Our Case Number: ACP-323980-25

Planning Authority Reference Number:

An Coimisiún Pleanála

Cllr. Séamie Morris
Rathnaleen
Nenagh
Co. Tipperary
E45 DK03

Date: 04 March 2026

Re: Proposed Water Supply Project for the Eastern and Midlands Region in the counties of Clare, Limerick, Tipperary, Offaly, Kildare, and Dublin.

Dear Sir / Madam,

An Coimisiún Pleanála has received your recent submission in relation to the above mentioned proposed development and will take it into consideration in its determination of the matter. Please accept this letter as a receipt for the fee of €50 that you have paid.

The Commission will revert to you in due course with regard to the matter.

Please be advised that copies of all submissions / observations received in relation to the application will be made available for public inspection at the offices of the local authority and at the offices of An Coimisiún Pleanála when they have been processed by the Commission.

More detailed information in relation to strategic infrastructure development can be viewed on the Commission's website: www.pleanala.ie.

If you have any queries in the meantime please contact the undersigned officer of the Commission. Please quote the above mentioned An Coimisiún Pleanála reference number in any correspondence or telephone contact with the Commission.

Yours faithfully,

Eimear Reilly
Executive Officer
Direct Line: 01-8737184

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Submission *Objection to the* the Proposed Water Supply Project for the Eastern and Midlands Region
SHANNON to DUBLIN WATER SUPPLY PROJECT (Ref. PA92.323980)

Applicant: Uisce Éireann

Submitted by:

Cllr . Séamie Morris M C C

Tipperary County Council

25 February 2026

Cllr. Séamie Morris MCC

Rathnaleen

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Preface .

This application by Uisce Eireann is being submitted while at the same time Ireland is being heavily fined by the EU (CJEU) for the breach of the EU water framework directive (WFD) citing long-term failures to protect waterways . This has recently been exacerbated by the decision by UE to do a 19 million eu WWTP upgrade to Ballina WWTP without putting in tertiary treatment affecting the very same part of the River Shannon they are now looking to abstract water from and also the fact that the Commission for regulation of Utilities(C R U) recently fined U E 20 million euros for not making leak targets .

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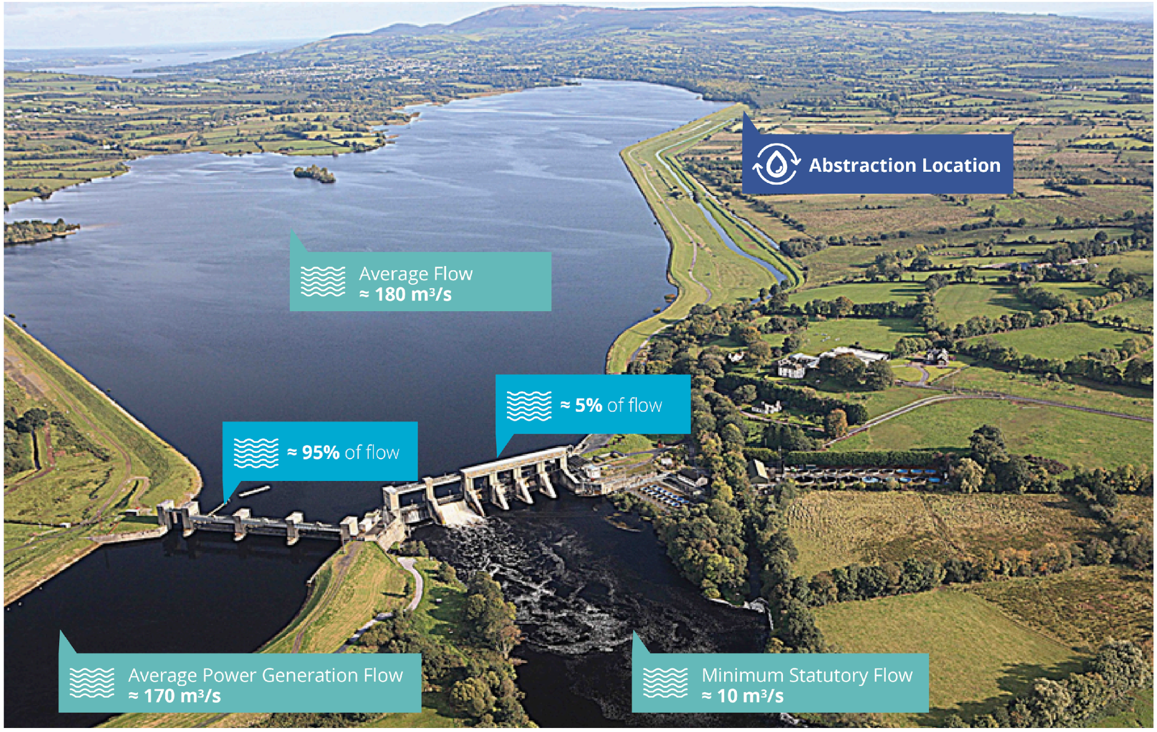


Chapter 1: Introduction & Legal Framework

Background and Purpose

This submission objects to the granting of planning permission for the proposed Eastern and Midlands Water Supply Project ("the Project") on the basis that it is **unlawful under EU environmental law**, **factually unsound**, and **procedurally defective**.

This submission is a combined and consolidated objection, integrating the full technical, ecological, hydrological and climate evidence.

Description of the Eastern & Midlands Water Supply Project

The Project involves the continuous abstraction of up to approximately 330 million litres per day from the River Shannon system at Parteen Basin, a hydrologically regulated and ecologically stressed water body forming part of the Shannon International River Basin District.

Application of the EU Law

The Project, as assessed and presented by the developer, fails to comply with binding obligations under EU law, including but not limited to:

- Directive 2000/60/EC (Water Framework Directive);
- Directive 92/43/EEC (Habitats Directive);
- Directive 2009/147/EC (Birds Directive);
- Directive 2011/92/EU as amended (Environmental Impact Assessment Directive);
- Directive (EU) 2020/2184 (Drinking Water Directive);
- Article 191 TFEU (precautionary and preventive principles).

Consent cannot lawfully be granted where these obligations are not met.

The central defects include:

The Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) repeatedly frame the proposed abstraction as representing approximately 2% of average annual flow at Parteen Basin.

This framing is factually misleading and legally impermissible.

Ecological impact under the Water Framework Directive and Habitats Directive is determined by low-flow and drought conditions, not long-term averages. This is explicitly acknowledged in:

EPA technical guidance;

The independent review of the NIS (February 2026);

The developer's own flow datasets when correctly interrogated.

During Q95 and drought-year conditions, the proposed abstraction would remove between approximately 30% and nearly 50% of available flow in the Lower Shannon under realistic operational scenarios.

The Project documentation therefore misrepresents the true scale of abstraction impacts by presenting an average-flow percentage that conceals severe low-flow effects.

This constitutes a material flaw in the environmental assessment

Summary of Core Legal and Technical Defects

- Systematic misrepresentation of abstraction impacts through reliance on average flows
- Failure to assess low-flow, drought, and zero-generation scenarios
- Unlawful reliance on Heavily Modified Water Body (HMWB) designation
- Failure to satisfy Article 4(7) WFD derogation requirements
- Failure to demonstrate no adverse effect on Natura 2000 site integrity
- Defective and misleading alternatives analysis, particularly groundwater

- Failure to account for climate non-stationarity
- Unsound economic, energy, and governance assumptions

These defects are fatal in law. Planning permission must be refused.

2. MISREPRESENTATION OF FLOW REGIME AND ABSTRACTION IMPACTS

2.1 Reliance on Average Flow Is Scientifically and Legally Invalid

Sustainable water planning requires management at catchment scale, prioritising **source-region protection**, ecological integrity, and long-term resilience. The Project reverses this principle by externalising environmental risk to the Shannon catchment for the benefit of Dublin.

The Shannon system is already:

- Hydromorphologically altered
- Ecologically stressed
- Subject to multiple competing demands

It is not an under-utilised resource.

The Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) repeatedly frame the proposed abstraction as representing approximately 2% of average annual flow at Parteen Basin.

This framing is factually misleading and legally impermissible.

Ecological impact under the Water Framework Directive and Habitats Directive is determined by low-flow and drought conditions, not long-term averages. This is explicitly acknowledged in:

- EPA technical guidance;
- The independent review of the NIS by Laura Kavanagh (February 2026);
- The developer's own flow datasets when correctly interrogated.

During Q95 and drought-year conditions, the proposed abstraction would remove between approximately 30% of available flow in the Lower Shannon under realistic operational scenarios .

The Project documentation therefore misrepresents the true scale of abstraction impacts by presenting an average-flow percentage that conceals severe low-flow effects.

This constitutes a material flaw in the environmental assessment.

2.2 Low flow Drought and Zero -Generation Scenarios

The independent expert review of the Natura Impact Statement confirms that the Project assessment:

- Relies on assumed ESB operational behaviour rather than enforceable constraints;
- Does not robustly model low-storage and drought-year conditions;
- Fails to demonstrate ecological safety during periods when the system is most vulnerable .

Under settled EU case law (*Waddenzee*, *Sweetman*, *People Over Wind*), where scientific doubt remains, consent must be refused. The legal test is certainty, not plausibility.

That test is not met.

3. UNLAWFUL RELIANCE ON HEAVILY MODIFIED WATER BODY (HMWB) STATUS

3.1 HMWB Designation Does Not Permit Deterioration

The Lower Shannon below Parteen has Not Yet been classified as a HMWB (it is earmarked as a potential candidate, but it is already a protected SAC which has not actually been modified, rather it has been left to deteriorate). Lough Derg is designated as a Heavily Modified Water Body (HMWB).

This reliance is legally incorrect.

Under Article 4 of the Water Framework Directive:

- HMWB designation does not remove the obligation to prevent deterioration;
- HMWBs must achieve and maintain Good Ecological Potential;
- Dependent protected areas (including Natura 2000 sites) remain fully protected.

The EPA's own technical review of HMWB designation confirms that over-abstraction from regulated systems can still cause unlawful deterioration, particularly under low-flow conditions .

The Project's abstraction regime would materially alter:

- Flow magnitude and variability;

- Lake level stability in Lough Derg;
- Downstream dilution capacity;
- Floodplain and groundwater interactions.

These are precisely the parameters protected under the WFD, even for HMWBs.

3.2 Failure to Meet Article 4(7) WFD Conditions

Any new abstraction constituting a modification of a water body must satisfy **all** conditions under Article 4(7) of the WFD.

The Project fails to do so:

1. **No overriding public interest has been lawfully demonstrated**
   The demand case underpinning the Project is demonstrably overstated and based on acknowledged methodological errors in demand forecasting and leakage assumptions .
2. **Significantly better environmental alternatives exist**
   Groundwater resources within the supply corridor were dismissed using incorrect distance metrics, flawed assumptions, and outdated studies, without any field verification .
3. **All practicable mitigation has not been applied**
   The Project relies on discretionary operational management rather than binding hydrological limits, which is legally insufficient.

Failure on **any one** of these criteria is fatal. The Project fails on **all three**.

4.BREACH OF THE HABITATS DIRECTIVE (ARTICLE 6(3))

Habitats Directive (92/43/EEC)

The project, as currently proposed, based on the information available to the public, does not meet the requirements of the Legal Test under Article 6(3) of the Habitats Directive (92/43/EEC)

(a) Applicable Legal Standard

Under Article 6(3) of the Habitats Directive, the competent authority may grant consent only where it has ascertained, beyond reasonable scientific doubt, that the proposed development will not adversely affect the integrity of the Lower River Shannon SAC. This is a strict precautionary test. Consent should be granted only if the absence of adverse effects is certain. The Court of Justice has consistently held that: an appropriate assessment must exclude adverse effects with certainty, any remaining scientific doubt precludes consent, and the test is one of prior certainty, not post-hoc reassurance.

(Case C-127/02, Waddenvereniging and Vogelbeschermingsvereniging ("Waddenzee"), paras 56–59)

(b) Consequences of the Article 6(3) Test The legal consequences of Article 6(3), as confirmed by settled CJEU jurisprudence, are as follows: Burden of Proof

The burden of proof rests entirely on the developer and the competent authority, not on objectors. (Waddenzee, para 59) Scientific Uncertainty where reasonable scientific doubt remains, consent must be refused. Scientific uncertainty operates against authorisation, not in its favour. (Waddenzee, paras 56–57; Case C-258/11, Sweetman, paras 40–41)

Measures relied upon to avoid adverse effects must be certain in their effect, enforceable, and assessed as part of the project. Measures which are contingent, aspirational, or dependent on future operational discretion cannot lawfully be relied upon at Article 6(3) stage. (Case C-323/17, People Over Wind, paras 35–40) Assessment of Worst-Case Conditions

The assessment must consider worst-case, ecologically critical conditions, not average or assumed operating conditions. Reliance on long-term averages where impacts arise during extremes is legally impermissible. (Sweetman, para 44; Waddenzee, para 44)

(c) Prohibition on Balancing at Article 6(3) Stage At the Article 6(3) stage, the competent authority is not entitled to balance environmental risk against project need, public interest, or water supply considerations. Such balancing is permitted only under Article 6(4) (Imperative Reasons of Overriding Public Interest), which has not been invoked. Any attempt to justify residual risk by reference to necessity or benefit therefore constitutes a misdirection in law. (Sweetman, paras 33–36)

(d) Misapplication of the Test in the Present Case

The Appropriate Assessment relies heavily on long-term average flow metrics (2% abstraction at Parteen) while failing to lawfully assess low-flow and drought conditions, which are the periods of maximum ecological sensitivity for the Lower River Shannon SAC. As demonstrated by the quantitative evidence before the decision-maker: At dry summer flows (15 m^3/s), the proposed abstraction of 3.82 m^3/s would remove approximately 25.5% of available flow. At extreme low-flow conditions (10 m^3/s), abstraction would remove approximately 38.2% of available flow.

These figures represent order-of-magnitude impacts, not marginal effects, during precisely the conditions most relevant to SAC integrity (fish migration, dissolved oxygen, habitat availability, and hydromorphological functioning by assessing impacts primarily by reference to average flows and failing to exclude adverse effects under worst-case low-flow conditions and relying on operational assumptions and future controls rather than certain, assessed mitigation, the competent authority failed to attain the level of certainty required by Article 6(3).

(e) Legal Consequence In circumstances where: adverse effects on SAC integrity have not been excluded beyond reasonable scientific doubt, and scientific uncertainty demonstrably persists under low-flow and drought scenarios, the grant of consent is unlawful and must be quashed.

4.1 Relevant Natura 2000 Sites and Hydrology Connectivity

The abstraction point at Parteen Basin lies within the hydrological envelope of multiple Natura 2000 sites, including:

- Lower River Shannon SAC;
- Lough Derg SAC;

- Shannon Callows SAC;
- Associated SPAs.

4.2 Failure of the Integrity Test

The independent review of the NIS concludes that the assessment does not exclude adverse effects on site integrity beyond reasonable scientific doubt, particularly during low-flow conditions .

Key deficiencies include:

- Inadequate assessment of lake-level drawdown impacts;
- Failure to account for cumulative abstraction pressures;
- Reliance on assumed mitigation rather than proven absence of effect;
- Failure to assess basin-scale hydrological connectivity.

4.3 Legal Consequences of Residual Scientific Doubt

Under Article 6(3), precaution is mandatory. Where doubt remains, consent must be refused.

5. Defective Alternative Analysis

A central requirement of both the EIA Directive and Article 4(7) of the Water Framework Directive is that a proposed project may only proceed where all reasonable alternatives have been properly identified, assessed, and objectively compared That test has not been met. The alternatives analysis underpinning this Project is fundamentally defective and materially misleading. As a result, reliance on Article 4(7) WFD to justify the abstraction is legally unsustainable. The alternatives analysis underpinning this Project is fundamentally defective and materially misleading. As a result, reliance on Article 4(7) WFD to justify the abstraction is legally unsustainable. Groundwater has been dismissed as a viable alternative on the basis of a series of demonstrable errors and flawed assumptions. These include:

Incorrect mathematical application of distance thresholds Groundwater options were screened out using arbitrary distance criteria that have no basis in hydrogeological science or EU guidance. Distance from Dublin city centre was treated as a limiting factor, despite the fact that water supply infrastructure routinely operates across far greater distances.

An illogical study area centred on Dublin city rather than the supply corridor: The groundwater study area was defined by an artificial radius around Dublin city, rather than by proximity to existing and expandable treatment plants, pipeline corridors, or areas of known hydrogeological potential. This approach systematically excluded viable aquifers that could reasonably supply the Eastern and Midlands region.

Failure to update assessments following demand reductions: Projected demand figures have been repeatedly revised downward over time due to: increased treatment capacity, reduced per-capita consumption and improved leakage control. Despite this, the groundwater assessment was never revisited to reflect the reduced scale of need. This failure artificially inflated the perceived inadequacy of groundwater solutions. False assumption that only a single-source solution was acceptable. The analysis was predicated on the incorrect assumption that water security required a single, large-scale source. EU water policy does not support such an approach. On the contrary, distributed, modular, and diversified supply solutions are recognised as more resilient, adaptable, and environmentally sustainable. These flaws were identified as early as 2016–2017, yet they remain uncorrected. The continued reliance on a demonstrably flawed groundwater assessment represents a failure to engage in a lawful alternatives analysis.Under both the EIA Directive and Article 4(7) WFD, the absence of a robust and up-to-date assessment of groundwater alternatives is sufficient, in itself, to render the Project unlawful.

5.2 Polaphuca Reservoir as an Alternative Strategic Asset. Polaphuca Reservoir represents a significant existing strategic water asset that has not been adequately assessed as an alternative or complementary solution.

Polaphuca has: a total storage capacity of approximately 166 billion litres, an active storage capacity of approximately 148 billion litres, and a surface area of 22.26 km^2.espite its scale, location, and existing role in water management, Polaphuca has not been properly evaluated in terms of: sustainable yield optimisation, operational flexibility during drought conditions, integration with existing treatment and distribution infrastructure, or phased enhancement as part of a diversified supply strategy. The failure to meaningfully assess Polaphuca as an alternative strategic resource undermines the claim that abstraction from the Shannon represents the only feasible option

5.3 Desalination and Other Supply-Side Options: Desalination and other supply-side options have been dismissed at a high level without a detailed or up-to-date comparative assessment. While desalination presents environmental and energy considerations, it is: a reversible and location-specific intervention, scalable and modular and increasingly used internationally as part of diversified water supply portfolios, particularly in climate-stressed regions. Crucially, desalination does not require the permanent modification of a river basin or the irreversible loss of restoration potential in protected freshwater systems. Other supply-side options, including: targeted expansion of existing treatment plants, conjunctive use of surface water and groundwater, seasonal or emergency-only abstraction strategies, have likewise not been adequately explored or compared.

5.4 Legal Implications: The alternatives analysis fails to meet the standard required by EU law. Where: groundwater alternatives have been unlawfully dismissed, existing strategic assets have not been properly assessed, and supply-side options have been rejected without rigorous comparison, the conditions of Article 4(7) WFD cannot be satisfied. In such circumstances, the Project cannot lawfully proceed.

6 Existing Ecological Status of the Shannon Water Bodies–Lough Derg System

6.1 Baseline Ecological Condition

Environmental Protection Agency (EPA) assessments have classified Lough Derg and associated Shannon water bodies as being at less than good ecological status. Pressures include:

Nutrient enrichment from diffuse and point sources

Hydromorphological alteration

Barriers to fish migration

Invasive species (e.g. zebra mussel, Asian clam)

Altered flow regimes

Planning decisions must be made against this degraded baseline.

This baseline condition is critical: abstraction risks must be assessed against an already stressed system with reduced ecological resilience, not a pristine or high-status waterbody.

Fisheries monitoring by Inland Fisheries Ireland further documents ecological concerns through Water Framework Directive fish classification surveys and ongoing stock assessments. These surveys identify altered fish community structure and continuing management challenges for migratory and resident species.

Why Baseline Stress Matters: Lessons from International Analogues

Large-scale ecological failures associated with abstraction—such as the Aral Sea, the Colorado River, and the Murray–Darling Basin—did not arise from single abstractions imposed on healthy systems. They occurred where systems already subject to regulation, nutrient pressure, or habitat alteration lost resilience and were pushed beyond ecological thresholds during drought years.

The Murray–Darling Basin is the closest analogue for Ireland: a temperate, developed country with regulated rivers, competing demands, and climate-driven low-flow risk. Its collapse demonstrates that abstraction impacts are non-linear and emerge most strongly during dry periods, not average years. The Water Framework Directive explicitly prohibits authorising projects that risk further deterioration of already stressed water bodies. Further abstraction from Lough Dery would likely result in a catastrophic concentration of toxic algae in the lake.

6.2 Loss of Ecological Resilience

Resilience refers to a system's capacity to absorb shocks (such as drought) without undergoing regime change or long-term degradation. Abstraction during low-flow periods reduces ecological buffering capacity, making collapse more likely during extreme events.

6.3 Loss of Ecological Resilience in a Regulated System

The project is frequently framed as abstracting approximately 2% of the long-term average flow of the Shannon at Parteen. This framing is ecologically misleading. Ecological impacts are driven by low-flow conditions, not long-term averages.

During drought periods: Flows are already near ecological thresholds and Lake storage (Lough Derg) is relied upon. Small additional abstractions have disproportionately large impactsLong-term average flow at Parteen is approximately 180 m^3/s. The proposed abstraction of 300–330 ML/day corresponds to approximately 3.47–3.82 m^3/s.
While this equates to 2% of average flow, ecological stress does not occur during average conditions. It occurs during low-flow, high-temperature periods when:

- flows are already reduced,
- oxygen availability is lower,
- nutrient impacts are magnified,
- fish movement is constrained.

Low-Flow Abstraction Is Far Riskier Than % of Annual Average Flow

7. Hydrological and Ecological Impacts of Large-Scale Abstraction

Using published EPA licensing material for the Lower Shannon, the Q95 low-flow statistic is reported as approximately 12.53 m^3/s. If a continuous abstraction of 3.82 m^3/s were imposed under such conditions, it would represent: 30.5% of the river flow at Q95 conditions.
By definition, Q95 conditions occur approximately 5% of the time in the long-term flow record. These periods correspond to the very conditions most likely to cause ecological harm.
Even using the lower 3.47 m^3/s abstraction figure, the proportional impact remains in the double-digit percentage range under low flows. The ecological issue is not whether statutory compensation flows are maintained, but where the abstracted water is operationally sourced during droughts: reduced hydro diversion, altered lake levels, or modified release timing. These trade-offs are precisely where paper sustainability assumptions have failed in other regulated systems. Lough Derg possesses an approximate total water volume of 0.887 cubic kilometers, equivalent to 887 million cubic meters or approximately 213 billion gallons. Its key physical characteristics include a surface area of 130 square kilometres, an average depth of 7.6 meters, a maximum depth of 36 meters, and a length of 38.6 kilometres. In contrast, the Pollaphuca Reservoir has a total capacity of 166 billion Liters and an active capacity of 148 billion Liters, with a surface area of 22.26 square kilometres.

A compensation flow of 10 cubic meters per second is consistently maintained in the lower River Shannon, along with a Fish Pass flow of 0.7 cubic meters per second, even when the Ardnacrusha Flow is at zero and all turbines are disengaged. The water level at Parteen Weir is managed within a narrow operating band, approximately 460 millimeters in depth, which extends over the natural surface of Lough Derg. ESB manages water levels within this normal operating band, across a wide range of flows, as an integral component of their hydroelectric scheme management. During flood periods, water levels in Lough Derg may exceed this normal operating band.

Each of Ardnacrusha’s four turbines utilizes approximately 100 cubic meters per second. The flow through Parteen Villa Weir is distributed between the original course of the Shannon, which is allocated 10 cubic meters per second, and the new channel directed through Ardnacrusha. When there is no water flow through Ardnacrusha, the water level of Lough Derg remains at its normal state, as indicated by the Killaloe pier head chart, and no significant current is observed at Killaloe. It is important to note that a water level drop of 0.3 meters is a recurring event on Lough Derg, falling within the established operating band of 0.46 meters. Such occurrences are primary contributors to the increased frequency of algal blooms observed on Lough Derg, exemplified by the event in September 2025 when the water table experienced a 28-centimeter decline.

