. Hydromorphological and hydrological surveys, or underwater surveys, were not undertaken at the outfall location, or within the ZoI, which is located within a pool mesohabitat located near artificial weirs.

  Based on the information provided by the applicant, potential impacts on hydrology could occur during periods of low and/or base flow periods that coincide with higher wastewater discharge scenarios, when the impounding effects of the multiple documented weirs are increased. It is envisaged that these associated impacts would include short-term alteration to the immediate flow dynamics within a relatively short distance adjacent to, and downstream of, the outfall. The significance of such impact remains unknown, and further hydrological analysis relating to the outfall location and the ZoI would be required to reach data-based conclusions. The latter would require the provision of site-specific multi-annual[17] high-frequency flow data, encompassing the range of flow conditions, at the outfall location and the ZoI.

- The assessment of impacts (direct, indirect, cumulative and in-combination) on hydrology, based on the information provided within the planning appeal, is deemed to be incomplete.

- A Method Statement has not been included regarding the proposed works within and adjacent to the River Boyne (NIS 2022, p. 4 & p. 24), thereby preventing any review by the author. The applicant has indicated that a Method Statement will be provided at a post-consent stage.

- The hydrological (and hydromorphological) impacts associated with the proposed instream construction of the proposed precast support/anchor blocks, that are required to support and secure the discharge pipeline, have not been adequately assessed (NIS, 2022, attachment 3.2, p. 19; EIAR, 2022, p. 91). The proposed works

[17] Note: the hydrological year spans October 1st to September 30th.

area within the River Boyne is estimated at approximately 125m^2 and may extend to the centre of the watercourse (NIS, 2022, p. 16). Furthermore, analysis of substrate composition and condition was not undertaken, which would be necessary to quantify and define the composition of the imported materials required for the proposed riverbed reinstatement work.

- It is proposed to provide a SuDS storage and soakaway system designed to BRE365 for any stormwater running directly off any impermeable area of the site construction compound(s) (NIS, 2022, section 3.2 P. 105); a compound is proposed towards the riverine component of the project. The results of a BRE365 test have not been provided and the necessary subsoil conditions, including permeability and water table depth, have not been confirmed.

2.4. Review third-party appeal reasons and submissions as relevant to water quality and the Water Framework Directive including the appeal made by Inland Fisheries Ireland amongst others.

Table 3 outlines a summary review of the third-party appeal reasons and submissions from statutory bodies, as relevant to water quality and the Water Framework Directive (only). The basis of the third-party appeal reasons relevant to water quality and the Water Framework Directive centred on the following:

- Potential impacts on surface water quality, drinking water sources, fish species, biodiversity and the receiving habitat.

- Implication for IFI research projects associated with the proposed development and its activities, and the potential for adverse effects on the River Boyne.

- Potential impacts on designated and non-designated sites concerned.

- EIAR and NIS deficiencies: lacunae within the assimilative capacity assessment and mixing model presented, inconclusive assessment of impacts (inc. direct, indirect, cumulative and in-combination), lack of adequate environmental and ecological survey data, inadequate consideration of bacterial, viral and parasitic content within the treated wastewater, and inadequate consideration of pharmaceutical and veterinary product residues within the treated wastewater discharge.

- Failure to comply with national and EU legislation, including, but not limited to, the Habitats Directive, the WFD and its sister directives, the Drinking Water Directive, The EIA Directive, the Urban Wastewater Treatment Directive (as amended), and the 2009 Surface Water Regulations (as amended).

- Failure to adhere to the requirements outlined in the River Basin Management Plan, the Meath County Development Plan, and the National Development Plan.

2.4.1. Summary

Based on the information provided by the applicant, and the conclusions previously stated in sections 2.1, 2.2, and 2.3, it *cannot* be ruled out, beyond reasonable scientific doubt, that the project will not cause a deterioration of the status of a surface waterbody and/or jeopardize the attainment of *good* surface water quality status, within the prescribed timeframe. As such, the third-party appeal reasons and submissions as relevant to water quality and the Water Framework Directive, cannot be disregarded.

Table 3. Summary review of third-party appeals and key submissions, regarding water quality and the WFD.

Appellant and key submission content	Review of relevance to water quality and WFD implications
Inland Fisheries Ireland (ABP LDG ref.: 053569-22)	
Impacts on fish species, biodiversity and habitat, due to surface water pollution, including effects during low flow periods, and historical water quality issues at the River Boyne. Potential negative implications for any Strategic Framework for Public Sector Energy, the National Adaption Plan, and Ireland's Climate Action Plan. Implications for IFI research projects. Lacunae and gaps within NIS regarding construction methodology, data used in Assimilative Capacity Assessment and Mixing Models, a lack of (fish) survey data on the Dollardstown tributary or other tributaries, and risk to fish stock from bacterial and viral loading.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty. The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Save the Boyne (ABP LDG ref.: 053794-22)	
Implications for Staleen Water Treatment Plant[18], surface water quality supply and recreational usage at the River Boyne. Potential for surface water pollution. National Development Plan (2022-2027), National Strategic Outcome 9. United Nations Sustainable Development Goals (6 and 14).	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Sonairte (ABP LDG ref.: 053795-22)	

[18] Uisce Éireann indicate that the Staleen Water Treatment Plant will supply over 70,000 people (source: https://www.water.ie/projects/local-projects/staleen-water-treatment-plant-upgrade).

Potential for surface water pollution and implications for WFD goals. Potential impacts on N2K sites (i.e. QIs). EIAR deficiencies.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty. The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Sustainability 2050 (ABP LDG ref.: 053807-22)	
Deficiencies in EIAR, NIS, Assimilative Capacity Assessment and Mixing Model. Cumulative and in-combination impact assessment are incomplete.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty. The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Peter Whelan (ABP LDG ref.: not listed)	
Potential for surface water pollution. Non-compliance with Local Authority Water Programme themes.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Slane Anglers (ABP LDG Ref.: 053784-22)	
Potential for surface water pollution and impacts on drinking water supply sources. Article 5 and 28(2) of the 2009 SW regulations. Impacts on flora, fauna, hydrology. Potential impacts on N2K sites (i.e. QIs).	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty.

NIS deficiencies, including inadequate QI survey data, cumulative and in-combination impact assessment incomplete, and effects of climate change. Effects of viral loading and pharmaceuticals.	The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be inconclusive (please refer to section 2.1 for details). Inadequate environmental and ecological data limited the assessment of impacts. Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details). Impact assessment(s) have not included consideration of pharmaceutical residue(s) and viral content within the treated wastewater discharge.
Gillian Toole (ABP LDG ref.: 053791-22)	
Implications associated with surface water pollution and goals of WFD, Meath County Development Plan (2021-2027). Potential impacts on N2K sites (i.e. QIs/SCIs). Implications for Staleen Water Treatment Plant, surface water quality supply.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty. Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Ciaran Maguire (Canoeing Ireland) (ABP LDG ref.: 053725-22)	
Implications associated with surface water pollution, the WFD, and recreational usage of the River Boyne (health and safety), including bacteria and other pathogens, veterinary product residue, and issues highlighted with the assimilative capacity assessment (especially during low flow).	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Impact assessment(s) have not included consideration of chemical or pharmaceutical residue(s) within treated wastewater.
Bobby McCormac (ABP LDG ref.: 053728-22)	
UN Sustainable Development Goal (6: clean water and sanitation; goal 14: life below water). Implications for WFD, Urban Wastewater Treatment Directive, Drinking Water Directive, River Basin	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty.

Management Plan, Meath County Development Plan, National Development Plan. Environmental and biodiversity risks. EIAR deficiencies (i.e. flow data/divergent flow rates, assimilative capacity of the River Boyne, project description and methodology). National Development Plan (2022-2027), National Strategic Outcome 9.	The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details).
Silver Bridge Kayak Club Ltd. (ABP LDG ref.: 053662-22)	
Potential impacts on N2K sites. Implications for Habitats Directive, WFD, Drinking Water Directive. EIAR deficiencies (inc. the validity of assimilative capacity assessment and mixing model results, inappropriate data sources, and level of dilution at the discharge point). Potential impacts on surface water quality and drinking water supply sources. Implications for recreational usage at the River Boyne. Implications associated with surface water pollution, including bacterial and pathogenic content, and veterinary products. Meath County Council Biodiversity Action Plan (2015-2020).	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). Potential impacts on the N2K sites concerned *cannot* be ruled out at this point, without scientific uncertainty. The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and data gaps have been confirmed within the impact assessment(s) results presented (please refer to sections 2.1, 2.2 and 2.3 for details). Impact assessment(s) have not included adequate consideration of veterinary product residue(s) and the pathogenic content at the point of discharge.
James Byrne (ABP LDG ref.: not listed)	
Not applicable to water quality and the WFD	
An Taisce (Ref.: 21/424)	