Fluctuating water levels pose several detrimental impacts on freshwater lakes, contributing to pollution through various mechanisms: Sediment Exposure: Reduced water levels expose the lakebed, leading to the release of stored nutrients and chemicals from the sediment into the water column. Habitat Disruption: Variations in water levels disrupt aquatic habitats, thereby destabilizing the ecosystem and rendering it more susceptible to external pollutants. Increased Runoff: Rapid declines in water levels, particularly when followed by substantial rainfall, can escalate surface runoff, transporting pollutants from terrestrial areas into the lake.

Local Case Study -Parteen weir

Below are photographs from St. Flannan's Angling Club Killaloe members taken on the 12.02.26 who encountered navigation challenges departing the club's 70-berth boat shed. are over 180-200 berth owners south of Killaloe Bridge who are significantly impacted by variable flow conditions in the Parteen basin and have expressed concerns regarding the pipeline.

In Ireland, a hydrological drought is associated with surface and sub-surface water availability. Hydrological droughts often lag meteorological and agricultural droughts. Depending on catchment characteristics, it takes longer for precipitation deficits to emerge in streamflow, groundwater and reservoir levels. They can also last long after meteorological and agricultural droughts have ended.
See
https://www.ria.ie/blog/drought-a-risk-being-overlooked-in-ireland/
These periods may not involve an absolute absence of rainfall, but rather insufficient precipitation to replenish river systems adequately.

The pipeline is currently presented as a 'negligible' 2% abstraction.
This 2% is derived from annual average flow of the Shannon. To use average flow from a whole year is grossly misleading.

The proposed abstraction will in fact be the equivalent of up to 30% of available flow in drought periods, due to already lowered water levels.
This is explained in detail below.
This is a completely unacceptable environmental risk.

It is evident that over recent years, 'experts' have failed to perform a robust drought sensitivity analysis, and failed to demonstrate that the project supports a wide margin of safety in this regard.
It is unreliable as a dry-spell water source for Dublin.

3. Flow breakdown

The three outlets from Parteen Basin are
- Ardnacrusha hydro station
- Old Shannon rivercourse
- Clareville WTP.

Flow data obtained from the ESB under the **Freedom of Information Act see Appendix E** indicates that, over the past ten years, there have been, on average, 20 days per year during which the turbines at Ardnacrusha took Zero water. Clareville WTP was supplying 0.6m3/s to Limerick all the time.And from the same dataset, ONLY the Statutory Minimum of 10.5 m3/s was flowing down the Old Shannon.
The proposed pipeline would abstract 3.5m3/s or the equivalent of 33% of this flow of 10.5 m^3/s. So over the last 10 years, for about 20 days each year, there was No Surplus that could have been taken by a pipeline. Limerick City is already abstracting approximately 0.6 m^3/s from the Parteen Basin. This demand will increase as further housing and industry development, and associated infrastructure are constructed. It is therefore completely misleading to suggest that there is a “surplus” available for a pipeline.
During dry spells, when Ardnacrusha already cannot operate, it is impossible to simultaneously satisfy
- statutory flow requirements for the Old Shannon,
- supply Limerick
- maintain lake levels within ecological acceptable min/max range.
- AND supply the pipeline to Dublin.

Concrete example from 2018

The most recent significant dry spell (drought) was summer 2018, during which the low-flow conditions persisted for 74 consecutive days. (ESB data).
During this period, Ardnacrusha abstraction ceased. It was Zero.
The only Shannon flow arriving into the Parteen basin, was just sufficient to meet the minimum statutory requirement of 10 m^3/s for the Old Shannon, and supply Clareville WTP. Additional abstraction for a pipeline under these circumstances would have been unacceptable. Lowering the water levels in the Old River Shannon and/ or Lough Derg above Parteen, would have been the only option, with no means to control duration. We do not control how long droughts last.

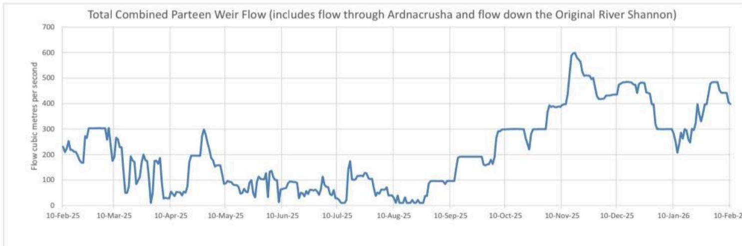
The mitigation measures proposed by Uisce Éireann are insufficient, lack enforceable guarantees, and do not adequately address these realistic already-occurring climate scenarios.Their flow modelling has not been back-tested against examples such as 2018. The entire stretch of the River Shannon concerned, is protected under the EU Natura 2000 network, which places strict legal obligations on the State to avoid deterioration of protected habitats and species. Any development, such as lowering water levels below established minimums, risking permanent ecological harm, is illegal under these

protections.

Energy for generations

Current Total Combined Parteen Weir Flow (includes flow through Ardnacrusha and flow down the Original River Shannon)

10-Feb-26 09:00:00	398	cubic metres per second



Please note the following:

1. Note that ESB does not guarantee the accuracy of any data provided. It is the user's responsibility to independently verify and quality control any of the data used and ensure that it is fit for purpose/use. ESB does not accept responsibility for the use of any data made available, read or interpreted or used in any way by the user, or passed to a third party, and do not accept liability for any damage or loss howsoever arising out of the use or interpretation of this data.

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Energy for generations

Last 30 readings for Total Combined Parteen Weir Flow (includes flow through Ardnacrusha and flow down the Original River Shannon)

Timestamp	Value	Units
10-Feb-26 09:00:00	398	cubic metres per second
09-Feb-26 09:00:00	405	cubic metres per second
08-Feb-26 09:00:00	442	cubic metres per second
07-Feb-26 09:00:00	442	cubic metres per second
06-Feb-26 09:00:00	442	cubic metres per second
05-Feb-26 09:00:00	442	cubic metres per second
04-Feb-26 09:00:00	454	cubic metres per second
03-Feb-26 09:00:00	484	cubic metres per second
02-Feb-26 09:00:00	484	cubic metres per second
01-Feb-26 09:00:00	484	cubic metres per second
31-Jan-26 09:00:00	484	cubic metres per second
30-Jan-26 09:00:00	478	cubic metres per second
29-Jan-26 09:00:00	437	cubic metres per second
28-Jan-26 09:00:00	397	cubic metres per second
27-Jan-26 09:00:00	397	cubic metres per second
26-Jan-26 09:00:00	360	cubic metres per second
25-Jan-26 09:00:00	330	cubic metres per second
24-Jan-26 09:00:00	356	cubic metres per second
23-Jan-26 09:00:00	398	cubic metres per second
22-Jan-26 09:00:00	323	cubic metres per second
21-Jan-26 09:00:00	296	cubic metres per second
20-Jan-26 09:00:00	301	cubic metres per second
19-Jan-26 09:00:00	247	cubic metres per second
18-Jan-26 09:00:00	260	cubic metres per second
17-Jan-26 09:00:00	295	cubic metres per second
16-Jan-26 09:00:00	300	cubic metres per second
15-Jan-26 09:00:00	263	cubic metres per second
14-Jan-26 09:00:00	286	cubic metres per second
13-Jan-26 09:00:00	242	cubic metres per second
12-Jan-26 09:00:00	207	cubic metres per second

Please note the following:

1. Note that ESB does not guarantee the accuracy of any data provided. It is the user's responsibility to independently verify and quality control any of the data used and ensure that it is fit for purpose/use. ESB does not accept responsibility for the use of any data made available, read or interpreted or used in any way by the user, or passed to a third party, and do not accept liability for any damage or loss howsoever arising out of the use or interpretation of this data.

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7.1 Lake Level Fluctuations and Littoral Habitat Loss

Assumes that in very low flow/drought conditions, that Ardnacrusha does not draw water for power generation. The statutory minimum flow for the Old Shannon is supposed to be 10 m3/s (10 cumecs).

From our OEA AIE 2026 02 from the EPA of 4 Feb, in Record 2 the ESB claims that the mean daily flows are 10 or sometimes 10.5 cumecs, (this figure is always 10 or 10.5, from 1st april to 1st Oct, in each year between 2016-2024). Please note the EPA rely on these figures from the ESB, which mean daily flows in the summer months, we can say the ESB claim to be releasing a daily average of 10.5 cumecs down the Old Shannon from Parteen. Only 10.5 cumecs was coming down the whole Shannon system and then being sent down the Old Shannon from Parteen weir. For these approx 14 days, spread across the summer dry months, if the proposed pipeline takes 3.47 cumecs, this would represent: 3.47/10.5 = 33% of the total flow in the Shannon.

We have extracted the flow data for 2018 and sorted by lowest flow. In 2018 there were 74 days where Ardnacrusha took Zero, and only the 10.5cumecs was going down the old Shannon. So for those 74 days, in order to preserve the statutory flow in the old Shannon, the pipeline would not have been able to take any water! Given that we are due droughts every two years this is a huge concern.

The EPA already knows there is a risk to flows from abstraction. This extract is from page 12 of the "Technical review of HMWB designation" of March 2022.

''Impacts to flows. Large dams which capture a large proportion of a catchments flow cause significant alteration of the natural flow regime. Compensation flows, while providing a benefit in terms of a minimum flow, may be constant and non-varying, and the total flow will be impacted by the abstraction. The intensity, timing and frequency of the downstream flow regime will be completely altered, often resulting in a decrease in the magnitude of small and medium sized flood peaks, and an increase in low flows. In some instances, operational procedures can result in rapid flow fluctuations that occur at non-natural rates. Over-abstraction of the upstream reservoir can also result in the downstream river drying out at certain periods of the year.''

The Castleconnell River Association maintains and monitors about 200 wild salmon spawning beds (redds) in the Old Shannon River near Castleconnell village. See ccriverassoc.org

These are the only, and the last, wild salmon still spawning in the Shannon. Atlantic salmon are on the IUCN Red List of Threatened Species. NO degradation of habitat is permitted, under the Habitats Directive. The survival of eggs and newly hatched fry are particularly sensitive to the above water flow issues. Once these are gone, they are gone. They cannot be re-established.

(The Shannon used to host the biggest wild salmon runs of all the rivers in Europe, estimated at over 400,000 fish per year).

Specific Ecological Impacts

Littoral and Shoreline Habitats

Shallow margins of Lough Derg are among the most biologically productive habitats in the system. Sustained water level drawdown of even 10–30 cm can result in:

- Desiccation of reed beds and macrophytes
- Loss of invertebrate production
- Reduction in fish spawning and nursery areas
- Repeated drawdown leads to long-term habitat loss with slow or incomplete recovery.

Fish Populations and Migration

The Lower Shannon and Parteen–Ardnacrusha complex is already a critical bottleneck for migratory species. Reduced flows:

- Impair attraction flows at fish passes
- Disrupt migration timing
- Increase predation and exhaustion
- Population-level impacts typically manifest gradually, making them easy to dismiss until recovery is no longer possible.

Water Quality and Oxygen Dynamics

Low flows combined with warmer temperatures:

- Reduce dilution capacity
- Increase residence time
- Raise the risk of algal blooms and hypoxia
- Such conditions are well-documented precursors to fish kills and ecosystem collapse in regulated river–lake systems worldwide.

A **100-metre stretch of native woodland** will be directly affected and removed at the point of abstraction. The proposed abstraction pipeline and associated works, located at Parteen Basin (coordinates: 52.782954, -8.444928), require the clearance of an established tree line along the shoreline. This woodland forms part of a sensitive riparian habitat, providing ecological functions that include:

- bank stabilisation and erosion control,
- shading and temperature regulation of near-shore waters,
- habitat connectivity for birds, mammals, and invertebrates, and
- landscape and amenity value within a protected river system.

The removal of this woodland will result in immediate and irreversible habitat loss at the abstraction point, fragmenting shoreline ecology and compounding the wider hydrological and ecological pressures already affecting the Lower Shannon system.

Given the location within a highly regulated and ecologically sensitive basin, the clearance of native woodland at the abstraction point cannot be regarded as minor or localised. It represents a direct physical impact that must be fully assessed in its own right, particularly in the context of Natura 2000 protections and the cumulative effects of abstraction-related works.

8: The Lower Shannon: A River in Decline

8.1 Historical Context

The body of water known as the Lower Shannon consists of that part of the river downstream from the Parteen Regulating Weir to where it joins the water from the Ardnacrusha tailrace at Long Shore, about a mile upstream of Limerick City.

Only about 5% of the river's natural flow is allowed through this section; the remainder is diverted to the Ardnacrusha generating station. Since the inception of the Shannon Scheme in 1929, the river has been gradually closing in—a change that is clearly visible in Castleconnell, Plassey, and Corbally.

First, a little background. There is a 26-kilometre stretch of the River Shannon, from the Parteen Weir to Limerick city, which in the early 1920's was a unique salmon fishery. The estimated annual salmon run was between 350,000–500,000 fish. In 1927, 414,000lb of salmon were caught on the river. Salmon weighing 55 lb or more were regularly caught using local, hand-crafted Enright rods at Castleconnell. Then came the Ardnacrusha hydro power station which was officially opened on July 22, 1929 by President WT Cosgrave. The impact on salmon, trout, eels, lamprey and coarse fish was immediate and catastrophic.

There are essentially two reasons why the river just north of Limerick city was a world-class fishery. First, Atlantic salmon migrate from the sea to reach freshwater to spawn. At the Thomond Bridge area in Limerick city they encounter the tidal limit and pass into fully fresh, non-tidal water. The salmon paused in huge numbers in this area to rest and recover before setting-out to points upstream on the 360km river. Second, the previous, full natural flow from the upper Shannon produced ideal conditions to create the perfect salmon habitat, particularly just above the Doonass Falls in Castleconnell; rich, diverse riverbanks, oxygen-rich water, deep holding pools and shallow gravel beds gave rise to famous salmon pools.

The Shannon Scheme entailed diverting water from the river at a newly constructed Parteen Weir down a 13km long canal, called the headrace, to the turbines in Ardnacrusha Power Station. The water then exited to a constructed tailrace, 5km in length, before joining up with the old River Shannon in the city centre.Post 1929, the annual average flow of water down the river was 210 m^3/s. Of this, 200 m^3/s was diverted down the headrace to Ardnacrusha for power generation and the remainder, a "compensation flow" of 10 m^3/s, was diverted down the old Shannon river. As the water level in the old Shannon fell from 210 m^3/s to 10 m^3/s, the old river was too shallow for the fish to migrate upstream, the spawning beds became exposed to birds and frost.

However, the "lordly" salmon kept coming up the estuary but now, because they instinctively swim towards fast water, they went up the tailrace, not the old river, where they encountered, literally, a concrete wall at Ardnacrusha. Equally, the salmon and smolts coming down the Shannon entered the headrace and found themselves either trapped or mangled by the four turbines at the power station. Confused and exhausted, the fish died in huge numbers in the polluted water on either side of the power station. It took 30 years, until 1959, before the ESB introduced a fish lift at Ardnacrusha; an ineffective lift still in use today.

This lift enabled the fish in the tailrace to go upstream and allowed the fish in the headrace to swim downstream into the estuary. Despite the establishment of the River Shannon Salmon Management Programme in 1990, the number of fish ascending the lift in Ardnacrusha has fallen from 12,000 in 1964 to a miniscule 123 in 2024 and fishermen on the old river are now all but non-existent. The requirement to maintain a minimum compensation flow of 10 m^3/s down the old River Shannon is a statutory requirement based on the Shannon Electricity Act 1925.

8.2 Flow Diversion, Channel Contraction and Habitat Degradation

This means that Uisce Eireann's proposal to abstract 4 m^3/s at the Parteen Basin, under normal circumstances, must come from the flow of water to Ardnacrusha not the old Shannon river. The water abstraction will reduce by an equal amount the flow of water to the power station which is a carbon-neutral form of electricity. How much of the water abstraction will reach households, business and hospitals in the Dublin region?

The pipeline includes multiple offtake hubs along the route presumably intended to supply towns and communities in the Midlands. Hence the 4 m^3/s is very likely to be a minimum not a maximum and there is no pending legislation specifying a maximum abstraction.

Of the water reaching Dublin, 33%, or 1.3 m^3/s, will be lost through leaks before reaching homes and businesses. This is due to an archaic, damaged pipe system dating back to the Victorian era. In most Western European cities the leakage is typically in the 10–25% range. In addition, existing Dublin data centres will use approximately 17% of the abstracted water or 0.46 m^3/s.

Instead of the further exploitation of an unique habitat and treating the Shannon as a trade-off between power and water supply, this is an opportune time to expand the narrative and add a third variable to the equation, namely ecology, and the restoration of the old River Shannon to a living salmon river. Salmon restoration cannot happen without an adequate supply of water and modern fish guidance systems to divert the fish to the old river. As an example, starting from the pre-abstraction situation, increasing the old Shannon flow from the current 10 m^3/s to 50 m^3/s, backed-up by serious habitat restoration in tributaries and spawning grounds and favourable ocean conditions, the old River Shannon could plausibly start to move towards the conservation limit.

This would reduce Ardnacrusha's average available flow by 44 m^3/s which corresponds to about 100 GWh per year in energy or about 0.3% of Ireland's annual electricity consumption. A small price to pay for repairing the sins of the past.

8.3 Contemporary Pollution and Navigation Impacts

In parts of Castleconnell, the river is now no more than 10 metres wide, notably at the Gap of the Dam, Poulcaum, and the Dancing Hole. In sections of Plassey, the river's width has shrunk by 50 metres or more.

If you walk across the Living Bridge at UL and look downstream, you will see numerous small islands that have formed over time. Here, the river has an average depth of little more than half a metre—a striking contrast for what was once described as the largest river in the British Isles.

A similar situation exists at St Thomas's Island near Corbally. During the summer months, there is a profusion of weed growth in most shallow areas of the river. At Cooper's Height, between Castleconnell and O'Brien's Bridge, this causes serious problems for the rowing clubs—both Castleconnell and Limerick—who use this stretch for training and competition. Further downstream at Plassey, Lanarone, Clouncarthy, and all the way to Corbally, it is often difficult to navigate due to the abundance of pond weed and streamer weed.

The section of river beginning about 200 metres below Black Bridge at Plassey, near the sewage discharge point, is particularly badly polluted due to an overloaded pumping station. Seagulls can be seen perched on the bridge railings daily, waiting for effluent to be discharged. This was once the stretch of river where much of Limerick learned to swim, before the advent of swimming pools. Anglers used the water to train their "billy cans." It has been many long years since people swam at Sandy, the Shannon Fields, Corbally Baths, or Island Baths.

About 16 years ago, main drainage was finally installed, and it was believed that Limerick's sewage problems would be solved overnight. Unfortunately, this proved not to be the case. The new wastewater treatment plant, located a further mile and a half downstream at Bunlicky near the cement factory, is now overloaded and unable to handle the volume produced. As a result, clean water is not being discharged into the river.

On an incoming tide, this effluent is pushed back up through Limerick, creating a toxic environment during the summer months, when water levels are at their lowest. We now await further news on what will undoubtedly be a very expensive upgrade.

Clareville Water Works is located on the River Shannon treat and supplies around 50,000 m^3 of water per day to Limerick. That capacity supports the drinking water needs of Limerick City and substantial surrounding populations — estimates range into tens of thousands This water supply will also potentially be affected.

The proposed pipeline extraction would effectively eliminate the possibility of restoring the lower course of the Shannon River in the future. unlawful under EU environmental law breaching the EU Water Framework Directive (WFD) – Directive 2000/60/EC

If the river is not a HMWB, the State must:

- Prevent deterioration of water status
- Achieve or restore "Good Ecological Status"

Article 4(1)(a) – No Deterioration

- Any project that prevents future restoration constitutes deterioration in law, even if current status is already poor.
- The Court of Justice of the EU (CJEU) has confirmed that *blocking improvement pathways* breaches this article.

Article 4(1)(a)(ii) – Restoration Obligation

- Member States must actively restore water bodies to good status.
- A pipeline that makes restoration impossible is incompatible with this duty.

Article 4(7) – New Modifications

- New infrastructure is only permitted if:
    - There is overriding public interest
    - No significantly better environmental alternatives exist
    - All mitigation measures are applied

If the water body is *not* designated HMWB, relying on Article 4(7) becomes legally weak and highly challengeable. Without HMWB status, the project is presumed unlawful under the WFD unless an Article 4(7) exemption is rigorously justified.

9: Climate Change and Increasing Drought Frequency

9.1 Historical Droughts affecting the Shannon Catchment

Introduction: Noone et al. (2017) developed a historical drought catalogue for the island of Ireland, showing that we have had intimate past experiences of drought with diverse impacts. Murphy et al. (2020) report on a major drought from 1765-1768 that impacted across the British and Irish Isles, dwarfing many subsequent droughts in the record. Forthcoming research from the JPI funded project CrossDro on multi-century tends in drought across Europe shows that Ireland has amongst the strongest trends to greater precipitation deficits in summer.

The year 2018 revealed the vulnerabilities of Irish society to drought across multiple sectors, particularly water supply, agriculture and ecology. In the context of multi-centennial historical records, the 2018 drought was not very remarkable. However, this should alert us to how vulnerability to drought has grown in Ireland over recent decades. It should prompt us to ask how we could have been better prepared.

Durning the Covid-19 pandemic, another drought came. Following a wet winter, an exceptionally dry spring resulted in precipitation deficits comparable to (and in places exceeding) 2018 in the east and southeast, but earlier in the year. Soil moisture deficits were considerable. Seasonal forecasts from multiple international modelling centres as predicted brought a hotter and drier than normal summer.

Over the coming decades our experience of drought is likely to become more frequent. Human driven climate change will be super-imposed on natural variability. Climate models tend to project reductions in summer precipitation for Ireland, though the magnitude of decreases is uncertain. Warming temperatures will also likely increase evapotranspiration, potentially increasing drought severity and the more rapid generation of soil moisture deficits. The persistence of blocking anti-cyclones – the atmospheric conditions often linked to droughts are anticipated to increase. Winters are expected to become wetter, but also more variable, with potential impacts on drought timing and duration.

Observed climate data for Ireland over the last decade demonstrates increased frequency of absolute and partial droughts, longer dry spells, including in the Shannon catchment and Higher summer temperatures increasing evaporation and oxygen stress. Climate projections indicate these trends will intensify, directly undermining the hydrological assumptions underpinning the project.

9,2 Climate Projections

Ireland's rainfall regime is strongly controlled by the North Atlantic jet stream. Research indicates that climate change may Increase atmospheric moisture capacity (7% per °C warming, Clausius–Clapeyron scaling). Increase the intensity of heavy precipitation events and alter storm-track positioning and blocking frequency over the North Atlantic–European sector which will result in more intense rainfall episodes, particularly when storm tracks align through the Irish Sea or south of Ireland. The jet stream does not simply determine how much rainfall Ireland receives; it determines where, when, and in what intensity it falls. Under climate change, this redistribution of rainfall increases the probability of hydrological imbalance — heavier episodic rainfall in the east alongside longer inter-event dry spells nationally. This has direct implications for the resilience assumptions underpinning large-scale inter-regional water transfer schemes such as the Eastern and Midlands Water Supply Project (commonly referred to as the Shannon-to-Dublin pipeline). We will experience longer dry intervals between frontal systems, especially during blocking patterns. For the east — including Dublin — this translates into higher flood risk during extreme events but greater summer and multi-week dry spell vulnerability. For the west, although annual totals remain higher, projections suggest stronger seasonality: wetter winters, drier summers.

Authoritative sources documenting these shifts include:

Met Éireann – Climate change assessments and rainfall trend analysis.

Environmental Protection Agency – National Climate Change Risk Assessment.

Climate Ireland – Regional projections for precipitation intensity and seasonal drying.

Royal Irish Academy – Research on North Atlantic storm track variability.