Lack of details on the outfall and rising main. Implications for water quality and WFD compliance (inc. the assimilative capacity assessment and modelling). Potential impacts on drinking water supply source.	Lacunae and gaps have been highlighted within the EIAR and NIS, including but not limited to, the analysis of substrate composition and condition, the composition of the proposed reinstatement materials, and the hydrological impacts of the discharge pipe and in-stream anchoring system. Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Impact assessment(s) have not included adequate consideration of veterinary product residue(s) and the pathogenic content at the point of discharge. Lacunae and data gaps have been highlighted within the EIAR and NIS.
DAU (Ref.: 21/424)	
Not related to water quality or WFD (primarily archaeological base).	N/A
HSE (Ref.: 21/424)	
Implications for water quality and WFD compliance. EIAR deficiencies (WFD status goals and effect of climate change). Implications for recreational usage at the River Boyne.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and gaps have been highlighted within the EIAR impact assessment process (please refer to sections 2.1, 2.2 and 2.3 for details).
IFI (Ref.: 21/424)	
Implications for water quality and WFD compliance. Background water quality data used for Assimilative Capacity Assessment and Mixing Models was not suitable. Lack of details on the discharge point and the discharge pipe.	Potential impacts on receiving surface water quality and implications for the WFD goals *cannot* be ruled out at this point (please refer to section 2.2 for details). The results of the Assimilative Capacity Assessment and Mixing Models presented have been deemed to be *inconclusive* (please refer to section 2.1 for details). Lacunae and gaps have been highlighted within the EIAR and NIS, including but not limited to, the lack of analysis of substrate composition and condition, the lack of definition of the composition of the proposed reinstatement material for the River Boyne streambed, inadequate assessment

Lack of ecological survey data, including for the Dollardstown tributary or other tributaries. Potential impacts on N2K sites (i.e. QIs). Implications associated with bacterial, viral or other pathogens on fish stock.	of hydrological and geo-hydromorpholgical impacts of the discharge pipe and the in-stream anchoring system, and inadequacies regarding the ecological data provided relating to the receiving environment. Impact assessment(s) have not included consideration of wastewater pathogenic content at the point of discharge; the conclusion stated relates to the on-site wastewater treatment system, which is min. 6.2km from the discharge point. Treatment efficiency rates are quoted for Cryptosporidium only.

3. Conclusion

The following conclusions were reached relating to the proposed development and its activities, in terms of the requirement outlined within the client brief:

- The results of the *Assimilative Capacity Assessment* and *Mixing Models* presented are deemed to be *inconclusive*, at this point.

- Based on the information provided by the applicant, it *cannot* be ruled out, beyond reasonable scientific doubt, that the project will not cause a deterioration of the status of the receiving River Boyne surface waterbody and/or jeopardize the attainment of *good* surface water quality status, within the prescribed timeframe.

- Based on the information and scientific evidence provided within the planning appeal, potential impacts on hydrology and aquatic ecology *cannot* be entirely ruled out, at this point. It is the Author's professional judgement that, the assessment of the impacts on hydrology presented is *incomplete*, in terms of the proposed development and its associated activities.

- The third-party appeal reasons and submissions relevant to water quality and the Water Framework Directive cannot be disregarded, given that detrimental impacts to the latter *cannot* be ruled out beyond reasonable scientific doubt.

Insufficient impact(s) characterization, and inadequate ecological and environmental data relating to the receiving environment, limited the assessment of the potential construction and operational impacts associated with the proposed development.

Appendix 1. Hydrological data for the River Boyne.