Drought Risk Is Increasing — Even in a “Wet” Country

Ireland is often characterised as water-rich. However, drought risk is driven not by annual totals but by:

- Seasonal distribution
- Soil moisture deficits
- Reservoir recharge timing
- Consecutive dry weeks
- Demand concentration

Recent drought episodes (e.g., 2018 and subsequent summer deficits) demonstrated that eastern catchments are highly vulnerable to sustained high-pressure blocking. Climate projections consistently indicate:

- Drier summers in eastern and midland regions
- Increased evapotranspiration under warming
- Greater variability in recharge

Thus, the emerging hydroclimatic regime is one of hydrological volatility, not abundance.

9.3 Implications for long term water security

The Eastern and Midlands Water Supply Project, led by Uisce Éireann, proposes abstraction from the River Shannon to supply the Greater Dublin Area and Midlands.

Critical vulnerability considerations:

- Source Reliability Under Climate Stress. The Shannon basin is also subject to projected summer drying and higher evapotranspiration. A national transfer scheme assumes long-term surplus availability that may diminish during prolonged drought sequences.
- Systemic Concentration Risk
  Increasing dependence on a single inter-basin transfer creates centralised exposure to:

Multi-year drought, operational constraints, Ecological flow protections, Mismatch Between Rainfall Intensity and Storage, Heavier rainfall events do not automatically increase usable supply. Rapid runoff during intense storms may also Increase flooding, Reduce infiltration Limit groundwater recharge and Exceed storage capture capacity

Demand-Side Escalation
Population growth in the Greater Dublin Area compounds risk during summer low-flow periods — precisely when jet stream blocking is most likely to suppress rainfall.

Strategic Policy Concern

If climate change increases we will see

- Rainfall intensity variability
- Summer drying in eastern and midland regions
- Drought frequency under persistent high-pressure regimes

Then a long-lived (multi-decade) infrastructure decision must be stress-tested against compound drought scenarios, not historical averages. A core policy question emerges: *Does the current design sufficiently account for non-stationarity in Ireland's hydroclimate?* The traditional assumption of Shannon surplus availability may rely on past climatology rather than future jet-stream-mediated variability.

Policy Conclusion

The emerging climate signal for Ireland is not one of uniform wetness, but of greater extremes and seasonal asymmetry. The jet stream's evolving behaviour means:

The east may experience more intense rainfall events but also sharper summer deficits.

The west may remain wetter annually yet face longer inter-event dry periods.

National water security will depend increasingly on storage, demand reduction, leakage control, and decentralised resilience, rather than simple inter-basin transfer.

From a climate adaptation perspective, any major water abstraction project must demonstrate robustness under:

- Repeated multi-season droughts
- Reduced recharge efficiency
- Increased interannual volatility

Failure to incorporate these dynamics risks infrastructure lock-in based on outdated hydroclimatic assumptions.

The jet stream doesn't just change how much rain Ireland gets — it changes where and how we get it. As climate change loads the dice toward heavier rainfall when conditions align, the east (including Dublin) can see more high-impact rain episodes under certain storm tracks and Irish Sea shower setups, while the west can simultaneously experience longer drier spells between events—even though it remains the first landing point for many Atlantic systems.

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5.6 Major Historical Droughts Affecting the Shannon Region

According to Maynooth University's 250-year drought reconstruction catalogue (1765–2015; O' Connor et al. 2022; Jobbová et al. 2024), the following periods saw significant dry conditions across Irish catchments, including the Shannon:

- 1765–1768: Identified as the most severe to affect Ireland over the 250 year period (Murphy et al. 2020) and is noted to have spanned 40 months thus being a multi-year drought. The drought is notable across Britain and Ireland but is most severe in Ireland and Scotland (Murphy et al. 2020). Significantly, one of the impacts, reported in newspaper accounts, is that the River Shannon had 'been fordable on foot'.
- 1800–1809: A decade characterized by intense, long-duration, and recurring droughts.
- 1854–1860: A long-duration, intense drought.
- 1887–1888: A "national calamity" identified by Maynooth researchers, featuring intense summer drought.
- 1933–1935 & 1944–1945: Significant droughts identified in Irish catchment studies.
- 1975–1976: A major pan-European drought that caused severe water stress in Ireland.
- 2018: The most significant recent drought. Water levels in parts of the River Shannon and the River Liffey dropped so low that sections could be safely waded across in 2018 (O'Connor et al. 2022).
- 2020: A significant spring drought, leading to national water shortages (O' Connor et al. 2022).

Broad findings from ICARUS (Irish Climate Analysis and Research Units) publications:

· Drought as a "Forgotten Hazard": Researchers have highlighted that recent decades (post-1990) have been relatively wet, causing a societal underestimation of Ireland's drought vulnerability (O'Connor et al. 2022; Jobbová et al. 2024).

· Long-term Data: By digitizing pre-1940 rainfall records and analyzing newspaper archives, the Maynooth team established that extreme events are more common than modern experience suggests (O' Connor et al. 2022; Jobbová et al. 2024).

· Changing Patterns: While winter/spring precipitation has increased, summers have seen a trend toward drier conditions, increasing the risk of summer hydrological droughts (Jobbová et al. 2024).

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Data From ICARUS/Maynooth University

Likely increased drought or dry weather periods in the Mid-West of Ireland over the next 20 years (to 2045), drawing on the most relevant information from Met Éireann, Copernicus, and climate research linked to ICARUS/Maynooth University, supplemented with broader climate projections for Ireland:

1) Current Observations: Dry Periods Already Increasing

· Met Éireann's 2025 climate analyses found numerous dry spells and drought events across Ireland in 2025, including absolute droughts (15+ days without significant rain) and extended dry periods recorded at many stations. This reflects a recent pattern of more frequent dry weather and warming trends that support such conditions.

· Copernicus European Drought Observatory (EDO) indicated periods in 2025 where large parts of Ireland and Europe were experiencing drier than average conditions and drought warnings/indicators — showing dry conditions in many areas.

2) Climate Model Projections: More Variable Rainfall, Longer Dry Spells

While Ireland's overall annual precipitation isn't projected to sharply decline, the seasonal distribution and variability are expected to change in ways that favour dry spells, especially in summer:

Summer dryin

· Climate projections for Ireland (e.g., regional climate models under different emissions scenarios) suggest summer rainfall may decrease significantly by mid-century (e.g., a 2–17 % summer decrease under

high-emissions scenarios), with dry periods (5+ days with very little rain) becoming more frequent, potentially up to 48 % more common in summer.

More variable precipitation

· But projections also indicate the number of heavy rainfall days will increase in autumn/winter even as summers become drier — meaning that drought and flood risks both grow.

· Seasonal models show increased potential evapotranspiration (drying due to higher temperatures) combined with less summer rain is likely to increase aridity and water deficits, especially in spring/summer, by late century.

Temperature increases accelerate drought risk

· A warmer atmosphere increases evaporation from soil and plants. Even without large drops in total rainfall, higher temperatures can lead to more frequent or severe meteorological and agricultural drought conditions in summer, particularly if rainfall timing shifts.

3) Contributions from ICARUS / Maynooth University

Although ICARUS and Maynooth University research primarily focuses on attribution of extreme temperatures, heatwaves, and event attribution (which is extremely relevant to drought potential):

· Recent collaborative studies (e.g., WASITUS project) show that warm summers like 2025 are now more likely due to climate change and that similar conditions will occur more frequently as background warming continues. Such warm, dry conditions are a key factor in increasing drought risk.

· ICARUS is also part of research (EXACT project) funded to assess how droughts, floods, and other extremes have changed and may evolve under climate scenarios — implying strong scientific interest and emerging results on future drought risks.

Although ICARUS has not yet published a headline national drought projection in the easily summarised literature, their work clearly aligns with the broader climate science consensus that extreme conditions including drought risk are increasing as temperatures rise.

Likelihood of Increased Drought / Dry Spells (Next 20 Years)

· Increased variability of rainfall, with more extended dry periods during summer even if annual totals don't decline sharply.

· More frequent warm summers and heat extremes, which enhance soil moisture deficits and drought potential — increasingly likely as global warming continues.

Moderate confidence

· Actual meteorological drought frequency (strictly defined) may have uncertainties at regional scales due to natural climate variability, but model consensus indicates a trend toward more frequent/longer dry spells in summer by 2040-2050 under current emissions pathways.

Less certain

· The magnitude and exact location of drought impact vary year-to-year and depend on broader circulation patterns (e.g., jet stream shifts), which remain intrinsically uncertain.

Summary — What This Means for the Mid West of Ireland

Over the next 20 years (to 2045): Warmer average temperatures are very likely. Summer rainfall is likely to become more variable and on average lower in many years. Dry spells and prolonged dry periods (and potentially moderate drought conditions) will become more common during the growing season, although severe precipitation deficits will still vary by year.

Together, these changes increase the likelihood of dry weather impacts — particularly on agriculture, soil moisture, and water resources — even if Ireland still experiences o

Example Taken from 2018

We have extracted the flow data for 2018 and sorted by lowest flow. Conclusion: in 2018 there were 74 days where Ardnacrusha took Zero, and only the 10.5cumecs was going down the old Shannon.

So for those 74 days, in order to preserve the statutory flow in the old Shannon, the pipeline would not have been able to take any water!

The spring drought in 2020 had 20 zero Ardnacrusha days, mostly in May and June)

10. Failure of Environmental Assessment (EIA and AA) Internal Inconsistency in the EIAR

10.1 Internal Inconsistency in the EIAR

The Environmental Impact Assessment Report (EIAR) acknowledges a wide abstraction zone of influence extending from upstream of Parteen to downstream of Limerick Dock yet limits ecological assessment to the immediate intake area based on subjective 'look and feel' criteria. The gauge no. 25075 this information is not in the public domain by the EBD. The project fails to demonstrate beyond reasonable scientific doubt that it will not adversely affect the integrity of Natura 2000 sites hydrologically connected to the Shannon system, particularly under drought and climate stress scenarios.

10.2 Reliance on ESB Operational Assumptions

The EIAR relies heavily on assumptions regarding ESB operational controls (e.g. maintaining water levels within a normal operating band) without assessing abstraction impacts independently of those assumptions.

Third-party operational intentions cannot lawfully substitute for mitigation unless they are certain, enforceable, and assessed as part of the project.

11. Groundwater as a Superior and Sustainable Alternative

11.1 Groundwater resources in County Kildare as a superior alternative to long-distance surface-water abstraction.

A Strategic Case for Groundwater as a Sustainable Water Source in County Kildare

County Kildare is uniquely positioned to play a critical role in Ireland's future drinking-water strategy. Beneath the county lies a network of productive gravel and limestone aquifers that already supply homes, farms, group water schemes, and public supplies. When properly developed and protected, these groundwater resources offer a high-quality, lower-carbon, environmentally resilient alternative to large-scale surface-water abstraction schemes.

We set out why groundwater in Kildare should be fully explored and prioritised as a sustainable water source, particularly in the context of supplying the Greater Dublin Area. Kildare's Major Groundwater Systems overlies several regionally important aquifers capable of yielding substantial volumes of water:

Curragh (North Kildare) Gravel Aquifer

a) The largest shallow aquifer in the county
b) Occurs in extensive gravel deposits
c) Supplies local and public abstractions, including Monasterevin wellfield
d) Highly productive where properly developed

Allenwood Limestone Aquifer

e) A fissured limestone bedrock aquifer
f) Extends through Allenwood, Rathangan and Robertstown
g) Proven yields of several million litres per day from individual wells

Calp Limestone Aquifer

h) Regionally important limestone aquifer
i) Used for public supply near Johnstown Bridge
j) Like all limestone aquifers, it requires careful management due to areas of faster groundwater flow

Local Bedrock and Gravel Aquifers

k) Distributed throughout the county
l) Successfully support group water schemes and private supplies (e.g. Kilteel, Kilkea)
m) These aquifers are already functioning assets — not theoretical resources.It is often noted that limestone aquifers can have fast groundwater flow and therefore vulnerability. This is true only where development is poorly planned. With a proper drilling programme, including:
n) Step-drawdown and long-term pumping tests
o) Water quality analysis
p) Sustainability and recharge assessment
q) Source protection zoning
r) …the quantity, quality, and long-term security of groundwater can be accurately assessed and safeguarded.
s) This approach is not new. It has been successfully applied for over 55 years in Ireland, supplying group water schemes serving 100+ houses and farms, often to a higher standard than surface-water supplies.

Naturally Superior Water Quality

t) Groundwater is naturally filtered through soil and bedrock
u) Typically, low in turbidity (floating solids)
v) Requires less chemical treatment than river water
w) This is fundamentally where drinking water should come from

Shorter Distance, Lower Carbon

x) Kildare is approximately 30 km west of Dublin
y) Contrast this with proposed surface-water abstraction from the River Shannon — a journey of ~165 km
z) A shorter supply route means:
aa) Lower carbon footprint
bb) Less construction disturbance
cc) Reduced impact on national amenities, flora, and fauna

Lower Treatment Burden

Shannon water carries significant turbidity, particularly during high flows. At least one-third of initial treatment would be dedicated to removing suspended solids. This produces large volumes of sludge mixed with treatment chemicals. Concerns have been raised — and independently investigated — regarding Shannon abstraction figures during drought conditions. Alarmingly, these figures do not add up in low-flow seasons. Ireland cannot afford an “eleven-month-a-year project” that: Fails under drought stress and affects multiple communities along its route which Impacts sensitive river ecosystems. Groundwater, by contrast, is buffered against short-term drought, particularly when abstraction is spread across multiple wellfields and aquifers. Groundwater is the backbone of urban water supply across Europe: London and Paris source up to 50% of their drinking water from groundwater wells. Across Europe, groundwater supplies 70% of potable water (Ireland currently 20%) Ireland —is behind, not ahead, on this issue. A Kildare-based groundwater strategy would save tens of millions of euro in infrastructure costs and reduce energy use and chemical dependency including minimize environmental disruption and align with EU Water Framework Directive objectives and deliver a resilient, high-quality supply "as nature intended" Simply put: It represents a superior supply with a quarter of the journey, far fewer environmental impacts, and long-term sustainability. This option must be formally considered, assessed, and explored as part of Ireland's national water strategy — before committing to irreversible, high-impact surface-water schemes. The dismissal of these options has been selective, inconsistent, and inadequately justified.

11.3 Environment, Carbon and Cost Advantages

As discussed in sections above, Uisce Eireann have not seriously considered exploring groundwater as resource (Usce Eireann, 2026) that, in combination with fixing leaks, could be explored as a resource at a fraction of the cost of the Shannon Pipeline project. Existing groundwater supply schemes such as the Portlaoise and Mountmellick Water Supply Schemes how that more locally sourced groundway from bedrock can supply local communities.

Further, research has shown that certain configurations of structural geology and groundwater and Carboniferous limestone formations, which exist in the Dublin area and surrounds can produce quantities of groundwater that where strategically targeted with wells are a potential resource worth investigating (Moore & Walsh, 2013; 2021; Moore et al. 2019).

A point on a fault incepted during the excavation of Lisheen mine produced flows in excess of 1.3m3/s in 1999 and this only dissipated to 0.3m3/s upon mine closure in December 2015 (Moore & Walsh, 2021). Flows fluctuated with rainfall. Conceptualisation of the mine geology and shows that point on the fault had such high sustainable flows because of its connectivity to karstified faults and fractures in the Waulsortian limestone Formation and the Lisduff Oolite formation. It is the Carbonate rich nature of these formations which has meant connection to the them produces higher flows. The higher carbonate content means dissolution and karstification of fractures is greater thus resulting in better connectivity and greater and more sustainable flows. These formations and formations of similarly high carbonate content occur in the Dublin area and surrounding counties e.g. Meath, Kildare. Configuration of faults within and bounding these formations in the Leinster region are worth exploring for high well yields prior to undergoing a major, costly project such as the Shannon pipeline project which is vulnerable at low flows and drought periods.

A point on a fault of the same age and geometry as the Lisheen fault (Cenozoic Strike-slip Faults; Moore & Walsh,2013; 2021) was intercepted in Huntstown South Quarry in north county Dublin in 2012 producing over 0.06m3/s. The point on the fault flowed until 2016, fluctuating with rainfall. The EBdrock formation where the fuatl was intercepted is a shaley limestone and shale Formation that does not show significant karstification similar to the Carbonate rich formations mentioned above however can still produce yields supplying local areas (as described by GSI aquifer maps).

The timing and geometry of the faults that have points of high flow is well understood (Moore & Walsh, 2021) plus the geometry of other structures in Ireland are also well understood. In addition, structural and bedrock configurations that would produce high flows to a groundwater well (Moore et al. 2019) are worth investigating in the Dublin and surrounding region in particular because it would be at a fraction of the cost of the Shannon pipeline project.

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Demand Management and Leakage Reduction

Dublin continues to lose a very large proportion of treated water through leakage in aging infrastructure. Proceeding with a multi-billion-euro supply scheme without first securing the existing network is inefficient and environmentally unsound.

Scale of Water Loss in Dublin's Supply Network.

Uisce Éireann's public documents fail to provide an adequate analysis of the extensive leakage crisis in Dublin's water network. Uisce Éireann's leakage reduction program indicates that over 46% of treated water was lost through leaks before it reaches consumers in 2012 when this project was first suggested and has fallen to 37% in 2022 with a planned reduction to 25% in 2030. This means that any additional water abstracted from the Shannon will largely be wasted through the same failing infrastructure. By failing to prioritize leak detection, mapping, and repair, Uisce Éireann is proposing an inefficient and unsustainable approach that disregards the principles of conservation and best available technology (BAT) required under EU environmental law.

https://www.water.ie/news/leakage-reduction-program-2

https://enterprise.gov.ie/en/news-and-events/department-news/2018/july/04072018.html

Summary of the Kennedy Analysis of Irish Water's Shannon Project and Its Relevance to Sustainable Alternatives such as Kildare Groundwater. This report was written by Emma Kennedy who is an independent consultant for the River Shannon Protection Alliance Ltd.

The Kennedy Analysis critically examines Irish Water's justification for this project and concludes that the project is not required, is based on flawed analysis, and would fail to solve Dublin's real water problems. See full report in Appendices.

12. Economic, Energy and Governance Considerations

Key Findings of the Kennedy Analysis

The "Need" for the Shannon Project Is Fundamentally Flawed

- Irish Water's demand analysis contains multiple mathematical errors
- Correcting just three of these errors removes the projected supply deficit entirely
- On this corrected basis, there is no need for the Shannon Project at all

- Irish Water has made false or misleading statements regarding the necessity of the project
- These statements have been made to the public, media, and government
- The perception of crisis has been used to justify a predetermined solution
- Dublin's Real Problem is Leaking Pipes and not Lack of Water

Extreme Leakage Rates

- Dublin's water network suffers from 37% leakage
- This is far outside international norms
- Much of the network consists of ancient, corroded Victorian-era pipes

- **International Comparison Highlights the Failure**
- London, with leakage less than half of Dublin's, is replacing its entire Victorian water main network
- Irish Water, by contrast, plans to replace only 1% of mains per year
- At this rate, Dublin's pipes will remain fundamentally unfit for decades

The Shannon Project Will Not Fix Outages or Water Quality

- Dublin currently experiences:
- Frequent water outages
- Unreliable water quality due to ingress through cracked pipes

- Pipe replacement is unavoidable — it must happen eventually
- Proceeding with the Shannon Project first means:
- Paying for a massive abstraction scheme now
- Paying again later to fix the pipes
- This represents poor value, poor sequencing, and high risk

Irish Water's response to the Kennedy Analysis has been:

- Defensive
- Dismissive
- Lacking substantive technical rebuttal

12.1 Project Cost Escalation and Financial Risk

The Kennedy Analysis strengthens the case for decentralized, resilient alternatives, including Properly assessed groundwater development in counties such as Kildare Shorter supply distances (30 km vs 172 km) and lower carbon footprint combined with naturally high-water quality with reduced treatment, sludge, and chemical waste, Incremental, scalable investment rather than a single mega-project. If Dublin does not face a genuine supply deficit, there is time and space to develop better options — including Kildare's proven aquifers — rather than committing to an irreversible, environmentally disruptive scheme.The Kennedy Analysis demonstrates that the Shannon Project is: Unnecessary, Over-engineered Financially reckless, Incapable of solving Dublin's actual water problems. Ireland must: Fix Dublin's leaking pipes and subject all analysis to independent review including fully assess lower-impact, groundwater-based alternatives, including those in County Kildare.

12,2 Energy Use, Carbon Impact and Ardnacrusha Generation

- Project cost estimates have escalated dramatically over time, with figures ranging from several billion to over ten billion euro. Such variance indicates profound uncertainty and exposes the State to long-term financial risk.
- Energy Intensity and Carbon Impact
- Long-distance pumping and treatment entail high, permanent energy demand. Claims of carbon neutrality rely on offsetting rather than genuine emissions avoidance and are incompatible with national climate obligations.
- Subsurface Leaks and Their Geological & Structural Risks. A key issue that has not been properly assessed is the geotechnical and hydrological impact of conΘnuing to allow large volumes of treated water to leak into the ground beneath Dublin. Such impacts may include the following.
- Formation of Sinkholes and Ground Subsidence: The continuous seepage of large volumes of water underground can dissolve underlying geological materials, particularly where so clays or karst limestone formations exist. This can lead to the collapse of roads, pavements, and buildings. Several past incidents of sinkholes in Dublin have been linked to water-related ground destabilizing.
- Weakening of Building Foundations: Prolonged exposure to high water tables from leaks can weaken building foundations, particularly in older structures that rely on shallow footings. This increases the risk of structural failures, requiring costly remedial engineering work.
- Increased Risk of Sewer and Infrastructure Failure: Water leaks can interact with Dublin's aging sewer network, leading to the ingress of clean water into wastewater systems, overloading treatment plants, and increasing pollution risks. High levels of leakage also exacerbate pipe bursts, accelerating infrastructure deterioration.
- Contamination of Groundwater Resources: Continuous leakage introduces the risk of cross-contamination between clean water supply pipes and polluted subsurface water, particularly in areas where sewerage infrastructure is also leaking. This creates a public health risk and potential non-compliance with the Drinking Water Directive (EU 2020/2184).

The Need for a Comprehensive Leak Mapping and Hydrological Model. Before proposing any new water abstraction scheme, Uisce Éireann must:

- Develop a citywide geospatial model mapping active leak, water loss volumes, and their hydrological effects.
- Conduct a ground stability risk assessment, including sinkhole formation and structural
- impacts on buildings. Quantify the potential economic cost of continued leaks versus the cost of targeted repairs
- Compare the carbon footprint of large-scale leak reduction programs with the energy-intensive WSP. Without this essential data, the WSP proposal is incomplete and fails

to meet the basic requirements of environmental due diligence under EU and Irish planning laws.

Ecological and Hydrological Risks of Large-Scale Water Abstraction

The proposed abstraction from Shannon raises serious concerns about its impact on: Water quality and assimilative capacity – reducing the Shannon's ability to absorb wastewater and industrial pollutants. Water becomes more concentrated. River hydro morphology – altering natural sediment transport and water flow dynamics. (need stats on this). Protected habitats and species – potentially violating the Habitats and Birds Directives if fish spawning areas, wetlands, or aquatic flora are impacted. Hydroelectric generation at Ardnacrusha – reducing available water for renewable energy production. 1.6% (50% of hydroelectric power generated). GPR. 86 mega watts. 3 Francas turbine, 2 Kaplan-332 Kigowatt.

12.3 Governance Deficits and Source-Region Equity

Lack of Statutory Basis for National Water Resource Plans

Uisce Éireann's national water resource planning framework lacks clear legislative underpinning. The assumption of authority over national water resources without corresponding statutory responsibility raises serious governance concerns.

Source-Region Equity and Social Licence

The project imposes environmental risk on Shannon catchment for the benefit of Dublin, without adequate justification, compensation, or democratic consent. Comparable projects internationally have repeatedly failed due to loss of social licence.

13. International Precedents and Failure Modes

13.1 Lessons from the Murray-Darling Basin, Colorado River and Aral Sea.

Global experience demonstrates that large-scale inter-basin transfers and abstractions commonly fail due to: Underestimation of drought risk, Cumulative impacts and weak Enforcement of Environmental Safeguards. Notable examples include the Murray–Darling Basin, the Colorado River, and the Aral Sea basin.

Below are **clear, well-documented cases where large-scale river abstraction or diversion caused serious ecological destruction**, in ways that are directly relevant to concerns raised about **Shannon abstraction** (even if the Irish proposal is smaller in scale).

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1. Aral Sea Basin (Central Asia) – *Collapse of an entire ecosystem*

What happened
Massive abstraction from the **Amu Darya and Syr Darya rivers** for irrigation (cotton farming) from the 1960s onward.

Ecological destruction

- Aral Sea lost **~90% of its volume**
- Salinity increased several-fold → **complete collapse of fish populations**
- Wetlands destroyed; migratory bird routes collapsed
- Creation of toxic salt deserts, spreading pesticides via dust storms

Why it matters as a precedent
This is the most extreme example of **"incremental abstraction + political assurances" leading to irreversible collapse** when extraction exceeded ecological thresholds. Even though each scheme was "justified" individually, the system failed cumulatively.

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2. Colorado River (USA/Mexico) – *A river that no longer reaches the sea*

What happened
Extensive abstraction for cities and agriculture across seven U.S. states and Mexico.

Ecological destruction

- The **Colorado River Delta** (once ~7,800 km^2 of wetlands) is now **~10% of its former size**
- Loss of riparian forests, fish nurseries, and bird habitats
- River routinely **fails to reach the ocean**

Why it matters

- Every individual abstraction was "within legal limits"

- Environmental flows were ignored until collapse occurred
- Climate change later made the system far more fragile than expected

This is a textbook example of **long-term over-confidence in flow reliability**.

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3. Murray–Darling Basin (Australia) – *Slow ecological death of a river system*

What happened
Decades of water extraction for irrigation across multiple states.

Ecological destruction

- Repeated **mass fish kills** (notably in 2018–19)
- Collapse of native fish populations
- Loss of floodplain forests and wetlands
- Salinity increases and algal blooms

Official findings
Multiple government and independent reviews concluded that **over-allocation and weak enforcement** caused ecological collapse, even though abstraction limits existed on paper.

Why it matters
This is one of the **closest analogues** to Ireland:

- Temperate climate
- “Sustainable” abstraction rules
- Failure triggered during drought / low-flow years

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4. Ebro River (Spain) – *Delta degradation linked to upstream extraction*

What happened
Heavy abstraction upstream combined with dams and diversions.

Ecological destruction

- Reduced sediment reaching the **Ebro Delta**
- Delta retreat, wetland loss, increased salinity intrusion
- Decline in fisheries and bird habitats

Why it matters
Even without total river collapse, **removing relatively small proportions of flow upstream** caused downstream ecosystems to unravel over time.

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5. Yellow River (China) – *Seasonal ecological failure*

What happened
Large-scale abstraction for agriculture and cities.

Ecological destruction

- For years in the 1990s, the river **ran dry before reaching the sea**
- Collapse of estuarine ecosystems
- Loss of fisheries and wetlands

Key lesson
Authorities believed abstractions were manageable until **drought revealed system fragility.**

What these cases have in common (the warning signs)

Across *all* of these failures:

1. **Abstraction looked "small" relative to average flow**
2. **Low-flow and drought scenarios were underestimated**
3. **Environmental flows were the first thing sacrificed**
4. Damage became visible **only after tipping points were crossed**
5. Recovery was **slow, partial, or impossible**

This is why ecologists tend to focus less on *percentage of annual flow* and more on:

- **Seasonal low-flow impacts**
- **Cumulative abstraction**
- **Climate-change-driven variability**
- **Governance failure under stress**

Bottom line

There are **multiple global precedents where river abstraction schemes—initially defended as safe, limited, and well-regulated—caused severe ecological destruction**, especially when climate variability and cumulative impacts were underestimated.

If you want, I can next:

- Compare these directly to **Shannon hydrology & Lough Derg ecology**
- Explain **why low-flow abstraction is far riskier than annual averages**
- Or summarise **what independent ecologists typically flag as red lines** in projects like Uisce Éireann's proposal

all of this pls Compare these directly to Shannon hydrology & Lough Derg ecology Explain why low-flow abstraction is far riskier than annual averages Or summarise what independent ecologists typically flag as red lines in projects like Uisce Éireann's proposal

Thought for 24s

Below is a **direct, nuts-and-bolts comparison** between the big "ecological destruction" abstraction/diversion failures (Colorado, Murray–Darling, Aral-type dynamics) and **what's actually distinctive about the Shannon at Parteen / Lough Derg**—plus why **low-flow risk** is the whole game, and the **red lines** independent ecologists typically point to for schemes like Uisce Éireann's.

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1) What's special about the Shannon at Parteen (and why that matters)

The Shannon here is already a highly managed, flow-split system

At **Parteen Regulating Weir**, most Shannon flow is diverted into the **headrace canal** to supply the **Ardnacrusha** hydro station; a **statutory "compensation flow" of 10 m^3/s** goes down the **Old Shannon** channel.

Source: [cdn.esb.ie+2Uisce Éireann+2]

Source: ESB also explicitly states it **manages Lough Derg levels** via operation of Ardnacrusha and gates at Parteen. [ESB Corporate+1]

Why this matters ecologically:
Many "destruction" case studies (Colorado, Murray–Darling) involve **layers of allocation + infrastructure** that make the system brittle in drought. The Shannon at Parteen already has that "brittleness ingredient": flows and levels are not purely natural; they're **operational outputs**.

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2) Compare directly to Lough Derg ecology: where the stress points are already

EPA catchment assessments describe **Lough Derg at Poor ecological status** (2010–2015) and list pressures including **diffuse agriculture, hydromorphology, fish passage issues, invasive species (including zebra mussel and Asian clam), urban wastewater, and the inputting river**.

Source: [Catchments.ie+1]

Fisheries Ireland surveys also document ecological concerns via fish status/communities (e.g., WFD fish classification work), and continue to monitor stocks.

Source: [Inland Fisheries Ireland+1]

Why this matters compared to "ecological destruction" examples:
The worst failures usually weren't "healthy systems that got tapped once." They were systems with **existing pressures** where extra abstraction **reduced resilience** and pushed them past thresholds during bad years (Murray–Darling is the closest "temperate developed country" analogue).

14. Soil Composition and Pipe Stress

Dublin's geology is largely defined by glacial till (often called "Dublin Boulder Clay"). This material is dense and heavy, but it reacts significantly to environmental changes:

* Expansion and Contraction: During periods of heavy rain (common in early 2026) or drought, certain clay-heavy soils in Dublin expand and contract. This movement creates physical stress on rigid, older pipes made of cast iron or lead, causing them to snap or "joint-pull."

* Saturated Ground: As seen in recent reports from January 2026, saturated ground from high rainfall increases external pressure on water mains. When the soil becomes waterlogged, it loses its ability to support the weight of the pipes and the roads above them, leading to bursts.11.1 . Bedrock and Subsoil Permeability

According to Geological Survey Ireland (GSI), the bedrock under Dublin is predominantly Carboniferous Limestone.

Corrosion: Limestone can influence the chemistry of groundwater. In some areas, the interaction between groundwater and metal pipes leads to external corrosion, thinning the pipe walls until they can no longer contain the internal water pressure.

Vulnerability: Areas with high "subsoil permeability" allow surface water to reach the pipe level quickly. This rapid fluctuation in moisture levels is a leading cause of the "freeze-thaw" effect during cold snaps, which brittle Victorian-era pipes cannot survive.

The geotechnical risks associated with continuous underground water leaks, including sinkholes, foundation instability, and water pollution. Lack of a comprehensive hydrological and geological models to assess the full impact of Dublin's leaking water system.

Quantitative Flow, Power Generation, and Abstraction Context (Complementary Technical Note)

This section provides additional quantitative context on River Shannon flows, abstraction percentages, and the operational realities of the Parteen–Ardnacrusha system. It is intended to complement the ecological, legal, and planning arguments set out above by demonstrating why reliance on average flow metrics materially understates real-world impacts during critical low-flow conditions.

Baseline River Shannon Flows at Parteen / Killaloe

Long-term monitoring indicates that:

Mean annual discharge of the River Shannon at Limerick is approximately 208.1 m^3/s.

Corresponding flows at Killaloe / Parteen Weir are typically estimated at 180–186 m^3/s.

For the purpose of analysis, a representative average value of 183 m^3/s at the abstraction point is assumed.

This figure is frequently used to justify abstraction as a small percentage of total flow. However, this approach is hydrologically and ecologically misleading.

12.1 Proposed Abstraction Volume and Flow Variability

The current proposal involves abstraction of approximately 3.82 m^3/s. When assessed against the full range of Shannon flows, the percentage impact varies dramatically:

Major flood conditions (700 m^3/s):

Abstraction 0.55% (negligible)

Long-term annual average (183 m^3/s):

Abstraction 2.09% (the frequently cited "~2%" figure)

Dry summer conditions (15 m^3/s):

Abstraction 25.5% of available flow

Extreme low-flow conditions (10 m^3/s):

Abstraction 38.2% of available flow

During precisely the periods when ecological systems are under the greatest stress, the proposed abstraction would therefore remove one-quarter to nearly two-fifths of the river flow downstream of Parteen Weir. This is the critical planning reality that average-flow metrics obscure.

Legal Minimum Flows and Measurement Uncertainty

The statutory minimum compensation flow down the old Shannon channel toward Castleconnell is 10 m^3/s. However, the precision with which this flow is measured and enforced is unclear. The methods used are not transparent and may be insufficiently robust during rapidly changing low-flow conditions. Any abstraction during drought therefore operates directly at the margin of legal and ecological thresholds.

Ardnacrusha Operational Constraints and Flood Routing

Ardnacrusha power station has: Four turbines, each with a maximum capacity of 100 m^3/s.

A stated maximum operational flow of 400 m^3/s, producing up to 86 MW. Flows in excess of this capacity are automatically diverted down the old Shannon channel toward Castleconnell. During major floods, this can involve 200–300 m^3/s, contributing to flood risk in Clonlara, Shannon Banks, and Limerick City. Historical events (e.g. 2020 flooding) recorded flows approaching 650 m^3/s, with overtopping of infrastructure such as the Doonass footbridge.

Power Generation Efficiency and National Context

With an average annual Shannon flow of 208.1 m^3/s, and a mandatory 10 m^3/s compensation flow, the average effective flow through Ardnacrusha is approximately 198 m^3/s.This equates to:

- Average utilisation of installed hydraulic capacity: 49.5%
- Average power output: 42.6 MW
- Annual energy production: 373 GWh
- In national context:
- Total electricity generated in Ireland (2023): 30,600 GWh
- Contribution of Ardnacrusha: 1.2% of total generation

Renewable Energy Comparison

When compared with modern wind generation:

Typical onshore wind turbine capacity: 3 MW

Average capacity factor: 35%

Effective average output per turbine: 1.05 MW

On this basis, Ardnacrusha's average output is equivalent to approximately 40 modern wind turbines, a scale already commonplace in Ireland. In renewable energy terms: Renewables accounted for 40.7% of Irish electricity generation in 2023. Ardnacrusha contributed 3% of renewable generation. Removal of Ardnacrusha would reduce the renewable share by only 1.2 percentage points, a marginal change that does not justify disproportionate ecological and hydrological impacts.

Strategic Implications for Planning and Biodiversity

These figures demonstrate that: The abstraction proposal is ecologically severe during low-flow conditions. The energy benefits of maintaining the Parteen–Ardnacrusha regime are modest at national scale. The system disproportionately sacrifices river ecology and downstream resilience to preserve legacy infrastructure and facilitate an unsustainable water transfer scheme. From a planning and biodiversity perspective, the continued operation of Parteen Weir and Ardnacrusha cannot reasonably be treated as sacrosanct where it enables: Large-scale abstraction during drought, chronic ecological stress & Long-distance transfer of water to a network with unresolved leakage. This quantitative context reinforces the conclusion that the proposed pipeline is neither environmentally defensible nor strategically rational.

Long Distance Water Transportation

The WSP relies on a high-energy pumping system to transport water to Cloughjordan. Uisce Éireann claims the project is "net zero ready," yet:

- No detailed lifecycle carbon assessment has been provided.
- No guarantee exists that electricity demand will be met through 100% renewable sources.
- Pumping and treatment costs could rise significantly if Ireland's electricity grid remains under stress.

We request that Uisce Éireann provides a full energy and carbon analysis demonstrating compliance with Ireland's Climate Act 2015 and National Climate Action Plan.

Public Health Concerns – Water Transport & Storage Risks

Transporting raw and treated water over long distances poses public health risks. Scientific research suggests that water transported in dark, long pipelines may be susceptible to bacterial regrowth, chemical leaching from pipeline materials, and stagnation issues. We request that Uisce Éireann provides:

- A scientific assessment on water quality risks associated with long-distance water transfer.
- A microbiological and chemical monitoring plan ensuring compliance with the Drinking Water
- Directive (EU 2020/2184).
- How long is water in the pipes, how long in storage in Dublin– treatment to tap.
- The pipe Area = 3.1416m^s (note π*2^2/4 = π) so the Velocity = 3.8/3.1416 = 1.2(m^3/s)/m^2 = 1.2m/s and the time taken for the water to travel 132km = 132000m/1.2m/s = 110000 seconds = 30.6 hours = 1.275 days.

14. Conclusion planning Permission must be refused.

14.1 Summary of Legal Failures

The Uisce Eireann National water resources plans both national and regional, have no foundation in law. Nowhere in any of the Acts or enabling regulations stemming from them, has Uisce Eireann been given the right to develop such plans. In other Jurisdictions (England) such plans are required by law and the specific requirements of such plans are legislated for.

A water management plan is required but this does not extend to bestowing the entire water resources of the country under Uisce Eireann. The plans developed by UE therefore have no statutory standing and can only be considered Uisce Eireann internal plans, for which they set their own terms of reference, scope, inclusions, exclusions, omissions. In producing these documents and calling them National Documents, they have acted as Ultra Vires.

The lack of legislative underpinning is particularly relevant in relation to the relationship between UE and the ESB. As the ESB manages the water regime in Shannon, the application for the abstraction should either be by the ESB or alternatively a joint application by both parties.

The ESB have statutory obligations in respect to Shannon, they do not have the right of abstraction, only the right of utilisation for electricity generation, Uisce Eireann are incorrect in stating that their proposed abstraction is a substitution of one form of abstraction for another.

The water resources plans, assumes authority by UE, nowhere in these are the corresponding responsibilities for the management, protection and sustainability of the resources assigned.

The assessment of alternatives is incomplete and have been highly selective. Both in the current evaluation by UE and previously by RPS Strategic Environmental Assessment in 2008 for the Dublin water supply plan, no consideration was given to the optimization of utility of Poulaphuca reservoir, which was specifically intended for this purpose, with considerable space capacity, (electricity a secondary consideration). Nor any consideration given to utilisation the river Slaney, a river with twice the flow of the Liffey and rising adjacent to the Liffey in the Dublin Mountains, requiring just a 20km pipeline to connect to Ballymore Eustace water treatment plant and reduce dependency on the Liffey.

The full extent of proposed abstraction was not given. The long-term abstraction from Clareville Water Treatment works is intended as 100Mld, this abstraction is a combination from the Headrace and the old course of the Shannon. It is highly unlikely that it is legal to abstract a large amount of the statutory minimum compensation flow in the old course immediately downstream. It certainly is not in the spirit of the original intention of the compensation flow when originally allowed for.

The full extent of the long-term abstraction, including Athlone, (already on the Shannon with its own abstraction) Ballinasloe, (which is in the western water resource area) have to be factored in. As the band through which the river and particularly Lough Derg and the impoundment at Parteen are allowed to drop are seriously strained in a drought situation, the modelling indicates this. Add further abstractions for Athlone, Limerick Ballinasloe, and the model should have been run at a proposed abstraction of a minimum of 5Mld, at which point Lough Derg will be seriously compromised.

The long-term environmental reinstatement of Shannon will require a change in regime of the compensation flow down the old course, according to work on the River Basin Management Plan. This would require variable flow rates to mimic normal river flows, that is increased compensation flow generally. This in turn would affect the flow available to the abstraction at Parteen.

There is a big difference between the operational band regime that the ESB operates to control the water levels and the absolute band range. When UE say their models indicate that the water would not drop below the band range, this would be well after the ESB stopped abstraction under their operational band regime. Consequently, it can be anticipated that the supply to Dublin would be severely curtailed in a drought situation. With no back up indicated in the submission. The proposed abstraction at Parteen is putting all the Nations eggs in one basket.

The application is in respect of a pipeline to Dublin to show locations where spurs will be left for future take-offs. There are already some 400 landowners affected by the pipeline, there would possibly be another several hundred affected by the spur lines. The bare minimum requirement at this stage is indicative lines for these spurs as the people affected are entitled to know, at this stage as to what is proposed for them. For the most part these lines routes will have been determined.

The long periods where the turbines are shut down to preserve the levels for embankment and lake level preservation would indicate that there would be long periods where the flow would be severely restricted or even shut off. This would be at the precise time when all the rivers including Liffey are at their lowest. Consequently, impoundment will be required to bridge this event.

It is noted that the combined capacity of the twin 1500mm pipelines is 600Mld and the 1600mm pipeline presumably can be pressurised to this level of throughput. Consequently, the 300Mld proposed abstraction could reasonably be considered the initial proposal. UE previously proposed that the abstraction could be varied, by as much as 50% so that the total abstracted over a seven day or fourteen day back-to-back, would not exceed the 300 Mld, being currently applied for.

One of the objectives of an EIA is to identify the possibilities for mitigating effects on the environment and people. In this instance, the possibility of splitting the abstraction between Lough Ree and Parteen has not been adequately investigated. An abstraction of 60 Mld is, according to UE sustainably available from Lough Ree and a lot more most of the time as the average flow is 94Ml per second at Athlone, it would be imagined that an abstraction from Lough Ree, piped along the straight road R392 to Mullingar and onwards to Dublin would not only relieve the critical situation in Mullingar, but allow the Restoration of Lough Ennell, the Brona and allow flood storage in that Lake This would also be, by far the shortest route to Peamount

The proposed abstraction at Parteen could then be tailored to what is considered long term sustainable and initially used to serve to Nenagh along the old N7 and after onwards to join with the Boyne supply. This would seriously reduce the effects on people and environmental risks to the river and Lake systems. It would also allow for more control by the ESB over the system. There are a further 500 home which just got planning permission in Nenagh which will also required water from Lough Derg.

The project needs are overstated. The consumption figures start today at a 47Mld shortfall and build up from there, this is clearly not the case as the shortfall consists of headage, outage, and such that are not continuous demands, but treated as such. Also showing projected consumption per capita figures (121 litres pppd) in excess of that currently is the case (110 litres pppd). So the consumption figures which include massive industrial development provisions on the eastern seaboard and midlands , are clearly pie in the sky for the projected target date of 2050 at any rate.

It is accepted that the abstraction is from Lough Derg for all intents and purposes in drought situations. There were protocols established for Lake abstractions in the original River Basin Management plans (in this instance for the east area). This would not appear to have been applied in this instance. Also, as the abstraction will be de facto from Lough Derg in drought/dry periods, (section 28, Appropriate Assessment Screening) this would potentially turn Lough Derg into a heavily modified or artificial water body. There are no material effects on flood levels section 267 in assessment.

Housing In Limerick will be affected by water supply into the future.

Housing in Nenagh just announced over 500 new homes to be built will also be affected as they will need water supply.

The Eastern and Midlands Pipeline Project represents a high-risk, high-cost, and environmentally unsound approach to water supply. It fails to meet the requirements of EU environmental law, national climate policy, and fundamental principles of sustainable water management. The competent authority is therefore urged to refuse planning permission for the project and to require a comprehensive, independent reassessment of water supply strategy based on:

- Catchment-scale protection
- Demand reduction and leakage control
- Optimisation of existing assets
- Climate resilience
- Regional equity

Only such an approach can safeguard Ireland’s water resources for current and future generations.

Appendix A – Assessment of the Proposed Abstraction Against Water Framework Directive Article 4

This appendix assesses the proposed abstraction at Parteen Weir against the mandatory requirements of Article 4 of the Water Framework Directive (Directive 2000/60/EC), with particular reference to Articles 4(1)(a) (no deterioration), 4(4) (extensions of deadlines), and 4(7) (new modifications).

B1. Article 4(1)(a): Prohibition on Deterioration of Status

Article 4(1)(a) requires Member States to:

“prevent deterioration of the status of all bodies of surface water.”

B1.1 Existing Status

EPA classifications indicate that Lough Derg and associated Shannon water bodies are already at less than good ecological status, with known pressures including altered flow regimes, nutrient enrichment, and barriers to fish migration.

Where a water body is already below good status, any additional pressure capable of causing further deterioration is prohibited unless Article 4(7) is fully satisfied.

B1.2 Low-Flow Abstraction as a Deterioration Risk

Quantitative analysis demonstrates that while the proposed abstraction of 3.82 m^3/s represents approximately 2% of long-term average flow, it constitutes:

~25.5% of river flow during dry summer conditions (~15 m^3/s), and

~38.2% of river flow during extreme low-flow conditions (~10 m^3/s).

These are precisely the conditions under which ecological quality elements protected by the Directive (fish, benthic invertebrates, macrophytes, hydromorphology) are most sensitive to change.

The abstraction therefore presents a credible and foreseeable risk of deterioration, contrary to Article 4(1)(a).

B2. Article 4(1) and (2): Ecological and Hydromorphological Quality Elements

The Directive requires protection of hydromorphological conditions supporting ecological status, including:

Flow regime

Hydrological continuity

Water level fluctuations

B2.1 Flow Regime and Water Level Effects

The quantitative evidence demonstrates that abstraction during drought conditions would materially reduce downstream flows and exacerbate lake drawdown in Lough Derg.

Sustained or repeated low-flow abstraction is likely to result in:

Increased frequency and duration of low-water levels

Degradation of littoral habitats

Reduced dilution capacity and increased residence times

Such effects constitute hydromorphological deterioration within the meaning of the Directive.

B3. Article 4(7): New Modifications to Physical Characteristics

Where a project constitutes a new modification affecting hydromorphology, it may only proceed if all four cumulative tests under Article 4(7) are met.

B3.1 Article 4(7)(a): All Practicable Mitigation Measures

There is no evidence that all practicable mitigation measures have been identified or implemented, particularly in relation to:

Avoidance of abstraction during low-flow periods

Binding and enforceable low-flow cut-off rules

Real-time ecological monitoring linked to operational controls

Reliance on assumed ESB operational practices does not constitute enforceable mitigation.

B3.2 Article 4(7)(b): Overriding Public Interest

While water supply is a public interest, this test requires that the specific project, not the objective in general, is justified.

Given:

Severe leakage in the Dublin network,

Under-utilised eastern water resources,

Alternative demand-side and supply-side options,

it has not been demonstrated that this particular abstraction scheme is of overriding public interest compared to less damaging alternatives.

B3.3 Article 4(7)(c): No Better Environmental Options

The Directive requires demonstration that no significantly better environmental option exists.

The record shows that alternatives such as:

Leakage reduction,

Optimisation of Poulaphuca reservoir,

Eastern catchment options,

have not been eliminated through a robust, transparent, and equivalent environmental assessment.

Accordingly, this test is not met.

B3.4 Article 4(7)(d): Inclusion in River Basin Management Planning

Any reliance on Article 4(7) must be explicitly justified and documented within River Basin Management Plans.

There is no clear evidence that:

The full low-flow abstraction impacts,

Climate-adjusted drought scenarios, or

The scale of proportional flow removal identified in Appendix A

have been transparently assessed and justified at RBMP level.

B4. Climate Change and Article 4 Compliance

The Court of Justice of the EU has confirmed that climate change must be taken into account when assessing deterioration risk.

Observed Irish climate data demonstrate increasing drought frequency and duration. Under such conditions, abstraction that removes up to 38% of available flow during extreme low-flow periods cannot reasonably be considered compatible with Article 4 obligations.