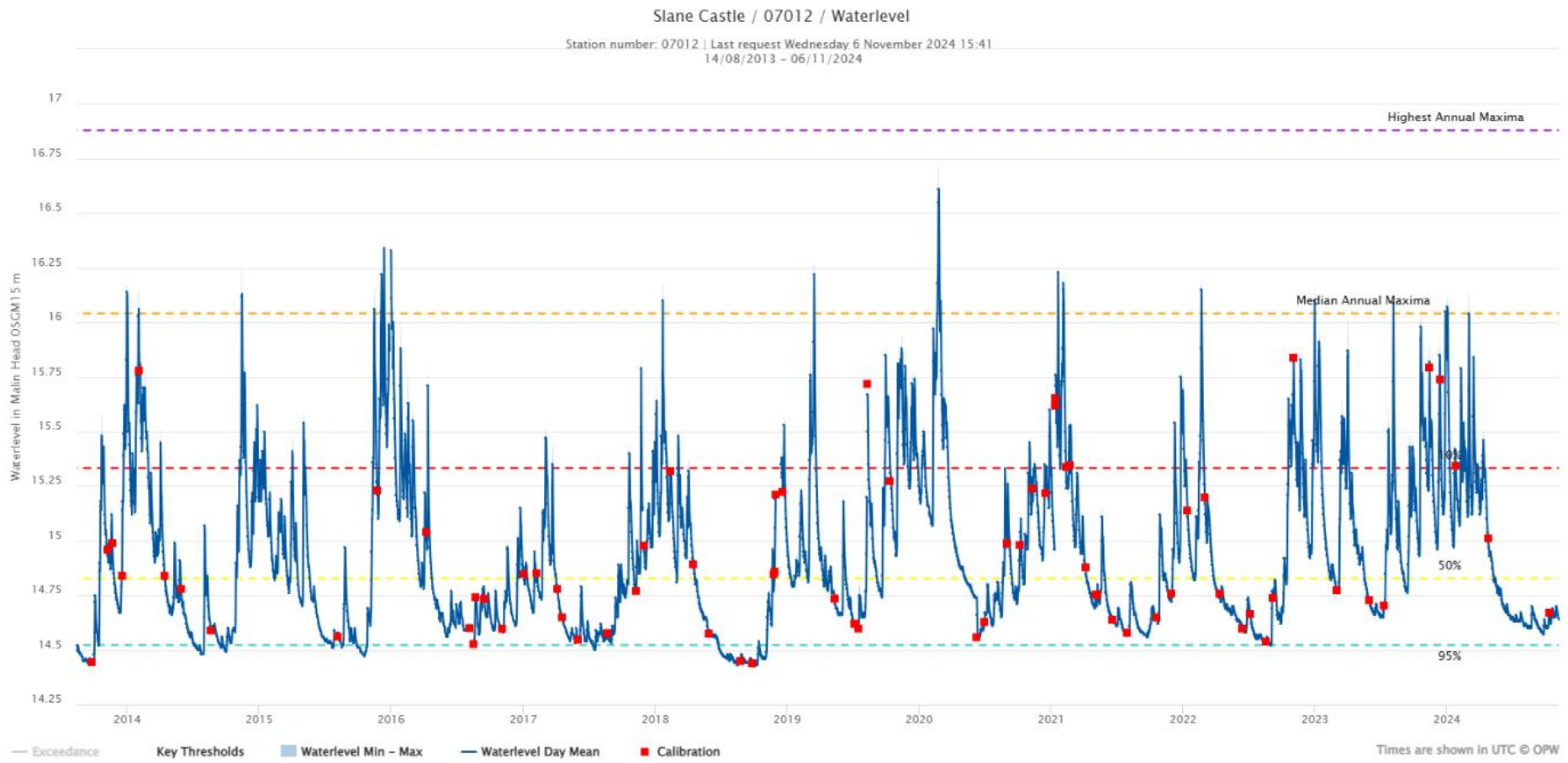

Figure 1. Water level (m) data obtained for Slane Castle monitoring station (Ref. No. 07012), for the period 2014 to 2024[19].

[19] Source: https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/12235/Slane%20Castle/Waterlevel?period=PoR.