Failure to assess these risks renders the decision-making framework non-compliant with the Directive.

B5. Conclusion: Incompatibility with Water Framework Directive Article 4

On the basis of the quantitative evidence set out in Appendix A and the legal tests above:

The proposed abstraction presents a real risk of deterioration, contrary to Article 4(1).

The project constitutes a new hydromorphological modification.

The mandatory cumulative tests under Article 4(7) have not been met.

Accordingly, planning permission cannot lawfully be granted unless and until full compliance with Article 4 of the Water Framework Directive is demonstrated beyond reasonable scientific doubt.

This appendix provides a structured quantitative assessment to support the planning objection. It sets out baseline flow data, proposed abstraction volumes, proportional impacts under varying hydrological conditions, and the operational and energy context of the Parteen–Ardnacrusha system. The purpose is to demonstrate why reliance on long-term average flow metrics materially understates environmental risk during critical low-flow periods.

Baseline River Shannon Flows at the Abstraction Point

Monitoring data indicate that the annual average discharge of the River Shannon at Limerick is approximately 208.1 m^3/s (208,100 litres per second). Corresponding flows at Killaloe and Parteen Weir are generally estimated to lie between 180 and 186 m^3/s. For the purposes of this assessment, an average flow of 183 m^3/s at the abstraction point is assumed.

Table A1 – Representative River Shannon Flows

A2. Proposed Abstraction Volume

The current proposal by Uisce Éireann involves abstraction of approximately 3.82 m^3/s at Parteen Weir.

A3. Observed Flow Variability in the River Shannon

The River Shannon exhibits extreme variability, ranging from major flood events to very low summer flows. In addition, a statutory minimum compensation flow of 10 m^3/s is required down the old Shannon channel toward Castleconnell.

Questions remain regarding the precision, transparency, and enforcement of this minimum flow, particularly during drought conditions when abstraction pressures are greatest.

A4. Proportion of River Flow Abstracted Under Different Conditions

When the proposed abstraction of 3.82 m^3/s is assessed against the full range of Shannon flows, the proportional impact increases sharply during low-flow periods.

Table A3 – Percentage of River Flow Abstracted

This table demonstrates that while abstraction appears negligible under flood or average conditions, it becomes ecologically dominant during drought and low-flow periods, precisely when riverine and lake ecosystems are most vulnerable.

A5. Ardnacrusha Hydropower Capacity and Flow Regulation

Ardnacrusha hydroelectric station comprises four turbines, each with a maximum hydraulic capacity of approximately 100 m^3/s, giving a total maximum throughput of 400 m^3/s and a peak installed electrical capacity of 86 MW.

Flows exceeding this capacity are diverted down the old Shannon channel toward Castleconnell, contributing to downstream flood risk during major events.

Table A4 – Ardnacrusha Operational Characteristics

A6. Average Utilisation and Energy Output

Allowing for the statutory 10 m^3/s compensation flow, the average effective flow available for power generation is approximately 198 m^3/s.

This equates to:

Average utilisation of installed hydraulic capacity: ~49.5%

Average electrical output: 42.6 MW

Annual energy generation: 373 GWh

Table A5 – Average Energy Output of Ardnacrusha

In national context:

Total electricity generated in Ireland in 2023: ~30,600 GWh

Contribution of Ardnacrusha: ~1.2% of total generation

A7. Comparison with Modern Wind Generation

Modern onshore wind turbines typically have a rated capacity of ~3 MW. Assuming an average capacity factor of 35%, this yields an effective average output of ~1.05 MW per turbine.

Table A6 – Wind Generation Equivalence

In renewable_toggle terms:

Renewables accounted for ~40.7% of Irish electricity generation in 2023 (~12,454 GWh).

Ardnacrusha contributed approximately 3.0% of renewable generation.

Removal of Ardnacrusha would reduce the renewable share to approximately 39.5%, a marginal national change.

A8. Planning-Relevant Conclusions

This appendix demonstrates that:

- The proposed abstraction represents a minor proportion of river flow only under average or flood conditions, but a very substantial proportion during low-flow and drought periods.
- The energy contribution of Ardnacrusha is modest in both national and renewable-energy terms.
- Continued reliance on the Parteen–Ardnacrusha regime disproportionately facilitates low-flow abstraction with significant ecological consequences.
- Accordingly, the use of long-term average flow figures as the primary justification for abstraction is misleading and unsuitable as a basis for planning consent.
- In drought periods such as 2018 there was no water sent to Ardnacrusha for 74 days (Data from ESB) so the Hydro storage theory fails in drought periods. ESB claims they were sending 10.5Cumecs down the old course f the Shannon, that means if the pipeline had been operating and took 3.4cumecs that is 3.4/10.5= 33% of the flow for 74 days. This reduces the flush down Lough Derg and if temperatures rise then algae blooms are guaranteed,

Appendix B Kennedy Analysis Overview

1 The Kennedy Analysis Overview Find the Appendices to this Kennedy Analysis Overview at www.kennedyanalysis.com/irish-water-shannon-project and contact Kennedy Analysis at www.kennedyanalysis.com

See Appendix 1a for details of the Kennedy Analysis interactions with Irish Water and the Kennedy Analysis reports on the Shannon Project: (i) the Kennedy Report, (ii) the Kennedy Response, and (iii) the Second Kennedy Response. Kennedy Analysis was founded by Emma Kennedy whose background is in carrying out forensic analysis of companies and projects - she was a corporate lawyer at Clifford Chance and worked in finance at a major global bank. She heard about the Shannon Project because the proposed pipeline crosses her husband's family farm. Despite concerns that her involvement might prove detrimental to them personally she has pursued this matter out of principle. The Kennedy Analysis of the Shannon Project has been produced pro bono in the public interest – the team that produced it have all worked on an unpaid basis in their free time because the Shannon Project is simply WRONG. For more about Emma Kennedy and Kennedy Analysis, see Appendix 1b. Summary of key findings The ancient and corroded state of Dublin's water mains is the key factor undermining its water supply. Dublin's problem is not a lack of water: only around 43% of the water put into Dublin's water supply system each day is actually used. Dublin's problem is that its water mains are in a third world state of decay having been neglected for decades. 57% of the water put into the supply system pours through holes in its pipes into the ground and never reaches the taps. 57% leakage is astonishing and far from normal: comparable cities identified by Irish Water's predecessor in this project have leakage below 10%. The state of Dublin's water mains also means (i) water outages and floods caused by mains bursts are a certainty as pressure in the system is normalised, and (ii) in low-pressure situations there is a risk of contaminated groundwater from the water-logged ground around the pipes re-entering the pipes carrying clean water to Dubliners' taps, requiring extra disinfection of the water before it is put into the supply system to counteract the risk to public health. The Shannon Project would be one of the biggest infrastructure projects in Ireland's history, but the analysis on which it was based contained mathematical and analytical errors. Corrected analysis (using Irish Water's own selected methodology and its current leakage targets) shows that, technically, no new raw water source is needed at all although Kennedy Analysis notes that Dublin would benefit from diversification away from its current reliance on almost exclusively surface-water sources - a much smaller and less expensive alternative to the Shannon Project could provide this (note: the Shannon Project would be yet another surface-water source). The Shannon Project would be a waste of scarce financial resources. Kennedy Analysis has notified Irish Water of the errors in its analysis and that many of its public statements about the need for this project have been false or highly misleading. Irish Water's reaction to the Kennedy Analysis has been defensive. Instead of addressing the issues head-on, Irish Water makes unrelated and irrelevant statements. Its responses deny the most undeniable of errors and even backtrack on issues that it had conceded during its face-to-face meeting with Emma Kennedy in February 2017. Instead of even attempting to justify its position on many issues Irish Water gives itself a clean bill of health without providing any substance, stating simply: "Irish Water do not accept this observation". London's leakage levels are less than half those in Dublin and have been deemed "unacceptable" by its regulator - itis currently replacing its entire Victorian water mains. Irish Water has no such plan: its leakage reduction targets are (contrary to its claims) extremely unambitious given the scale of the problem and its own report questions the level of funding that will be made available. An overhaul of Dublin's water mains will become inevitable in the coming years and demands a truly significant focus and investment. The Shannon Project would not negate this: it would be a very expensive sticking plaster. Irish Water proposes to pump water 172km from the River Shannon to Dublin, costing up to EUR1.3billion – EUR1,000 for every family in Ireland. A forensic review found that after just three errors in Irish Water's "need" projections are corrected there is no need for the Shannon Project. Part A of this Kennedy Analysis Overview sets out the findings of the Kennedy Analysis; Part B gives details of Irish Water's highly defensive reaction to the Kennedy Analysis and its failure to address the issues identified in the Kennedy Analysis. The proposed Shannon project has ominous parallels with the Kielder water project built in the UK in the 1970s and widely criticised as an unnecessary White Elephant. This should sound alarm bellsfor all who will rubber-stamp the Shannon project, particularly its economic regulator (the CRU): they are on notice about the errors in Irish Water's analysis and must challenge Irish Water before it is too late. If they have doubts about the merits of the Kennedy Analysis they should seek independent review of the two sets of analysis (Irish Water's "need" analysis and the Kennedy Analysis). The risk is too high to ignore. 2 Part A: The Kennedy Analysis Conclusions The Kennedy Analysis of the Shannon Project concluded: 1. Irish Water has used false claims to promote the Shannon Project to the public, the media and the government. 2. The Shannon Project is being pushed through on the basis of mathematical errors and incorrect data. Once these errors are corrected Irish Water's own analysis methodology shows there is no need for a project of this scale. 3. This project has outlived its need – the trajectory of water demand in Ireland has shifted dramatically in the 20 years since this project began but, contrary to its claims and to international best practice, Irish Water's analysis failed to take account of this. 4. Irish Water's analysis was constrained by the flawed premise that only a single-source solution was acceptable, despite the overwhelming advantages of using several smaller and less expensive solutions in conjunction. 5. The "benefit corridor" concept is being misrepresented to justify the Shannon project. 6. Dublin's ancient water mains are the single key factor undermining its water supply system. An overhaul of Dublin's water mains will become unavoidable in the coming years regardless of how much water is pumped to Dublin from the Shannon: the Shannon project would be a very expensive sticking plaster. If Irish Water was to adopt a genuinely ambitious mains-replacement programme now it would recover such huge volumes of water that Dublin would have a huge "spare capacity" and a highly resilient water supply system, eliminating the need for the EUR1.2billion Shannon project. 7. The parallels between the Shannon project and the UK's "White Elephant" Kielder project should sound alarm bells. (1) Irish Water has used false claims to promote the Shannon Project to the public, the media and the government If the messages that Irish Water is disseminating about Dublin's water situation were accurate it would indeed make the case for urgent and drastic action. Irish Water's message can be summarised as follows (each of these is a direct quote from Irish Water): "There is currently less than 2% spare drinking water capacity in Dublin"…. "The present infrastructure is struggling to meet current need as evidenced by a number of significant and costly outages in Dublin over the past 5 years"…. "The Project Need Report identified that projected demand for water in Dublin alone is expected to increase by over 50% by 2050"…. "The water demand projections in the Project Need Report include ambitious leakage targets which have been adopted by Irish Water, resulting in a very conservative approach to overall demand. This has resulted in a revision of the projected water requirement from 350Mld by 2040 to 330Mld by 2050. As such, the requirement to ensure that only water which is truly needed is sought from a new source has been met"…. Every one of these statements is FALSE as demonstrated in part C(2) and part D of the Kennedy Response and in Appendix 2 to this Kennedy Analysis Overview. (2) The Shannon Project is being pushed through on the basis of mathematical errors and incorrect data The Kennedy Analysis identified undeniable calculation errors in Irish Water's analysis. Irish Water's incorrect analysis concluded that, in 2050, Dublin will have a water deficit of 215Mld; however, after just three of its calculation errors are corrected, that 215Mld deficit becomes a 55Mld surplus. The corrected analysis, together with an explanation, is set out in Appendix 3a. Note the corrected analysis at Appendix 3a retains Irish Water's chosen analysis methodology and all of Irish Water's other assumptions (e.g. on population and economic growth, average household size and household number) some of which are very aggressive. It assumes nothing more than Irish Water's own unambitious leakage targets. It also retains the three considerable "safety-buffers" (peaking, headroom and outage) which total 35% - they are cumulative. Irish Water's analysis requires that this 35% of extra water over and above its (incorrect) projected average demand must be available in the form of freshly extractable raw water every day – unlike the approach in the UK, Irish Water's analysis does not offset any of its peaking requirement against the tens of billions of litres of raw water that is stored in Dublin's enormous raw water reservoirs1 . For a commentary on whether Irish Water's assumptions and its requirements in relation to the 35% safety-buffer are appropriate, see the Kennedy Report and part B(6) of the Kennedy Response. In its twenty-year life, this project has a history of drastically over-estimating future water demand yet the latest projection method is even more aggressive than those used in the past. This is summarised at Appendix 4. Irish Water has repeatedly failed to address the facts spelled out in the Kennedy Analysis to establish this point – instead, Irish Water simply states: "Irish Water do not accept the observation". (3) This project has outlived its need 20 years ago, when this project began, there was serious cause for concern about Dublin's water supply and as recently as 2010 talk of Dublin's water supply being on a "knife edge" was justified – see Appendix 5. However, since then, Dublin's water treatment infrastructure has received a long-overdue overhaul and the trajectory of water demand in Ireland has shifted significantly. 1 Thames Water, London's water supplier, does not include peaking in its raw water requirement because, it states: "peak demands in London can be met through the relatively large volume of surface water storage (reservoirs). The ability to meet peak demands is therefore not a resource availability issue…but dictated by treatment and transmission capabilities". 3 Since 1996 (the year this project began) industrial water intensity in Ireland has been on a consistent downward trend. This is a global trend and is accounted for in water "need" projections. Irish Water claims that its "need" analysis took account of the decline in industrial intensity of water demand. This is FALSE: the data that it used took NO account of this (see Appendix 3b). As a result, while London's industrial demand is projected to DECLINE between now and 2040, Irish Water projects that Dublin's industrial demand will MORE THAN DOUBLE2 . Simultaneously, in recent years, domestic consumers have become more aware of the value of water and the need for conservation (the threat of water charges has changed the way that the man on the street perceives water) and regulations have required that new-builds and household appliances are more water efficient. Declining/ plateauing demand for water is being observed in many cities across the world - see Appendix 5 - and Dublin is no different: for an entire decade since 2007 Dublin's total water demand has averaged around 540Mld. Irish Water cites Dublin's water crises of 2010/2013 as justification for the Shannon project. This is disingenuous: those crises were not caused by a lack of raw water but by the fact that Dublin's ancient water treatment plants had insufficient treatment capacity to convert raw water into drinkable treated water and had almost no treatment capacity over their licenced raw water extraction limits to cover "outages" etc. Fortunately, since Dublin's water crises, hundreds of millions of Euros have been invested upgrading most of Dublin's water treatment plants and the treatment plant at Vartry, which is unable to cope with Vartry's frequent algal blooms, has now received planning permission for a long-overdue upgrade. Dublin's water treatment capacity has been increased by 202Mld which is extremely significant. Irish Water's attempt to justify the proposed Shannon project through repeated reference to an historic position which no longer prevails is inappropriate. In most cities, another factor driving the reduction in "demand" for water has been a major focus on leakage reduction. "Demand" for water includes "true" demand (i.e. water actually used by domestic and business consumers) and "leakage" demand (i.e.

water that is put into the supply system but leaks out of the pipes before it reaches the taps). As "leakage" demand is reduced so a city's overall water demand is reduced. In Dublin, where leakage reduction has been extremely poor, this has barely had an impact. Going forward, the active recovery of water through plugging Dublin's leakage demand will reduce Dublin's total water "demand", creating the equivalent of an enormous new "source" of water. (4) Irish Water's analysis was constrained by the flawed premise that only a single-source solution was acceptable Having significantly over-stated Dublin's projected 2050 water deficit, Irish Water's consideration of potential new raw water sources was then restricted by the inexplicable premise that only a single-source solution was acceptable, ruling out the conjunctive use of several smaller solutions. This meant that only extremely large stand-alone water sources could be considered. The logic of this was flawed: (1) with the proposed one-water-source/one-treatment plant/one-pipeline Shannon project the entire supply would be lost in the event of a contamination event or supply interruption. By contrast, in the event of a contamination or major outage event at one of a number of smaller water sources, that single contaminated supply could be shut down temporarily without impacting the remainder of the supply sources; (2) Dublin's projected water demand is highly uncertain on many measures and the Shannon project is "all or nothing": not a single drop of water can be delivered until the entire pipeline has been built - and it will cost the best part of EUR1.2billion regardless of whether, in the end, it needs to supply Dublin with 215Mld of water, 50Mld of water or indeed no water at all. The investment costs of the Shannon project are heavily front-ended: unlike with smaller sources in combination, the Shannon project offers almost no scope for phasing of investment expenditure or bringing the project online in increments. Irish Water claims to have considered ten new water source options. This is very misleading: seven of the ten were simply different variations of pumping water from the River Shannon to Dublin (from different abstraction locations and via different routes). An aggressive mains replacement programme was not even one of the ten options considered, which was a grave omission given that this is the key issue undermining Dublin's water supply system. The other three options were: (1) groundwater, which was dismissed for a number of flawed reasons, including that it could not provide the full projected water requirement standalone. The Kennedy Response (at part B(9) and Appendix 6) and the Second Kennedy Response (at Appendix 4) spelled out in significant technical detail the mathematical and logical errors contained in the original 2008 groundwater report and in Irish Water's 2015 review of the original report. See Appendix 6 for an overview of those many errors, which Irish Water's latest response yet again failed to address. Even on its constrained and (self-proclaimed) conservative analysis, that groundwater report concluded that there are significant groundwater resources close to Dublin. It estimated that two of these aquifers alone are likely to yield 78Mld if developed, (2) conjunctive use of the River Barrow, which was dismissed primarily because it could not provide the full water requirement standalone, and (3) desalination, which was dismissed primarily on the illogical basis that it could not provide water to communities in the "benefit corridor" – see the "benefit corridor" section below for why this was so flawed. 2 See page 5 of Appendix 1 to the Kennedy Response. 4 Irish Water did not give detailed consideration to the many other smaller alternatives that are available, such as new reservoirs, environmental flow replacement, mine dewatering and rainwater harvesting. None of these would have been capable of supplying the entire (incorrect) projected 2050 deficit standalone, but combinations of them would have been a far more logical solution. Irish Water's November 2016 Final Options Appraisal Report stated: "the potential for using multiple sources was also investigated at various stages in the WSP. However it was found that while many sources, such as groundwater, rainwater and greywater, could be attractive secondary resources…. they are not sustainable primary water sources." This statement makes no sense: naturally if you have classified them as "secondary" they are not, by your own definition, "primary" – but this does not negate their value when used in combination. Two or three water sources operating in conjunction could be brought online incrementally (alongside an aggressive mains replacement programme) if and when the need does indeed arise and would reduce the risk of exposure to a contamination of any one supply in the future. Dublin currently gets 99% of its water from rivers – and the Shannon would be yet another river water source, offering no diversification protection. River water has its own inherent problems: it contains organic materials (e.g. from leaves that fall into the water) and trihalomethanes ("THMs") are produced as a by-product during the water treatment process when chlorine reacts with organic matter. River water is the most prone to producing THMs during the treatment process; deep wells present the lowest THM risk as the water from deep wells is not contaminated by organic matter. THMs are believed to be linked to serious health risks including cancer, miscarriages and birth defects. It has been reported that Ireland has the highest reported non-compliance for THM exceedances across the EU member states - even Erin Brokovich has flagged the issue of THMs in Ireland's drinking water. (5) The "benefit corridor" concept is being misrepresented to justify the Shannon project When Irish Water took this project over from Dublin City Council in 2014 it introduced the uncertain and vague concept of a "benefit corridor". Public details of this "benefit corridor" concept have been scant, but the analysis that was published in the 2015 Project Need Report was littered with errors (see pages 10/11 of the Kennedy Report). The concept has since shifted significantly – the version presented in the 2016 Final Options Appraisal Report was unrecognisable, yet very few details were provided and those provided were, yet again, highly questionable – see Appendix 7a. Irish Water claims that the Shannon project will serve over 40% of the population – but 39.99% of these live in Dublin or within a contiguous area and within supply networks that, according to Irish Water's own report, could easily be connected into the Dublin water supply network. The "benefit corridor" is better described as a "benefit blob" around Dublin. According to the Final Options Appraisal Report, the only people slated to receive water from the Shannon source outside of this "benefit blob" are around 4,000 people in Clare - these 4,000 people in Clare constitute just 0.01% of Ireland's population yet Irish Water repeatedly claims that the Shannon project brings a benefit to communities along the entire length of the pipeline. Notwithstanding its extremely questionable validity, the "benefit corridor" has been one of the key justifications provided by Irish Water for selecting the Shannon solution over other sources that are local to Dublin on the flawed basis that the Shannon source can provide water to more people than sources located in the heart of the Dublin water supply area (such as desalination). This justification is wholly illogical: a water source located within the Dublin water supply area would supply the "benefit blob" without the need for hundreds of kilometers of pipeline. (6) Dublin's ancient water mains and third world leakage levels are the key factors undermining its water supply system - yet Irish Water's mains replacement and leakage targets are unambitious The Kennedy Analysis team has undertaken a forensic analysis of Dublin's leakage and Irish Water's self-proclaimed "ambitious" leakage reduction targets. A summary is contained at Appendix 8 or click on this link for a copy of the full Kennedy Analysis of Dublin's Leakage. Dublin's problem is not a lack of water: Dublin's problem is that around 57% of the water put into its water supply system pours straight through holes in its ancient supply pipes into the ground and never reaches Dubliners' taps. Only around 43% of the The conjunctive use of several smaller water sources would allow for increased water supply to be brought online incrementally if and when it is actually found to be needed (unlike the all-or-nothing Shannon project). It would offer protection against a contamination event or supply interruption at an individual water source (unlike the one-source, one treatment plant, one-pipeline Shannon project) and would allow for diversification of Dublin's water sources away from surface water, with its inherently high THM risk (unlike the surface-water Shannon source). Irish Water suggests that the Shannon is better placed to supply the "benefit corridor" than a Dublin-centric solution and that the Shannon Project would bring a benefit to the communities along the entire length of the pipeline: this is false. 5 water put into Dublin's water supply system every day is actually used – the rest of the water is wasted through leakage. The ancient, corroded state of Dublin's water mains is the single key factor undermining its water supply system. Dublin's historic mains replacement rates have been inadequate: London has replaced its water mains at a rate 2,000% faster than that in Dublin despite the fact that London's leakage rates were less than half those in Dublin. Dublin City Council stated a decade ago: "…these mains are so ancient that leaving them alone is not an option" yet over the past ten years an average of only EUR10million per year has been spent on fixing leaks NATIONALLY (not in Dublin alone) - this equates to only 0.8% of the projected EUR1.2billion cost of the Shannon project. This failure has resulted in leakage levels of around 57% - this is far from normal or acceptable. The OECD carried out a study in 2016 observing leakage levels in cities across the world. Only 4 cities had leakage levels over 40%: all of them were in Mexico (Dublin did not take part in the study). The UK is known to have very high leakage rates – indeed Thames Water (London's water provider) was fined by its regulator yet again in July 2017 for "unacceptable" leaks – yet UK leakage levels are well under half those in Dublin: "total leakage" rates for water suppliers in the UK in 2012 ranged from 14% to 27%, with an average of 20%3 . It is notable that Irish Water tends to use London, which itself has "unacceptable" leakage levels, as its default comparator when attempting to justify its own unambitious leakage targets. Earlier in the life of the Shannon project, Dublin City Council selected 6 comparable countries/cities and presented data on them for comparison with Dublin – it found that the leakage levels for the countries that it had selected were: Country/city Approximate leakage rate Denmark 6% The Netherlands 6% Germany 7% Sydney, Australia 8.5% Lithuania 15% (in 2000) United Kingdom 23% Reference is often made to Dublin's "spare capacity" which Irish Water states is around 10% (although its published data suggests that, as a result of the major recent upgrades at Dublin's water treatment plants, its current spare capacity is significantly higher than 10%). It is important to understand: if Dublin had normal leakage levels it would have an absolutely enormous spare capacity. For example, if Dublin's 2015 leakage levels had been 20% (well above leakage levels in many comparable cities) it would have had 112% spare capacity. THIS IS ABSOLUTELY ENORMOUS. Irish Water's states that, in low-pressure situations, there is a danger of what is describes as "contaminated groundwater" leaking from the water-logged ground around the pipes back into the pipes carrying clean water to Dubliners' taps. This requires "boosted chlorination" of the water (with its associated THM risk, as mentioned above) before it is put into the supply system to counteract what Irish Water describes as a "public health risk". The cripplingly compromised state of Dublin's water pipes means that, until a significant proportion of them are replaced, water outages and flooding incidents caused by burst water mains are inevitable. What is more, the extreme extent of corrosion to the pipes means that repairing those bursts is extra complicated and takes far longer than it should. The 2017 Louth/Meath mains burst was an example of this: Irish Water's own press release stated: "three attempts to fix the 50 year old pipe failed over last weekend as the corrosion and warping of the pipe meant that any available standard fittings were not sufficient. A bespoke piece of pipe and fittings were manufactured in Belfast". Irish Water claims that its leakage targets are "ambitious" and it makes reference to highly misleading statements and invalid comparisons to justify its claims – see part (C) of Appendix 8. In fact, Irish Water's hard targets on leakage reduction aim to reduce Dublin's leakage by only 31% in 39 years. Its leakage reduction target is extremely unambitious given the scale of the problem and when compared with recent leakage reduction achievements in the UK4 and across the EU5 . For example: • London's leakage was reduced by 30% in only 6 years, • Scotland's leakage was reduced by 55% in only 10 years, • Lisbon's leakage was reduced by 64% in only 8 years, • Leakage in the Reggio Emilia province in Italy was reduced by 50% in 8 years, • Malta's leakage was reduced by over 83% in under 20 years. For its estimates of the costs of recovering water through fixing leaks, Irish Water's analysis used out-dated, over-stated figures: it used cost data from prior to the installation of water meters. This is wholly inappropriate: fixing leaks (on both the customer side and the distribution side of the network) is far less complicated and far cheaper now that meters have been 3 Source: Irish Water Final Options Appraisal Report Appendix J, "Preliminary Options Appraisal - Consultation Submissions Report", page 35. 4 Sources: Thames Water and Scottish Water. 5 Source: 2015 EU Reference Document "Good Practices on Leakage Management". 6 installed. Before meters were installed it was almost impossible to know where a distribution-side leak was unless water was actually pouring out of the ground. Meters now allow leaks to be pin-pointed simply by observing the difference in water pressure between two meter points. Irish Water's analysis assumed that recovering 1Mld of water on the customer-side of the network would cost "in the order of EUR 0.75million", but the results of the First Fix Free scheme (a scheme for repairing customer side leakage relying on "constant flow alarms" in water meters) show that saving water by fixing customer side leaks has cost an average of just EUR212,000 per 1Mld – this is one third of the amount that Irish Water had assumed and just 5% per unit of water than the predicted cost of delivering the same volume of water through the proposed Shannon Project. Irish Water's nonsensical attempts to dismiss this highly significant fact are discussed at Appendix 9c. The results of the First Fix scheme to date establish that far more water will be recovered through repairing Dublin's leakage than Irish Water's analysis accounted for (see Appendix 3c for more details on the results of the First Fix scheme). In every quarter, the amount of water recovered through the First Fix scheme was approximately DOUBLE the production of the entire Bog of the Ring wellfield. The Bog of the Ring wellfield produces 2.5-3Mld of water – the First Fix scheme has so far recovered a cumulative total of over 38Mld. That huge volume of "new" water is now available at Dubliners' taps every day instead of pouring into the ground. Recovering water by repairing customer leaks is equivalent to adding approximately two new, additional Bog of the Ring wellfields to Dublin's water supply every three months - but far less expensive. (7) The parallels between the proposed Shannon project and the UK's "White Elephant" 1970s Kielder project are ominous The Kielder reservoir and pipeline was built in the UK in the 1970s and has subsequently been widely criticised as having been an unnecessary White Elephant. Appendix 10 contains extracts from a damning 1982 report6 of the Kielder project highlighting alarming parallels with the Shannon Project. For example, it flags that the Kielder project was partly justified by potential increases in future water demand from certain major industrial users that were not appropriately validated at the time. Irish Water's "need" analysis for the Shannon project includes a huge 100Mld industrial "strategic allowance" (note: Dublin's total industrial demand for water is currently only 110Mld, which the "need" analysis assumes will grow organically alongside the separate, additional 100Mld industrial "strategic allowance") - a key justification for the 100Mld strategic allowance is "enquiries" from un-named potential industrial users. A University of Oxford study of the Kielder Water Scheme7 pointed out that the analysis used to justify the Kielder project used inappropriate data, including the incorrect assumption that non-domestic demand would continue to grow rapidly, but that in fact: "the industry it was planned to supply was already reducing its water requirements before construction started". The study noted that those who supported the scheme proclaimed: "the scheme is a bold and imaginative one: the largest single water conservation scheme yet undertaken in this country" and referred to "the politics of promotion of mega-projects". However, it stated, "unfortunately, engineering accomplishments were often marred by economic miscalculation. The resulting mismatch between vastly increased water supply at a time of diminishing rise in demand, together with huge debts incurred at a time of rapid inflation and high interest rates, had lasting effects on the state's management of water resources". The study stated: "The Scheme is described on a bronze plaque at the reservoir site as one of the biggest water projects ever undertaken in Europe…. Today, the reservoir rests mostly idle. The water is rarely needed for supply…." 6 "Spending Money like Water", William Charlton, The Spectator, 22 May 1982. 7 "The Kielder Water Scheme: the last of its kind?" CS MCCULLOCH, University of Oxford, UK (2006) Irish Water has cited the inconvenience of traffic disruption in Dublin as a factor against an overhaul of its water mains. Perhaps Dubliners should be presented with two alternatives - either: (1) accept traffic disruption in rotating areas of Dublin for the coming years while Irish Water aggressively replaces pipes - this will be expensive but will (a) address Dublin's water volume, quality and pressure issues, (b) make Dublin a viable investment proposition for incoming investors who need confidence in not only the volume of water available but also the quality of that water, and (c) eliminate the need to spend EUR1,000 per family on the Shannon project, or (2) accept that they will continue to (a) drink potentially contaminated water being delivered through ancient and corroding water pipes, and (b) be exposed to mains bursts/water outages, while Irish Water spends a huge amount of money piping water from the Shannon, which will only delay the expense and disruption of properly addressing Dublin's water mains. The ominous parallels with the Kielder project should sound alarm bells for anyone who will approve or rubber-stamp the Shannon project – they are on notice about the errors in Irish Water's analysis and must challenge Irish Water on the evidence contained in the Kennedy Analysis before it is too late. 7 Part B: Irish Water's reaction to the Kennedy Analysis has been highly defensive Irish Water's defensive reaction to the Kennedy Analysis is not the reaction that one would expect from a body intent on ensuring the best possible use of EUR1.3billion of scarce financial resources. Instead of addressing the issues head-on, Irish Water makes unrelated and irrelevant statements. Its responses deny the most undeniable of errors, often with very little or no substance. As summarised in the table below, its latest response even backtracked on issues that Irish Water had conceded during its 16 February 2017 meeting with Emma Kennedy, failed to make a note of important points that were discussed at that meeting and failed to address issues that the Irish Water team were unable to explain during the meeting and had confirmed would be dealt with in its written response (see Appendix 9a and Appendix 9b). Matter discussed during meeting The position Irish Water took in its written response Non-domestic demand data: Mick Garrick of Jacobs Tobin confirmed that the data that Irish Water had used was indeed Jacobs Tobin's data and not Indecon's data. Its response backtracked entirely, stating "Irish Water do not accept this observation". See Appendix 3b for details of this point. The false statement that past outages in Dublin have cost the economy EUR78million per day: Alan Gray of Indecon confirmed that Indecon had not even purported to make any analysis of the cost of past water outages – Irish Water is citing the Indecon analysis and this wholly inappropriate figure out of context. Its response failed to address this point at all and Irish Water continues to propagate this message despite having been informed in Emma Kennedy's presence that it is wrong. Irish Water's adoption of a 35-year projection window (which is not international best practice and which produces a much higher projected water deficit due to Irish Water's aggressive and uncertain assumptions): during our meeting, Irish Water was unable to explain why it had not used the industry-standard 25-year time frame and confirmed that this issue would be addressed in its written response. Its response failed to address this point at all. Irish Water's much-publicised statement that Dublin's demand was projected to increase by over 50% was FALSE: Irish Water was unable to provide any maths to justify this statement during our meeting. Its response created a fudge to try to explain away this basic mathematical error. See Appendix 2 for details of this false statement and its implications. The results of the First Fix scheme have PROVEN that the volume of water that Irish Water's "need" analysis assumed was being lost through customer side leakage was WRONG: Irish Water still refuses to acknowledge this most undeniable of errors. Its response failed to address this point at all. See Appendix 3c for details of this point. Irish Water's latest response still avoided addressing key issues that the Kennedy Analysis has raised - see Appendix 9b for examples. Even when Irish Water did attempt to address issues raised in the Kennedy Analysis many of the points that Irish Water made in its defence were simply wrong/made no sense/contained basic errors - see Appendix 9c for examples. Irish Water avoids addressing issues by stating simply that its methodology is "best practice" or "internationally recognised methodology". We have made clear to Irish Water that, although several aspects of its analysis are not considered international best practice, our principal concern is not with the methodology that Irish Water is attempting to follow, but rather our concern is that Irish Water has made major errors in its attempt to follow its selected methodology. Its analysis contains mathematical errors – this is NOT "best practice"; it is not "best practice" to account for "outage" on both sides of the supply: demand equation; "best practice" does not use data derived from analysis that contained basic errors; claiming to use one set of data while actually using a different set of data is not "best practice". See Appendix 3a for corrected analysis, using Irish Water's own selected methodology. The Kennedy Analysis spelled out Irish Water's mathematical errors and demonstrated how many of its public statements about the need for this project have been false or highly misleading. Instead of even attempting to justify its position on many of these issues, it has repeatedly stated: "Irish Water do not accept this observation". It gives itself a clean bill of health without providing any substance, for example stating simply: "the technical reports produced … have been subject to a full quality assurance process". Stating "we do not accept this observation" does not change the fact that the observation is accurate. Simply stating that its own analysis is correct does not make it so. Avoiding key issues by raising other matters that are not even in dispute is a method of diverting attention away from fully substantiated claims that Irish Water is incapable of providing evidence to refute: there is no need for the EUR1.3billion Shannon project and pursuing it would be a waste of scarce financial resources.

Appendix C

Quantitative Assessment of River Shannon Flows, Abstraction Proportions, and Ardnacrusha Operations

This appendix provides a structured quantitative assessment to support the planning objection. It sets out baseline flow data, proposed abstraction volumes, proportional impacts under varying hydrological conditions, and the operational and energy context of the Parteen–Ardnacrusha system. The purpose is to demonstrate why reliance on long-term average flow metrics materially understates environmental risk during critical low-flow periods.

A1. Baseline River Shannon Flows at the Abstraction Point

Monitoring data indicate that the **annual average discharge of the River Shannon at Limerick is approximately 208.1 m^3/s** (208,100 litres per second). Corresponding flows at **Killaloe and Parteen Weir** are generally estimated to lie between **180 and 186 m^3/s**.

For the purposes of this assessment, an average flow of **183 m^3/s** at the abstraction point is assumed.

Table A1 – Representative River Shannon Flows

Location	Flow description	Discharge (m^3/s)
Limerick	Long-term annual average	208.1
Killaloe / Parteen	Estimated annual average range	180–186
Killaloe / Parteen	Assumed planning average	183

A2. Proposed Abstraction Volume

The current proposal by Uisce Éireann involves abstraction of approximately **3.82 m^3/s** at Parteen Weir.

A3. Observed Flow Variability in the River Shannon

The River Shannon exhibits extreme variability, ranging from major flood events to very low summer flows. In addition, a **statutory minimum compensation flow of 10 m^3/s** is required down the old Shannon channel toward Castleconnell.

Table A2 – Observed Flow Conditions at Killaloe / Parteen

Condition	Approximate flow (m^3/s)	Notes
Major flood	700	Extreme flood events
Average conditions	183	Long-term planning average
Dry summer	15	Typical low-flow summer
Extreme low flow	10	Approaches statutory minimum
Statutory compensation flow	10	Legal minimum to Castleconnell

Questions remain regarding the **precision, transparency, and enforcement** of this minimum flow, particularly during drought conditions when abstraction pressures are greatest.

A4. Proportion of River Flow Abstracted Under Different Conditions

When the proposed abstraction of **3.82 m^3/s** is assessed against the full range of Shannon flows, the proportional impact increases sharply during low-flow periods.

Table A3 – Percentage of River Flow Abstracted

Hydrological condition	River flow (m^3/s)	Abstraction (m^3/s)	% of flow abstracted
Major flood	700	3.82	0.55%
Annual average	183	3.82	2.09%
Dry summer	15	3.82	25.5%
Extreme low flow	10	3.82	38.2%

This table demonstrates that while abstraction appears negligible under flood or average conditions, it becomes **ecologically dominant during drought and low-flow periods**, precisely when riverine and lake ecosystems are most vulnerable.

A5. Ardnacrusha Hydropower Capacity and Flow Regulation

Ardnacrusha hydroelectric station comprises **four turbines**, each with a maximum hydraulic capacity of approximately **100 m^3/s**, giving a total maximum throughput of **400 m^3/s** and a peak installed electrical capacity of **86 MW**.

Flows exceeding this capacity are diverted down the old Shannon channel toward Castleconnell, contributing to downstream flood risk during major events.

Table A4 – Ardnacrusha Operational Characteristics

Parameter	Value
Number of turbines	4
Capacity per turbine	~100 m^3/s
Maximum hydraulic throughput	~400 m^3/s
Maximum electrical output	86 MW

A6. Average Utilisation and Energy Output

Allowing for the statutory **10 m^3/s** compensation flow, the average effective flow available for power generation is approximately **198 m^3/s.**

This equates to:

- **Average utilisation of installed hydraulic capacity:** 49.5%
- **Average electrical output:** 42.6 MW
- **Annual energy generation:** 373 GWh

Table A5 – Average Energy Output of Ardnacrusha

Metric	Value
Average utilised capacity	49.5%
Average power output	42.6 MW
Annual energy generation	373 GWh

In national context:

- Total electricity generated in Ireland in 2023: **~30,600 GWh**
- Contribution of Ardnacrusha: **~1.2% of total generation**

A7. Comparison with Modern Wind Generation

Modern onshore wind turbines typically have a rated capacity of **~3 MW**. Assuming an average capacity factor of **35%**, this yields an effective average output of **~1.05 MW per turbine**.

Table A6 – Wind Generation Equivalence

Parameter	Value
Typical turbine rating	3 MW
Average capacity factor	35%
Effective average output	1.05 MW
Equivalent turbines to Ardnacrusha	~40

In renewable_toggle terms:

- Renewables accounted for **~40.7%** of Irish electricity generation in 2023 (~12,454 GWh).
- Ardnacrusha contributed approximately **3.0% of renewable generation**.
- Removal of Ardnacrusha would reduce the renewable share to approximately **39.5%**, a marginal national change.

A8. Planning-Relevant Conclusions

This appendix demonstrates that:

1. The proposed abstraction represents a **minor proportion of river flow only under average or flood conditions**, but a **very substantial proportion during low-flow and drought periods**.
2. The **energy contribution of Ardnacrusha is modest** in both national and renewable-energy terms.
3. Continued reliance on the Parteen–Ardnacrusha regime disproportionately facilitates low-flow abstraction with significant ecological consequences.

Accordingly, the use of long-term average flow figures as the primary justification for abstraction is **misleading and unsuitable** as a basis for planning consent.

Appendix D

The Conclusion of the Irish Water Forum – Review of the Eastern and Midlands Water Supply Project in 2019 was as follows:

The "helicopter" review of the Eastern and Midlands WSP that was conducted provided the Forum with some necessary insight to prepare its contribution to the CRU review, and in particular to identify the points that deserve further clarification or consideration by Irish Water.

The key take away points from the review include the following:

• The information presented to justify the need for the WSP project suffers from many unknowns and uncertainties :

o Either supporting data are available but not shared by Irish Water, which reflects a lack of pedagogy and transparency

o Or these data don't exist, which means that there is no solid foundation for the projections justifying the need for the project (at least at this scale): it might then be better to wait for progressing any further that basic buildings blocks are in place.

• However, without considering future demand, the situation in Dublin is already very challenging, due to the lack of headroom and more importantly, the almost exclusive reliance on a single source. Increasing the resilience of the water supply not just in Dublin but for all the Midlands region is therefore a critical argument to justify the Eastern and Midlands WSP; and may justify that it should start sooner rather than later.

• By all means, "fixing" water supply challenges are a complex matter, for which there are usually no "silver bullet" and the Eastern and Midlands WSP makes no exception. In particular, different ways of reducing demand as well as increasing supplies could be considered and implemented simultaneously, with impact assessment and cost benefits analysis allowing to define the most adequate combination.

• Water demand is not an external parameter, such as rainfall, but instead a component of the system that a water utility can, and should, manage; to that end, it is necessary to adopt a holistic view of all the drivers, as well as levers, that can influence water demand in the future. While Irish water indicates that it intends to implement a demand management strategy, the impact of such strategy is not evidenced in the proposed demand projections.

• The same applies for the leakage issue: Irish Water does not explain how future leakage targets have been set and how they are aligned with best practices, available resources and customer preferences. International experience, including that of Scottish Water, show that significant progress can be achieved in this area in relatively short period of time and without relying exclusively on infrastructure renewal. Raising ambition on leakage could help increase the acceptability of the Eastern and Midlands project, which otherwise could be seen as a "necessary evil" to compensate the current wastage of resources.

• At the same time, it is important to stress that improving performance (whether on leakage, demand management or operations in general) takes time and depends on many conditions (human resources capabilities, leadership, financial resources and above all regulatory pressure/support). Irish Water is still a fairly new organization inheriting a challenging situation: should the role of the CRU in helping it deliver better performance be strengthened?

• In addition to the CRU, the Forum could also play a significant role in helping Irish Water better understand the views of its customers as well as their preferences and priorities: through an ongoing engagement process, the utility could better anticipate, understand and potentially resolve future issues before they become national controversies; and develop better ways to engage and communicate with customers, above and beyond institutional "consultation".

Appendix E: The Natura Impact Statement (NIS) Review

The Natura Impact Statement (NIS) Review

Table of Contents

1. Introduction

1.1 Project background

The Proposed Project involves the abstraction of raw water from Parteen Basin within the Lower River Shannon SAC, its treatment to potable standard, and subsequent transfer via a 1.6 m diameter pipeline extending approximately 172 km through the Eastern and Midlands Region to south County Dublin. The scheme comprises six infrastructure sites, three main pipeline elements (the Raw Water Intake and Pipeline System; the Treated Water Pipeline from the Water Treatment Plant to the Break Pressure Tank; and the onward Treated Water Pipeline to the Termination Point Reservoir), and associated 38 kV Uprate Works.

The Natura Impact Statement (NIS) for the Proposed Project identifies a total of 78 European sites within the potential Zone of Influence (ZoI), defined as sites located downstream of the abstraction point, within the same groundwater body, or connected via plausible hydrological or hydrogeological pathways. Of these, 19 European sites were determined to have a valid source–pathway–receptor linkage to the Proposed Project, comprising nine SACs and ten SPAs.

While not all European sites identified in the NIS are located within the Shannon International River Basin District (IRBD), the abstraction point at Parteen Basin and the principal Natura 2000 sites with direct hydrological pathways for effect are situated within the Shannon basin. Accordingly, the assessment of potential impacts must be framed within the context of basin-scale hydraulic connectivity rather than as isolated, localised interactions.

These sites are not independent ecological units but interdependent components of a hydraulically continuous and operationally regulated basin-scale system. Hydrological changes introduced at Parteen Basin have the potential to propagate through altered lake storage, discharge management, river stage dynamics and groundwater gradients, engaging ecological processes across multiple Natura 2000 sites within the Shannon IRBD.

Given the scale, regulation and hydrological complexity of the Shannon system, abstraction-related effects cannot be considered purely localised or site-specific. In particular, during low-flow or drought conditions, small changes in storage or discharge may influence lake levels, floodplain inundation regimes and downstream freshwater–estuarine interactions across considerable distances.

This review therefore examines whether the NIS and associated documents demonstrate, beyond reasonable scientific doubt, compliance with Article 6(3) of the Habitats Directive and with Article 4 of the Water Framework Directive, having regard to the integrated hydrological functioning of the Shannon system.

Source: **Natura Impact Statement and Environmental Impact Assessment Report for the Water Supply Project Eastern and Midlands Region, Uisce Éireann. 2025.**

1.2. Shannon International River Basin District – Hydrological Context

The Proposed Project is situated within the Shannon International River Basin District (IRBD), a large and complex hydrological system characterised by extensive surface water and groundwater connectivity. The River Shannon itself flows through a predominantly low-gradient landscape, with

limited elevation change over much of its course and a concentration of hydraulic control structures in its lower reaches. This low-gradient character results in strong coupling between river levels, adjacent floodplains, and underlying groundwater systems.

A defining feature of the Shannon IRBD is the presence of large lakes and seasonally inundated floodplains, including the callow grasslands that occur along much of the middle and lower Shannon. These floodplain systems are highly sensitive to changes in water level, flow regime and groundwater contribution, and support a range of habitats and species of international conservation importance. Seasonal flooding and drawdown are natural components of the system; however, the timing, duration and frequency of these processes are critical in maintaining ecological function.

The hydrology of the Shannon has been extensively modified and regulated over the past century to accommodate hydropower generation, navigation, flood management and water supply. In particular, water levels and flows in the lower Shannon, including Lough Derg and Parteen Basin, are actively managed. While this regulation provides a degree of buffering under average conditions, it also means that additional abstraction pressures may interact with existing operational controls, particularly during periods of low flow when the system's capacity to absorb further change is reduced.

Groundwater is an integral component of the Shannon IRBD, with groundwater bodies extending beneath rivers, lakes and associated wetlands. Many floodplain habitats within the basin are groundwater-dependent, relying on sustained groundwater discharge to maintain soil moisture and ecological function. Consequently, alterations to groundwater heads or hydraulic gradients associated with abstraction have the potential to influence surface water–groundwater interactions and water availability at locations remote from the point of abstraction. The Shannon system therefore functions as an integrated hydraulic continuum in which rivers, lakes, groundwater bodies and floodplains operate as hydraulically connected components rather than discrete units. Under such conditions, alterations in discharge or hydraulic head at one location may redistribute gradients across the wider system, particularly during low-flow periods when regulatory flexibility is constrained.

In such a low-gradient, regulated system, abstraction pressures interact with lake level management and groundwater contribution in ways that may not be apparent from localised or average-condition assessments. In this context, hydrological impacts arising from abstraction within the Shannon IRBD cannot be assessed solely on the basis of proximity to the abstraction point. Basin-scale connectivity, cumulative pressures and sensitivity during low-flow conditions are central considerations for the assessment of potential effects on Natura 2000 sites within the basin.

Sources: **EPA (2022) Shannon International River Basin Management Plan; Geological Survey Ireland (GSI) groundwater and surface water interaction guidance.**

1.3. Legal and Policy Context

This assessment examines whether the Natura Impact Statement (NIS), together with the Environmental Impact Assessment Report (EIAR) and supporting documentation, adequately demonstrates compliance with:

- **Article 6(3) of the EU Habitats Directive (92/43/EEC), including the requirement to establish that a plan or project will not adversely affect the integrity of any European site; and**
- **Article 4 of the EU Water Framework Directive (2000/60/EC), including the objectives of non-deterioration and the protection of water-dependent protected areas.**

1.3.1 Habitats Directive – Article 6(3)

Article 6(3) of the Habitats Directive requires that any plan or project not directly connected with or necessary to the management of a European site must be subject to Appropriate Assessment where it is likely to have a significant effect on that site, either alone or in combination with other plans or projects.