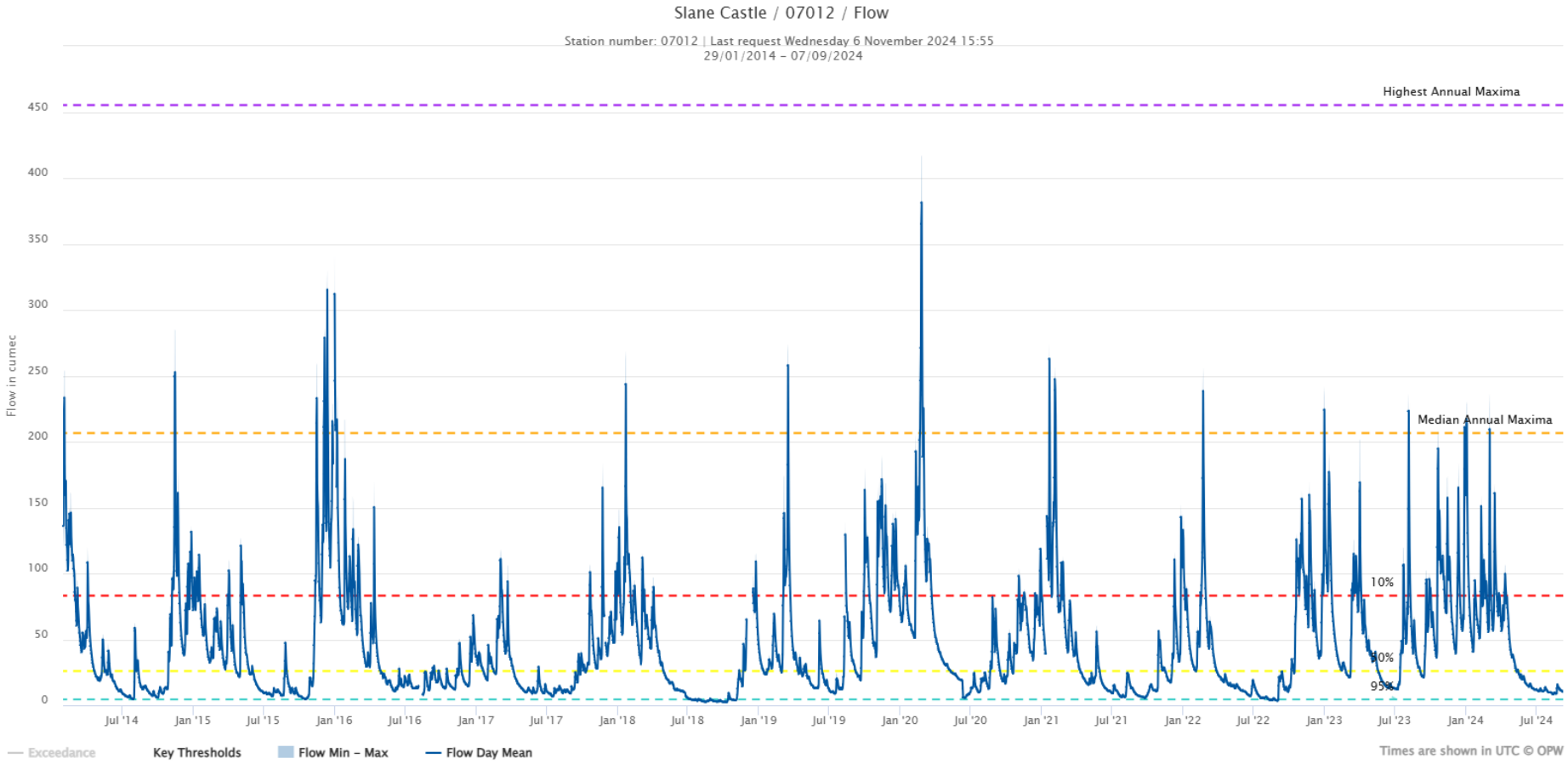

Figure 2. Flow data (cumec) obtained for Slane Castle monitoring station (Ref. No. 07012), for the period 2014 to 2024[20].

[20] Source: https://waterlevel.ie/hydro-data/#/overview/Waterlevel/station/12235/Slane%20Castle/Flow?period=PoR.

DURATION PERCENTILES								
Flows equalled or exceeded for the given percentage of time (m3/s) (Data derived for the period 1954 to 2024)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
164.463	105.784	83.141	50.24	25.947	11.832	6.202	4.462	2.329
Levels equalled or exceeded for the given percentage of time (mAOD Malin Head OSGM15) (Data derived for the period 1940 to 2024)								
1%	5%	10%	25%	50%	75%	90%	95%	99%
15.841	15.505	15.333	15.072	14.827	14.656	14.565	14.522	14.458

Table 4. Duration percentiles the Slane Castle monitoring station (Ref. No. 07012).

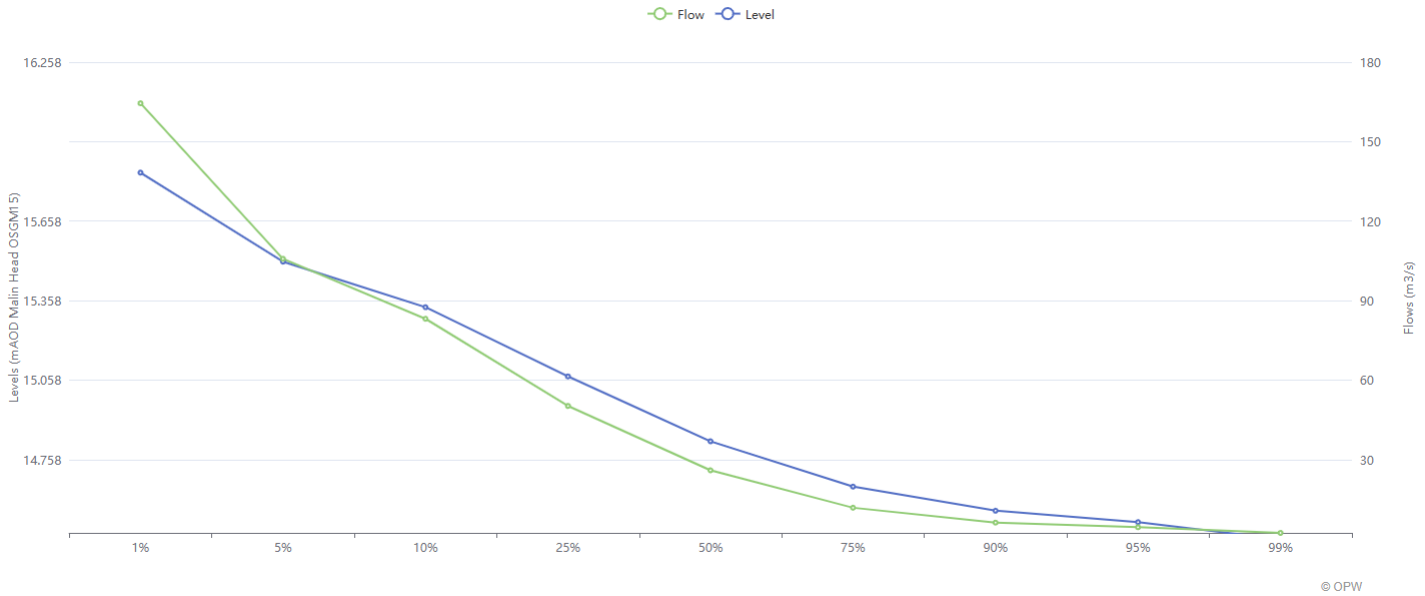

Figure 3. Flow duration curve for the Slane Castle monitoring station (Ref. No. 07012).

Appendix 2. Water quality data for the River Boyne.

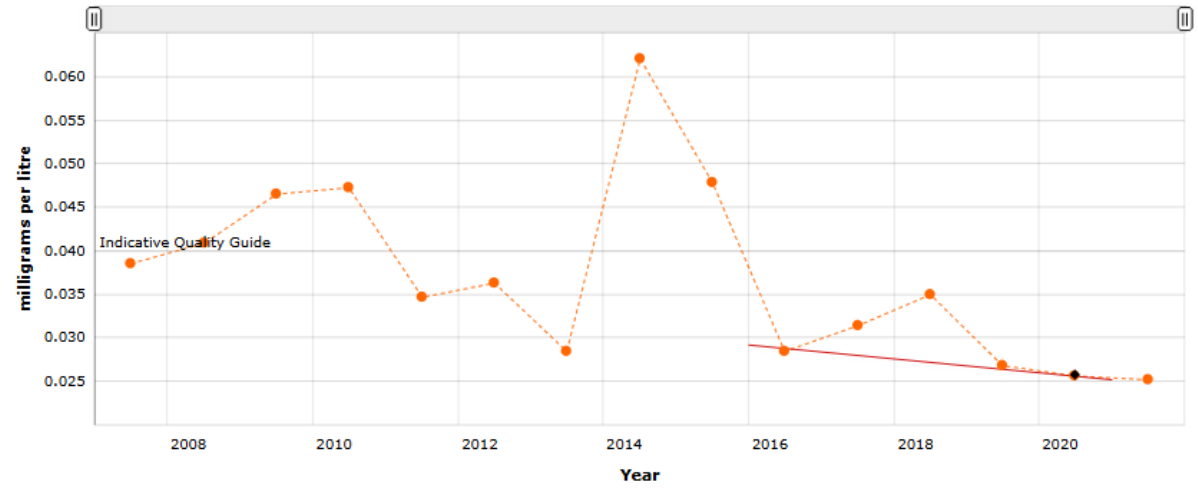

Figure 4. Ammonia-Total (as N) concentrations at Slane Bridge monitoring station between 2007-2021.