Consent may only be granted where the competent authority is satisfied, beyond reasonable scientific doubt, that the plan or project will not adversely affect the integrity of the site, having regard to its conservation objectives. Site integrity relates to the ability of the site to maintain the structure, function and long-term viability of the habitats and species for which it has been designated.

The Habitats Directive is underpinned by the precautionary principle, as developed through EU Treaty provisions and European Court of Justice case law. Where reasonable scientific doubt remains as to the absence of adverse effects, consent cannot be granted under Article 6(3) (European Commission, 2006).

Article 7 of the Habitats Directive applies the provisions of Article 6(3) to Special Protection Areas (SPAs) designated under the Birds Directive.

1.3.2 Water Framework Directive – Article 4

Article 4 of the Water Framework Directive (WFD) establishes legally binding environmental objectives for surface waters, groundwater and protected areas.

For surface waters, these objectives include the prevention of deterioration in status and the achievement of good ecological and chemical status, or good ecological potential and chemical status in the case of heavily modified or artificial water bodies.

For groundwater, objectives include the prevention of deterioration, the achievement of good quantitative and chemical status, and the maintenance of a balance between abstraction and recharge.

For protected areas, including Natura 2000 sites, Article 4 requires compliance with the objectives and standards under which those areas have been designated.

The WFD recognises surface waters and groundwater as hydraulically connected systems, such that abstraction-induced changes in groundwater head or river stage may alter hydraulic gradients and flow distribution, with ecological consequences at locations remote from the point of abstraction.

1.3.3 Heavily Modified Water Bodies

Under the Water Framework Directive, certain surface water bodies may be designated as Heavily Modified Water Bodies (HMWBs) where physical alterations are necessary to support important uses such as navigation, flood protection or water supply. In such cases, the environmental objective is to achieve Good Ecological Potential (GEP) rather than Good Ecological Status.

HMWB designation does not remove the obligation to prevent deterioration, nor does it remove the requirement to protect dependent protected areas. Any failure to achieve or maintain Good Ecological Potential must be justified under Article 4, including demonstration of overriding public interest, the absence of significantly better environmental alternatives, and the implementation of all practicable mitigation measures.

Water Framework Directive objectives are implemented at the scale of Water Management Units (WMUs). The Shannon International River Basin District is divided into seventeen WMUs, within which status, pressures, objectives and measures are defined. Compliance with Article 4 therefore requires consideration of potential abstraction effects at the WMU scale, including cumulative and in-combination pressures.

Sources: **Habitats Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (OJ L 206, 22.7.1992, p. 7–50), as amended. Birds Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version) (OJ L 20, 26.1.2010, p. 7–25). Water Framework Directive (WFD) 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (OJ L 327, 22.12.2000, p. 1–73), as amended.**

2. Hydrological Pathways and Legal Framework for Assessment

2.1 Zone of Influence (ZoI)

In accordance with established Appropriate Assessment guidance, any Natura 2000 site within the likely zone of influence of a plan or project must be considered. While a screening distance of 15 km is commonly applied for plans, derived from UK guidance (Scott Wilson et al., 2006), this is not a statuary threshold and cannot substitute for pathway based analysis. The extent of the ZoI must reflect the nature of the projects, the relevant impact mechanisms, and the sensitivities of the ecological receptors, in line with the precautionary principle.

For plans or projects with the potential to affect water quantity and/or water quality, particularly where water-dependent habitats or species are present, distance-based screening alone is insufficient. In such cases, it is necessary to consider the full extent of the hydrological system, including upstream and downstream reaches, regulated lake storage, and hydraulically connected groundwater bodies (DEHLG, 2009).

The Proposed Project involves abstraction from a regulated lake-rive system within the Shannon IRBD. The NIS identifies hydrological impacts associated with abstraction from Parteen Basin and defines a hydrological Zone of Influence (ZoI) extending from Meelick Weir downstream to the confluence of the River Shannon at Limerick Dock and the Ardnacrusha Tailrace.

However, the NIS also states that the Proposed Project would have a hydrological pathway for effect to fourteen European sites. Although the project footprint overlaps directly with a single European site (Lower River Shannon SAC), the acknowledged hydrological connectivity extends beyond the footprint to additional SACs and SPAs within the Shannon System.

Accordingly, for the purpose of Article 6(3), the functional ZoI is not confined to direct spatial overlap or to structural control points alone, but encompasses all Natura 2000 sites for which a hydrological pathway for effect has been identified.

2.2 Ornithological Zone of Influence

The NIS applies a disturbance ZoI of up to 300 m from the Proposed Project for breeding birds surveys, based on published guidance (Ruddock & Whitfield, 2007; Cutts et al., 2013; Scottish Natural Heritage, 2017; Goodship & Furness, 2022). These guidance documents were developed primarily in the context of infrastructure-related disturbance (e.g. wind energy, human presence, noise and visual intrusion) and are intended to inform screening distances for proximity based behavioural effects.

A disturbance buffer of this nature may be appropriate where the primary pathway of impact is direct human disturbance of nesting and foraging birds. However, the principal pathway associated with the Proposed Project is hydrological alterations arising from abstraction at Parteen Basin, with potential consequences for lake level dynamics, shoreline configuration and shallow water habitat availability.

Hydrological effects of abstraction operate at the scale of the lake system rather than within a fixed radial distance from infrastructure. Changes in water level may alter the spatial extent and distribution of littoral habitats for nesting and foraging birds. Such effects are not confined to a 300 m zone and may influence habitat availability throughout the Shannon system.

While the NIS extends survey coverage for wintering waterbirds to the wider hydrological system, breeding bird survey coverage is defined primarily by disturbance proximity. Where habitat availability

is hydrologically mediated, the functionally relevant ornithological ZoI must be determined by ecological dependence on water level dynamics rather than disturbance distance alone.

Accordingly, the functionally relevant ornithological ZoI for hydrological effects must be defined by ecological dependence on water level and habitat availability, rather than by fixed disturbance buffers alone.

2.3 Hydraulic Boundaries and Assumed Limits of Influence

The NIS identifies Meelick Weir as the upstream hydraulic limit of influence for water level effects associated with abstraction at Parteen Basin. It states that under low and medium flow conditions, free overflow at Meelick Weir prevents downstream lake level changes from influencing upstream river stage.

However, no detailed hydraulic modelling or sensitivity analysis is presented to demonstrate that abstraction-induced changes in lake storage, discharge regulation or hydraulic gradients could not influence upstream river stage or groundwater conditions under low-flow or drought scenarios. In low-gradient floodplain systems such as the Shannon Callows, small variations in stage can produce disproportionate changes in lateral inundation extent and groundwater–surface water interaction.

In addition, the River Shannon Callows SAC and the Middle Shannon Callows SPA extends both upstream and downstream of Meelick Weir, including groundwater-dependent alkaline fen habitats located south of Portumna Bridge. Accordingly, even if hydraulic independence upstream of the weir were demonstrated, hydrologically connected downstream habitats remain within the ZoI.

The downstream limit of hydrological influence has not been explicitly defined in hydraulic terms within the NIS. Given the regulated and hydraulically continuous nature of the Shannon system, including transitional and estuarine environments within the Lower Shannon and Shannon–Fergus system, the functional ZoI may extend beyond simple distance-based screening boundaries. The downstream extent of influence must be considered in light of regulated discharge, tidal interaction and freshwater–estuarine coupling within the Lower Shannon and Shannon–Fergus Estuaries system

For the purposes of this review, the ZoI is therefore defined by hydraulic connectivity and ecological dependence, rather than by fixed structural control points alone.

2.3 Core Hydrological and Ecological Issues Relevant to Water Abstraction

2.3.1 Abstraction Pressure in the Shannon IRBD

While many existing abstractions within the Shannon IRBD may be sustainable under average hydrological conditions, abstraction is identified by the EPA as a pressure on multiple river and lake water bodies within the Shannon IRBD, particularly during low-flow periods.

Primarily due to impacts on river flows and lake levels during periods of low flow. These pressures occur within a catchment already supporting substantial abstraction for domestic supply, agriculture, industry, energy generation and recreation.

2.3.2 Hydraulic Continuity and System Connectivity

Under the WFD, surface waters and groundwater bodies are recognised as hydraulically continuous systems. Abstraction-induced changes can alter groundwater head, river stage, base flow contribution, lake level behaviour and wetland hydrology at locations remote from the abstraction point.

These relationships are particularly relevant to floodplain systems, callows, groundwater-dependent terrestrial ecosystems (GWDTEs), and shallow littoral habitats.

2.3.3 Mechanisms of Impact from Abstraction
Potential abstraction related mechanisms include:

- **reductions in river discharge;**
- **altered lake level magnitude and timing;**
- **modified groundwater gradients.**

These hydrological changes may affect ecological processes relevant to both WFD classification elements and Natura 2000 conservation objectives.

2.3.4 Sensitivity to Low-Flow and Drought Conditions
Ecological sensitivity is typically greatest during periods of low flow and drought, when:

- **dilution capacity is reduced,**
- **groundwater recharge is limited,**
- **lake levels approach operational minima,**
- **floodplain inundation regimes are constrained.**

Hydromorphological pressures are recognised as a significant risk factor for surface waters nationally.

Assessment based solely on long-term average conditions does not necessarily capture risk during ecologically critical periods.

2.3.5 Limitations of Annual Average Flow Metrics
The Proposed Project is described as abstracting approximately 2% of long-term average flow at Parteen Basin. While technically correct under average conditions, this metric is ecologically misleading.

Using published EPA data, the Q95 low-flow statistic for the Lower Shannon is approximately 12.53 m^3/s. Under such conditions, the proposed abstraction of 3.47–3.82 m^3/s would represent approximately 25–30% of available flow.

These low-flow conditions occur during the periods when aquatic and wetland ecosystems are most vulnerable. The ecological issue is therefore not whether statutory minimum compensation flows are maintained, but how abstraction is operationally accommodated during drought conditions and the resulting implications for lake level management and habitat availability.

2.3.6 Lake Level Regulation
Operational constraints at Lough Derg already require turbine shutdowns to prevent lake levels falling below defined thresholds. Prolonged abstraction during such periods would necessitate trade-offs between water supply and ecological protection.

The NIS concludes that the additional abstraction related drawdown of 13-17 cm remains within the range of historical operational lake level fluctuations. However, this comparison is hydrological rather than ecological in nature. In shallow nearshore environments, small vertical reductions in lake level may translate into substantial lateral recession of littoral habitat, depending on shoreline gradient. For example, on a uniform 1:100 slope, a 15 cm reduction in stage would correspond to approximately 15 m of horizontal retreat. As the modelled drawdown applies across the whole water body, such recession

would occur simultaneously around extensive sections of shoreline during drought conditions, when ecological sensitivity is highest. The ecological implications of this basin wide compression of shallow water habitat are not evaluated in the NIS.

2.3.7 Modelling Assumptions and Sensitivity to Initial Storage Conditions

The hydrological model underpinning the assessment incorporates a "hunting routine" that adjusts simulated Ardnacrusha discharge to maintain Lough Derg levels toward the upper end of the Normal Operating Band (NOB) during periods of low inflow. As a result, simulated drought events commence from a storage condition biased toward the upper limit of the operational band (Appendix A9.1 Abstraction Assessment).

While this approach may stabilise model performance, it represents an optimistic starting condition for drought simulations. In practice, extended drought events are typically preceded by progressive inflow decline and may occur when lake levels are already mid-band or trending downward due to existing abstraction, regulation and climatic variability.

The model therefore evaluates abstraction impacts under conditions that maximise available storage at the onset of drought. The reported additional drawdown of 134 mm (300 MLD) and 65 mm (154 MLD) during the 2018 drought event occurs from the upper NOB rather than from a lower-band starting condition.

No sensitivity analysis is presented to demonstrate how abstraction-induced drawdown would manifest if drought conditions commenced from mid- or lower-band levels within the operational range.

In shallow littoral systems, incremental reductions in stage near the lower operational band may produce disproportionate ecological effects due to lateral shoreline recession and groundwater–surface water disconnection. The absence of sensitivity testing across the full NOB therefore represents a limitation in the assessment of ecological risk under low-flow conditions.

2.3.8 Drought Vulnerability and Climate Change Context

Hydrological drought represents a material and foreseeable stressor within the Shannon River Basin District. Irish Water's National Water Resources Plan (2021) acknowledges that hydrological drought, defined by sustained reductions in streamflow, groundwater levels and reservoir storage, is the most relevant drought type for water supply planning

Historical analyses demonstrate that Ireland has experienced severe multi-season and multi-year droughts, including events in 1975/76 and 1995, with more severe historical droughts reconstructed prior to the modern gauged record (Noone *et al*., 2017; Murphy *et al*., 2019; O'Connor *et al*., 2021). Recent research indicates that Ireland has exhibited strong trends toward greater summer precipitation deficits and increasing drought vulnerability in eastern and central catchments (Department of Transport, Climate Adaptation Research and Energy Division, 2025).

Climate projections under moderate and high emissions scenarios indicate:

- **increased summer temperatures,**
- **reduced summer rainfall,**
- **increased evapotranspiration,**
- **greater frequency of blocking high-pressure systems, and**
- **increased hydrological drought persistence.**

Hydrological droughts may lag meteorological droughts and persist beyond rainfall recovery, resulting in prolonged depression of lake levels, groundwater heads and floodplain soil moisture.

The hydrological modelling presented in Appendix A9.1 Abstraction Assessment relies on a 52-year simulation period (1972–2023) and identifies perceptible abstraction effects only during 1995 and 2018 drought analogues. However, the modelling does not demonstrate performance under reconstructed historical droughts, compounded multi-season hydrological drought, or prolonged climate-adjusted scenarios.

Given the ecological sensitivity of groundwater-dependent habitats, floodplain systems and shallow littoral zones to relatively small changes in stage or groundwater head, abstraction effects during prolonged or cumulative drought conditions represent a reasonably foreseeable scenario requiring robust assessment under Article 6(3).

2.4. Application of the Legal Tests to the Proposed Project

2.4.1 Engagement of the Habitats Directive and Water Framework Directive

The Proposed Project involves abstraction from the Lower River Shannon SAC within a hydraulically continuous river–lake–aquifer system in the Shannon IRBD. As acknowledged within the NIS, the abstraction has established surface-water and groundwater pathways to multiple Natura 2000 sites hydrologically connected to, the point of abstraction.

Where such hydrological connectivity is identified, the legal tests under Article 6(3) of the Habitats Directive and Article 4 of the Water Framework Directive are engaged. The assessment must therefore determine, on the basis of complete, precise and definitive findings, whether the Proposed Project, alone or in combination with other plans or projects, can be authorised without adverse effect on the integrity of any European site and without causing deterioration of water body status or failure to meet Protected Area objectives.

The presence of acknowledged hydrological pathways establishes the requirement for a robust and precautionary assessment.

2.4.2 Article 6(3) Habitats Directive — Integrity Test

Article 6(3) permits consent only where the competent authority is satisfied, beyond reasonable scientific doubt, that the plan or project will not adversely affect the integrity of any Natura 2000 site, having regard to its conservation objectives.

The NIS identifies hydrological pathways for effect to fourteen Natura 2000 sites. However, acknowledgement of a pathway is not, of itself, sufficient to discharge the integrity test. The assessment must demonstrate that the conservation objectives of each site will be maintained under all reasonably foreseeable operating conditions.

In this instance:

- **The assessment relies substantially on long-term or annual average hydrological conditions.**
- **The evaluation of abstraction impacts during ecologically critical periods, including prolonged low-flow and drought conditions is limited.**
- **The consequences of abstraction for site-specific hydrological processes (including seasonal inundation, groundwater support, and depth-dependent habitat availability) are not consistently quantified in ecological terms.**

Where the integrity of a site depends on hydrological regime, including timing, duration and variability of water levels, the assessment must demonstrate that conservation objectives will be maintained under reasonably foreseeable operating conditions, including low-flow and drought periods.

The question is not whether significant effects are likely under average conditions, but whether adverse effects on site integrity can be excluded beyond reasonable scientific doubt.

2.4.3 Application to Special Protection Areas (Article 7 of the Habitats Directive)
By virtue of Article 7 of the Habitats Directive, the requirements of Article 6(3) apply equally to SPAs designated under the Birds Directive.

For SPAs hydrologically connected to the abstraction area, the integrity of the site is dependent not solely on disturbance thresholds, but on the maintenance of the wetland habitat resource supporting the Special Conservation Interests. In lake and floodplain systems, this includes:

- **the availability and distribution of shallow feeding areas,**
- **seasonal inundation regimes,**
- **water depth profiles influencing prey accessibility.**

The NIS applies distance-based disturbance thresholds in respect of certain ornithological receptors. However, where hydrological alteration is the relevant pathway, the integrity test must address habitat functionality rather than proximity alone.

The assessment should therefore demonstrate that abstraction would not alter water level dynamics in a manner that could affect the availability, extent or persistence of habitat relied upon by SCI species, including during prolonged low-flow periods.

2.3.4 Article 4 Water Framework Directive — Non-Deterioration and Protected Areas
Article 4 of the Water Framework Directive requires the prevention of deterioration in the status of surface water and groundwater bodies, the achievement of good status or good ecological potential, and compliance with objectives for protected areas, including Natura 2000 sites.

Where a Natura 2000 site is hydrologically dependent on a surface water or groundwater body, failure to demonstrate compliance with Article 4 WFD has direct implications for the integrity assessment under Article 6(3).

In the present case:

- **The abstraction occurs within a heavily regulated system already subject to operational constraints.**
- **The assessment does not consistently test abstraction effects under combined low-flow, drought and operational constraint scenarios.**
- **The implications of abstraction for groundwater–surface water interaction in dependent habitats are not fully resolved.**

In circumstances where hydrological regime is integral to ecological status and to Protected Area objectives, the non-deterioration requirement must be demonstrably satisfied under reasonably foreseeable conditions.

2.3.5 Interaction Between the Habitats Directive and the Water Framework Directive

The objectives of the Water Framework Directive and the Habitats Directive are legally interlinked. Compliance with Article 4 WFD in respect of Protected Areas is not ancillary to the integrity test under Article 6(3), but complementary to it.

Where uncertainty remains as to whether abstraction may alter hydrological conditions in a manner relevant to Natura 2000 conservation objectives, that uncertainty cannot be cured by reliance on mitigation alone. The competent authority must be satisfied that no reasonable scientific doubt remains.

The assessment must therefore be judged against whether it provides sufficiently complete, precise and definitive findings to exclude adverse effects on site integrity and deterioration of water body status under the conditions in which the system is most sensitive.

3. Methodology for Site-Specific Assessment

The site-specific assessments that follow apply the legal and technical framework set out in Section 2. Site-specific assessment has been confined to Natura 2000 sites located within the Shannon International River Basin District, where hydrological and hydrogeological connectivity to the Proposed Project can be demonstrated with confidence.

The purpose of these assessments is not to re-describe site features, but to examine whether the Natura Impact Statement (NIS) and supporting documentation adequately demonstrate compliance with:

- **Article 6(3) of the Habitats Directive (no adverse effect on site integrity), and**
- **Article 4 of the Water Framework Directive (non-deterioration and protection of water-dependent protected areas),**

having regard to the specific qualifying interests, conservation objectives and hydrological sensitivities of each site.

For each SAC and SPA, the assessment follows a consistent structure:

1. **Site context and qualifying interests**
   A brief summary of the site's designation, qualifying habitats and/or species, with emphasis on those dependent on surface water, groundwater, floodplain processes or lake–river interactions.
2. **Hydrological and ecological pathways**
   Identification of the relevant pathways linking the Proposed Project to the site, including surface-water connectivity, groundwater connectivity, lake level regulation and floodplain processes, drawing on the Zone of Influence defined earlier in this report.
3. **Assessment against Article 6(3) Habitats Directive**
   Evaluation of whether the NIS demonstrates, beyond reasonable scientific doubt, that the Proposed Project will not adversely affect the integrity of the site, having regard to:
   - **conservation objectives and key site attributes,**
   - **sensitivity during low-flow and drought conditions,**
   - **potential for functional habitat loss or alteration,**
   - **the application of the precautionary principle where uncertainty remains.**
4. **Assessment against Article 4 Water Framework Directive**
   Consideration of whether abstraction-related effects could contribute to deterioration of surface water or groundwater bodies supporting the site, prevent achievement of Good Status or Good Ecological Potential, or undermine Protected Area objectives.
5. **Identification of assessment gaps and uncertainties**
   Where relevant, identification of limitations in the NIS, including reliance on average conditions, insufficient consideration of critical periods, or inadequate treatment of groundwater–surface water interactions.

Each site is assessed individually against its conservation objectives and hydrological sensitivities, in accordance with Article 6(3). However, where sites form part of a hydraulically continuous system, the assessment recognises that common abstraction-related mechanisms may operate across connected river, lake and groundwater units. In-combination and cumulative effects are therefore considered in the context of existing regulation, abstraction pressures and climatic variability within the Shannon system.

4. Site-Specific Assessments:

For the purposes of this review, the detailed site-specific assessment is confined to Natura 2000 sites located within the hydrological Zone of Influence (ZoI) of the Proposed Project. This approach focuses on those sites for which the NIS identifies hydrological pathways for effect associated with abstraction at Parteen Basin.

Accordingly, this section examines five Natura 2000 sites identified within the NIS as hydrologically linked to the Proposed Project, together with one additional site that falls within the hydrological context of Lough Derg but is not addressed within the NIS.

4.1 Barroughter Bog SAC [000231] Omitted from NIS Assessment

4.1.1 Site Context

Barroughter Bog SAC is a raised bog located directly on the eastern shoreline of Lough Derg in County Galway. It is designated for:

- **Active Raised Bog (*7110 – priority habitat)**
- **Degraded Raised Bog (7120)**
- **Rhynchosporion vegetation (7150)**

The site's conservation objectives explicitly identify the restoration and maintenance of:

- **High groundwater levels (mean levels at or near surface for most of the year)**
- **Stable hydrological regime and flow patterns**
- **Transitional habitats between open water, reedbeds and raised bog**
- **Appropriate microtopography and peat-forming processes**

The site documentation emphasises its proximity to Lough Derg and the succession from open water through marginal wetlands to raised bog as a defining feature of local distinctiveness (NPWS, 2013).

4.1.2 Hydrological Linkage to Lough Derg

Barroughter Bog lies immediately adjacent to the regulated lake system of Lough Derg.

Its ecohydrology is influenced by:

- **Regional groundwater levels**
- **Hydraulic gradients between lake and surrounding land**
- **Lake stage fluctuations**
- **Drainage and historical hydromorphological modification**

Raised bog habitats are dependent on the maintenance of near-surface water tables and stable hydraulic gradients. Published conservation objectives for the site require sustained high groundwater levels and hydrological stability to support peat-forming processes.

The hydrological model for the Proposed Project predicts additional drawdown of approximately 13–17 cm during severe drought analogues, and acknowledges lake level sensitivity to abstraction during extreme dry periods.

Given the site's immediate shoreline location and reliance on high groundwater tables and in the absence of site-specific hydrogeological assessment examining the relationship between lake stage and local groundwater levels at the bog–lake interface, it has not been demonstrated whether abstraction-related drawdown could influence the hydrological regime of the SAC.

4.1.3 Omission from the Natura 2000 Inventory

Despite its location on Lough Derg and its hydrological sensitivity, Barroughter Bog SAC:

- **Is not listed within the Natura 2000 inventory in the NIS;**
- **Is not identified among the fourteen European sites with hydrological pathways for effect;**
- **Is not assessed in relation to abstraction-induced lake level change.**

This site lies within the defined hydrological context of Lough Derg and falls within the 15 km Zone of Influence applied elsewhere in the NIS. However, it is not included in the inventory of European sites assessed for hydrological pathway effects.