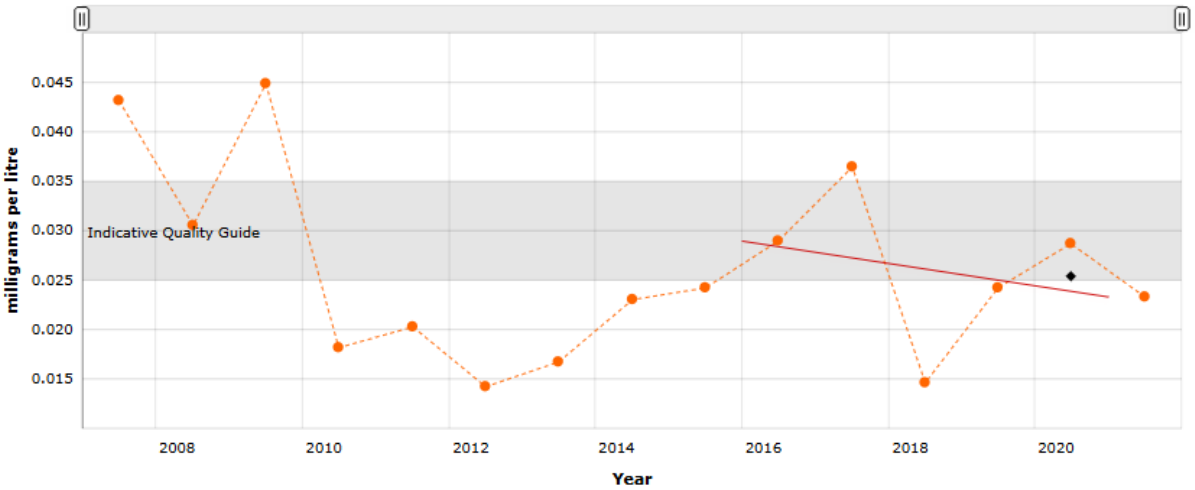

Figure 5. Ortho-Phosphate (as P) concentrations at Slane Bridge monitoring station between 2007-2021.

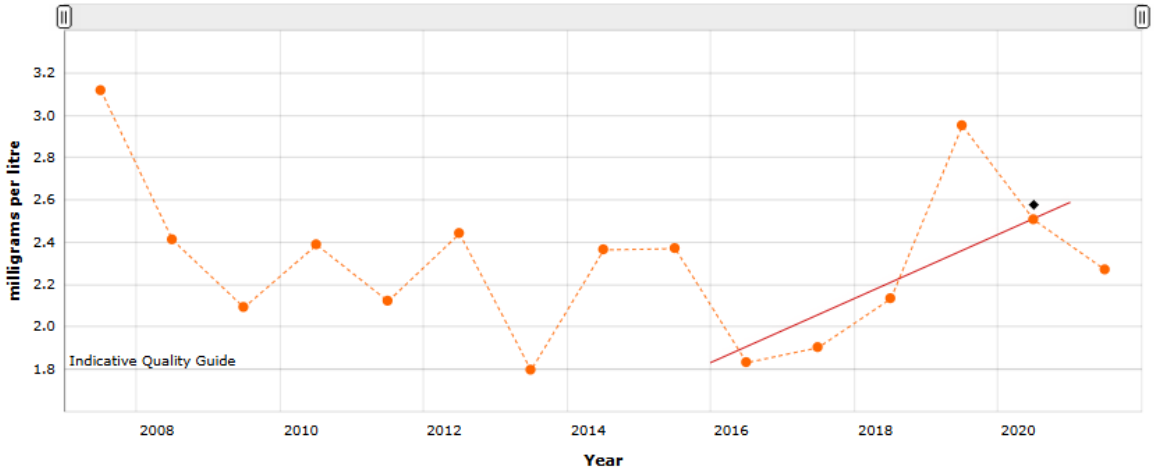

Figure 6. Total Oxidised Nitrogen (as N) concentrations at Slane Bridge monitoring station between 2007-2021.

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