4.1.4 Relevance to the Appropriate Assessment

Under Article 6(3) of the Habitats Directive, all European sites within the likely Zone of Influence must be identified and assessed where a source–pathway–receptor relationship cannot be excluded.

Barroughter Bog SAC lies directly within the hydrologically regulated Lough Derg system. Given:

- **its shoreline location,**
- **its dependence on sustained groundwater levels, and**
- **the modelling acknowledgement of abstraction-related lake level sensitivity during drought,**

a source–pathway–receptor relationship cannot be excluded on the basis of the information presented.

The absence of screening or assessment of this SAC indicates that the inventory of European sites considered in the NIS may not fully reflect all hydrologically connected receptors.

Where a site has not been screened or assessed, it cannot be concluded beyond reasonable scientific doubt that no adverse effect on site integrity will occur.

4.1.5 Procedural and Substantive Implications

The absence of screening or assessment of this SAC indicates that the inventory of European sites considered in the NIS may not fully reflect all hydrologically connected receptors.

Given that the project abstracts directly from a regulated lake system upon which this SAC is physically and hydrologically dependent, further site-specific screening and hydrogeological evaluation would be required to demonstrate compliance with Article 6(3).

Table 4.1 **Key Failures – Barroughter Bog SAC [000231]**

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
Identification within ZoI	**Barroughter Bog SAC is not listed among sites with hydrological**	**The SAC lies directly adjacent to Lough Derg yet is omitted from the**	**Article 6(3) requires identification of all European sites within the**

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
	pathways for effect.	Natura 2000 inventory and hydrological pathway analysis.	likely Zone of Influence. In the absence of identification and screening, compliance with Article 6(3) cannot be demonstrated.
Hydrological linkage to Lough Derg	Site not assessed.	No evaluation of whether abstraction-induced lake level changes could alter groundwater gradients or hydraulic conditions at the bog–lake interface.	Where a plausible source–pathway–receptor link exists, effects must be assessed beyond reasonable scientific doubt.
Lake level sensitivity during drought	Site not assessed.	No site-specific assessment of whether additional drawdown of 13–17 cm under abstraction scenarios could influence local groundwater levels supporting raised bog habitats.	Raised bog habitats are highly sensitive to small changes in water table. Drought-period sensitivity has not been evaluated in relation to site-specific groundwater dependence.
Groundwater dependency	Site not assessed	No hydrogeological analysis of groundwater contribution to the SAC, despite conservation objectives requiring sustained high water tables.	Conservation objectives explicitly require restoration and maintenance of appropriate water levels; groundwater effects must be evaluated under Article 6(3).
Restoration context	Site not assessed.	Site is undergoing restoration and targets expansion of Active Raised Bog to 14.7 ha; hydrological stability is critical to restoration success.	Article 6(3) applies to the maintenance and restoration objectives of designated habitats; assessment must consider effects on restoration trajectories.
Transitional habitats	Site not assessed.	Conservation objectives highlight succession from open water through reedbeds to raised bog; this transitional hydrology is not assessed.	Failure to consider ecotonal hydrological processes risks underestimating site sensitivity.
Cumulative interaction	Site not assessed.	No assessment of combined effect of abstraction drawdown + existing drainage pressures around bog margins.	Article 6(3) requires assessment alone and in combination. Existing drainage increases vulnerability to additional hydrological stress.
Precautionary principle	Site not assessed.	Absence of screening/assessment prevents demonstration of absence of adverse effect.	Where a pathway cannot be excluded and the site has not been assessed, the absence of adverse effect cannot be established.

4.1.6 Conclusion for Barroughter Bog SAC

Barroughter Bog SAC is located immediately adjacent to Lough Derg and is designated for hydrologically dependent raised bog habitats, including the priority habitat Active Raised Bog. The conservation objectives require the maintenance and restoration of high and stable groundwater levels and appropriate hydrological processes.

The hydrological modelling presented in Appendix A9.1 of the EIAR indicates additional lake level drawdown during severe drought analogues under abstraction scenarios. However, no screening or

site-specific assessment has been undertaken to evaluate whether lake stage variation could influence groundwater gradients or water table levels within the SAC, particularly at the lake–bog interface.

In the absence of such assessment, a source–pathway–receptor relationship cannot be excluded. Accordingly, it has not been demonstrated, beyond reasonable scientific doubt, that the Proposed Project would not adversely affect the integrity of Barroughter Bog SAC.

The omission of this SAC from the NIS means that compliance with Article 6(3) of the Habitats Directive has not been established in respect of this site.

4.2 Lower River Shannon SAC [002165]

4.2.1 Site Overview and Qualifying Interests

The Lower River Shannon SAC is designated for a wide range of Annex I habitats and Annex II species whose favourable conservation condition is dependent on the maintenance of hydrological regime, water quality, sediment processes and estuarine dynamics.

Qualifying interests include, inter alia:

- **Riverine and estuarine habitats;**
- **Floodplain and marginal wetland systems;**
- **Priority habitats such as Coastal Lagoons [1150]* and Alluvial Forests [91E0]*;**
- **Annex II species including Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Salmon (*Salmo salar*), Bottlenose Dolphin (*Tursiops truncatus*).**

The conservation objectives for Lower River Shannon SAC are set out in NPWS (2012).These objectives require the maintenance of habitat extent, structure and function, including the hydrological processes that sustain river–lake–estuary connectivity, flow variability, groundwater interaction and freshwater–marine mixing dynamics.

The proposed abstraction point at Parteen Basin lies within the footprint of the SAC. The site is therefore not merely hydrologically connected to the Proposed Project; it spatially coincides with it.

4.2.2 Pathways for Effect

The NIS acknowledges that the Proposed Project has direct hydrological pathways for effect on the Lower River Shannon SAC, including:

- **Direct abstraction within the SAC at Parteen Basin;**
- **Alteration of downstream discharge regime;**
- **Interaction with Lough Derg storage and regulation;**
- **Modification of groundwater–surface water gradients;**
- **Reduced freshwater discharge to the transitional and estuarine environment via the tailrace.**

A source–pathway–receptor relationship is identified in the NIS between the Proposed Project and the SAC.

The assessment must then address whether the predicted changes could affect conservation objectives beyond reasonable scientific doubt and will not adversely affect site integrity.

4.2.3 Assessment of Effects on Conservation Objectives
Hydrological Regime and Flow Dependency

The integrity of the Lower River Shannon SAC depends on:

- **Maintenance of flow magnitude, timing, variability and duration;**
- **Sediment transport and channel morphology;**
- **Lateral connectivity between channel and floodplain;**
- **Maintenance of transitional salinity gradients in downstream reaches.**

The NIS relies predominantly on long-term and annual average hydrological statistics. However, qualifying habitats and species are most vulnerable during low-flow and drought conditions, when system resilience is reduced.

The assessment does not robustly evaluate whether abstraction during such ecologically critical periods would:

- **Reduce wetted channel width or depth;**
- **Alter flow velocity and sediment processes;**
- **Prolong low-flow duration;**
- **Modify inundation frequency or floodplain connectivity;**
- **Shift transitional salinity gradients in downstream reaches.**

Reliance on annual/long-term averages does not, on its own, address sensitivity under low-flow conditions.

Groundwater–Surface Water Interactions

The Lower River Shannon SAC includes habitats sensitive to changes in groundwater levels and hydraulic gradients, particularly within floodplain and marginal zones.

Under the Water Framework Directive, groundwater bodies and surface waters are recognised as hydraulically continuous systems. Abstraction-induced changes at Parteen therefore have the potential to:

- **alter groundwater heads;**
- **modify baseflow contributions to the river;**
- **affect marginal wetland hydrology;**
- **influence soil moisture regimes in floodplain and transitional habitats.**

The NIS does not robustly assess these interactions, nor does it demonstrate that abstraction would not undermine groundwater-supported ecological functions during prolonged low-flow conditions.

4.2.4 Parteen Basin as a Functionally Important Component of the SAC

Parteen Basin forms an integral component of the Lower River Shannon SAC and lies within the core hydrological control zone of the Shannon system. It represents a transitional zone between regulated lake storage at Lough Derg and downstream riverine and estuarine environments, and its ecological character is intrinsically linked to abstraction pressure and operational management at Parteen Weir and Ardnacrusha.

The basin comprises shallow open water, extensive marginal and littoral habitats, and seasonally variable shoreline zones that are highly sensitive to changes in water level and flow regime and contribute directly to SAC structure and function.

Ornithological Function and Baseline Limitations

Available wintering and summer bird survey data demonstrate that Parteen Basin supports water-dependent bird assemblages across its wider extent and regularly supports wintering waterbird species in nationally important numbers, indicating its functional importance as feeding and roosting habitat within the SAC.

However, breeding bird survey coverage within the NIS was confined to a restricted portion of the south-eastern shoreline and does not encompass the full spatial extent of habitats potentially affected by abstraction-related changes in water levels or hydrological regime.

Given the functional importance of the basin and the spatial variability of habitat use by water-dependent birds, this limited coverage does not provide a sufficient baseline to assess whether abstraction-induced changes could result in:

- **loss or compression of shallow-water feeding areas;**
- **increased exposure of littoral zones;**
- **altered prey availability;**
- **displacement to less suitable habitats elsewhere within the SAC.**

4.2.5 Downstream Hydrological Effects within the SAC

Abstraction from Parteen Basin occurs within a highly regulated river system where downstream hydrological conditions are determined by the interaction of lake level management, turbine operation, compensation flows and abstraction demand.

During low-flow or drought conditions, even relatively small absolute changes in discharge can result in disproportionate ecological effects downstream, including prolonged low-flow periods, reduced lateral connectivity between channel and floodplain, and altered inundation regimes of marginal and wetland habitats.

Bottlenose Dolphin is a qualifying Annex II species for the Lower River Shannon SAC. The NIS states that the species' core range lies outside the defined hydrological ZoI. However, observational records demonstrate that dolphins forage upstream to Limerick Docks, within the transitional reach influenced by tailrace discharge.

The NIS acknowledges that abstraction may reduce discharge to the tailrace during certain conditions but asserts that tidal influence mitigates any effect.

The NIS does not provide quantitative assessment of:

- **freshwater–marine mixing dynamics;**
- **salinity front displacement;**
- **changes in estuarine stratification;**
- **prey distribution and aggregation effects.**

Reduced freshwater discharge during drought can increase saline intrusion and shifts estuarine balance upstream. Transitional habitats are highly sensitive to changes in freshwater input. No modelling of salinity regime alteration or ecological consequence is presented.

While the NIS acknowledges hydrological connectivity, it does not robustly assess whether abstraction-induced changes during critical periods could undermine downstream habitat functionality or contribute to cumulative hydromorphological pressure within the SAC.

4.2.6 Mitigation Measures and Their Limitations

The NIS identifies a number of mitigation measures intended to avoid or reduce potential effects on the Lower River Shannon SAC. These include:

- **Limiting abstraction velocity to below 0.15 m/s during hydrostatic testing;**
- **Restricting abstraction to no more than 10% of Q95 where flows are between Q80 and Q95;**
- **Ceasing abstraction below Q95 flow levels;**
- **Maintenance of compensation and fish pass flows;**
- **Operational management of lake levels within the Normal Operating Band (NOB).**

However, it is important to note that the proposed Q95-based restrictions and intake velocity limits are explicitly described as applying to hydrostatic testing and subsequent discharge post-testing. They are not presented as binding operational-phase abstraction controls governing long-term water supply abstraction.

Accordingly, these measures do not provide a comprehensive safeguard against hydrological impacts during routine operational abstraction, particularly during prolonged low-flow or drought conditions.

The Q95 threshold represents a statistical low-flow metric rather than an ecologically derived integrity threshold. Q95 denotes the flow exceeded 95% of the time under historical conditions; it does not define the flow at which qualifying habitats and species begin to experience ecological stress. In low-gradient, highly regulated systems such as the Lower Shannon:

- **Ecological sensitivity may arise at flows above Q95;**
- **Extended periods between Q80 and Q95 may generate cumulative hydrological stress;**
- **Small incremental reductions in discharge can produce disproportionate changes in river stage, lateral inundation, groundwater gradients and estuarine salinity balance.**

The NIS does not demonstrate that abstraction, whether constrained by Q95 thresholds or not, would not result in measurable changes to river stage, lateral connectivity, sediment transport dynamics,

groundwater–surface water interaction, or freshwater–estuarine mixing processes within the SAC during ecologically critical periods.

Hydrological modelling indicates that perceptible additional drawdown (c. 13–17 cm under higher abstraction scenarios) occurs during extreme drought events. While described as falling within historical fluctuation ranges, the modelling approach includes operational routines that tend to maintain lake levels towards the upper end of the Normal Operating Band during low inflow periods. The assessment does not demonstrate that this represents a conservative worst-case ecological scenario, nor does it evaluate habitat response to incremental stage reductions during multi-season hydrological droughts.

Furthermore, mitigation framed primarily around surface-water discharge thresholds does not address groundwater–surface water interactions supporting floodplain and marginal habitats within the SAC.

In respect of downstream transitional and estuarine environments, the NIS concludes that tidal influence would mitigate reduced flows in the Ardnacrusha tailrace during drought conditions. However, no quantitative assessment is provided regarding potential upstream migration of the saline intrusion front, alteration of freshwater–seawater balance, or ecological implications for transitional habitats and Annex II species.

4.2.7 Compliance with Article 6(3) Habitats Directive and Article 4 WFD

Article 6(3) of the Habitats Directive requires certainty, beyond reasonable scientific doubt, that the Proposed Project will not adversely affect the integrity of the Lower River Shannon SAC.

The NIS frequently concludes, in respect of qualifying habitats and species, that there is:

> **"No potential for effects, following the implementation of mitigation measures."**

Under Article 6(3), mitigation measures may only be relied upon where their effectiveness is demonstrated with sufficient scientific certainty to remove reasonable doubt. The assessment does not provide quantitative evidence demonstrating that the proposed operational thresholds:

- **Protect hydrological processes underpinning qualifying habitats;**
- **Prevent functional habitat loss during drought conditions;**
- **Avoid cumulative interaction with existing regulation and abstraction pressures;**
- **Maintain ecological integrity across the full range of reasonably foreseeable hydrological scenarios.**

Accordingly, while mitigation measures are proposed, the NIS does not demonstrate that they are sufficient to ensure the absence of adverse effects on the integrity of the Lower River Shannon SAC beyond reasonable scientific doubt. As the Lower River Shannon SAC is also a Protected Area under the Water Framework Directive, unresolved risks of deterioration or failure to meet Protected Area objectives under Article 4 WFD directly undermine confidence in compliance with Article 6(3).

Table 4.2: **Summary of Key Assessment Failures – Lower River Shannon SAC [002165]**

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Tests
Source–Pathway–Receptor	Hydrological pathways acknowledged between abstraction and SAC	Pathways acknowledged but not assessed under ecologically critical low-flow or drought conditions	Article 6(3) requires certainty under all reasonably foreseeable conditions
Hydrological Metrics	Reliance on long-term and annual average flow	Average flow metrics do not represent conditions when qualifying habitats are	Precautionary principle; does not assess worst-case

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Tests
	statistics	most vulnerable	conditions
Low-Flow and Drought Effects	Drought events modelled; impacts characterised as within historical fluctuation range	Ecological consequences of additional 13–17 cm drawdown during drought not assessed; no habitat sensitivity testing	Article 6(3) requires demonstration of no adverse effect, not comparison to historic fluctuation
Model Assumptions	Model includes lake-level “hunting routine” to maintain levels within NOB band	Model biases starting levels toward upper NOB during low inflow periods, potentially under-representing worst-case ecological drought scenarios	Mitigation or modelling assumptions cannot substitute for ecological certainty under Article 6(3)
Low-Flow Controls	Q95 based abstraction limits and velocity controls proposed	Q95 restrictions apply only to hydrostatic testing and post-testing discharge; no binding operational abstraction safeguards demonstrated for routine supply abstraction during prolonged drought	Mitigation must remove reasonable scientific doubt; absence of operational safeguards leaves uncertainty
Floodplain and Marginal Connectivity	No significant downstream effects predicted	No site-specific evaluation of abstraction effects on lateral connectivity, inundation frequency or marginal wetland persistence during drought	Integrity depends on habitat structure and function
Groundwater–Surface Water Interactions	Recognised in principle	No quantitative assessment of abstraction-induced changes to groundwater heads or baseflow supporting floodplain and wetland habitats	Article 4 WFD non-deterioration and Protected Area objectives
Parteen Basin Function	Considered primarily as abstraction location	Basin-wide ecological role within SAC (transitional habitat, shallow-water systems) not assessed under altered water level scenarios	Does not demonstrate SAC component critical to system integrity
Ornithological Baseline	Limited breeding bird survey undertaken	Survey coverage confined to restricted south-eastern shoreline area; not representative of basin-wide habitat use potentially affected by water level change	Insufficient baseline to rule out functional habitat loss
Wintering Bird Assemblages	National importance acknowledged in supporting reports	Functional implications of water level change for feeding depth distribution and habitat availability not assessed	SPA linked habitat functions within SAC not adequately considered
Downstream Hydrological Effects	Hydrological connectivity acknowledged	No robust assessment of downstream habitat responses under altered regulation and low-flow scenarios	In-combination effects required under Article 6(3)
Freshwater-Estuarine Interaction	Tailrace reductions considered mitigated by tidal influence	No quantitative assessment of salinity intrusion, freshwater-seawater balance, or implications for transitional habitats and Annex II species	Does not demonstrate hydrologically mediated ecological effects undermines integrity test
Cumulative Pressures	Existing abstractions and regulation noted	Combined effects with existing abstraction and operational pressures not tested	Required under Article 6(3) and Article 4 WFD
Water Framework Directive Compliance	Compliance asserted	Non-deterioration and Protected Area objectives not demonstrated during critical conditions	Article 4 WFD test not satisfied
Scientific Certainty	Conclusion of no adverse effect reached	Residual uncertainty remains regarding habitat structure and function	Does not evidence “beyond reasonable scientific doubt”

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Tests
			threshold

4.2.8 Conclusion for Lower River Shannon SAC

The Lower River Shannon SAC lies directly within the abstraction footprint of the Proposed Project and forms part of a regulated, hydraulically continuous river–lake–floodplain–estuarine system. Its qualifying habitats and species are intrinsically dependent on the maintenance of appropriate flow magnitude, timing, variability, groundwater interaction and freshwater–estuarine balance.

While the NIS acknowledges hydrological pathways for effect, it relies primarily on average-condition modelling and does not robustly assess ecological response under prolonged low-flow or hydrological drought conditions, the periods during which qualifying habitats and species are most vulnerable.

Proposed Q95-based abstraction controls apply only to hydrostatic testing and post-testing discharge and do not constitute binding operational safeguards for long-term abstraction.

Hydrological modelling indicates measurable additional drawdown during extreme drought scenarios. While characterised as within historical fluctuation ranges, the assessment does not demonstrate that such incremental reductions would be ecologically neutral, nor does it test sensitivity of qualifying habitats to repeated or prolonged drought sequences under future climate conditions.

Mitigation measures may only be relied upon under Article 6(3) where they remove reasonable scientific doubt. In this case, material uncertainty remains regarding hydrological regime, habitat structure and function, and downstream freshwater–estuarine processes.

Accordingly, it has not been demonstrated, beyond reasonable scientific doubt, that the Proposed Project would not adversely affect the integrity of the Lower River Shannon SAC.

4.3 Site-Specific Assessment: Lough Derg, North-east Shore SAC [002241]

4.3.1 Site Overview and Qualifying Interests

Lough Derg, North-east Shore SAC encompasses a series of fringing and shoreline habitats along the north-eastern margin of Lough Derg, including: fen and marsh communities, shoreline grasslands and fringing wetland habitat, associated transition zones between open water and terrestrial habitats, wet woodland and Priority habitats such as Alluvial Forests* [91E0], Limestone Pavement* [8240] and Yew Woodlands* [91J0].

These habitats are explicitly dependent on the lake's water level regime, including the magnitude, timing and variability of water levels and the frequency and duration of inundation and exposure.

The conservation objectives for Lough Derg, North-east Shore SAC are set out in NPWS (2019). The objectives for the SAC require the restoration and maintenance of:

- **habitat extent and distribution along the shoreline,**
- **structure and function of wetland and woodland communities,**
- **supporting hydrological processes, particularly seasonal water level dynamics.**

Lough Derg forms part of a regulated lake–river system within the Shannon IRBD, with water levels actively managed within a defined Normal Operating Band (NOB) for hydropower, navigation and flood

control. Any additional abstraction pressure within this regulated system may alter the hydrological processes underpinning these qualifying habitats.

4.3.2 Pathways for Effect

The NIS identifies Lough Derg, North-east Shore SAC as:

- **within the same regulated lake system as the abstraction at Parteen Basin, and**
- **within the hydrological zone of influence of the Proposed Project.**

The only mechanism identified for potential effect is alteration of lake level regime arising from abstraction.

Potential pathways therefore include:

- **additional drawdown during drought or low-inflow conditions,**
- **altered frequency or duration of low-water periods,**
- **modified interaction between lake storage and downstream discharge,**
- **changes in groundwater heads in fringing wetland zones linked to lake levels.**

The existence of a source–pathway–receptor relationship is therefore acknowledged at screening stage.

4.3.3 Assessment of Effects on Conservation Objectives

Lake Level Regulation and Shoreline Habitat Sensitivity

The NIS concludes that:

- **simulated lake levels are only affected during extreme drought years (1995 and 2018),**
- **for approximately 99% of the 52-year model period, no perceptible impact occurs,**
- **even during the worst drought event, additional drawdown (13–17 cm) remains within the Normal Operating Band,**
- **the magnitude and rate of drawdown fall within the range of historic observed lake fluctuations.**

However, this reasoning is framed in operational and statistical terms rather than ecological terms.

Remaining within the ESB Normal Operating Band does not demonstrate maintenance of:

- **shoreline habitat extent,**
- **hydroperiod duration,**
- **groundwater-supported wetland conditions,**
- **vegetation zonation,**
- **structural and functional integrity of qualifying habitats.**

The conservation objectives of the SAC relate to ecological function, not operational thresholds.

In shallow, gently sloping shoreline systems, modest vertical changes in lake level can result in disproportionate lateral recession of the waterline. A 13–17 cm additional drawdown during drought may:

- **increase the frequency of exposure of marginal wetland zones,**
- **shorten the duration of saturation in fringing habitats,**
- **alter sediment moisture regimes,**
- **affect macrophyte and moss communities,**
- **shift competitive balance toward more drought-tolerant species.**

The NIS does not translate modelled vertical drawdown into:

- **lateral habitat loss,**
- **altered hydroperiod duration,**
- **vegetation response thresholds,**
- **groundwater response analysis.**

Without this ecological translation, it is not possible to determine whether the integrity test has been satisfied.

Frequency, Duration and Timing of Low-Level Events

The NIS places significant weight on the fact that additional drawdown occurs in only two years of the 52-year simulation.

However:

- **Article 6(3) does not permit effects during reasonably foreseeable drought events.**
- **Climate projections for Ireland indicate increased summer drought frequency and intensity.**
- **Ecological damage often occurs during extreme conditions, not average years.**
- **Repeated low-water events may have cumulative vegetation and soil effects over time.**

The assessment does not evaluate whether abstraction could:

- **increase the frequency of lower-band conditions,**
- **prolong low-water duration,**
- **alter seasonal timing of drawdown,**
- **compound ecological stress during drought sequences.**

Reliance on the statistic that "99% of years show no perceptible impact" does not, in itself, demonstrate that adverse effects on site integrity can be excluded.

Groundwater–Surface Water Interaction

Fringing habitats along the north-east shore likely depend on both:

- **direct inundation by lake water,**
- **shallow groundwater hydraulically linked to lake level.**

Changes in lake level may alter:

- **local groundwater heads,**
- **soil saturation depth,**
- **capillary connection in marginal habitats,**
- **persistence of wet woodland and fen conditions.**

The NIS does not present site-specific analysis of groundwater–shoreline coupling under abstraction scenarios.

Without this ecological translation, it is not possible to determine whether the integrity test has been satisfied.

Mitigation Measures

The mitigation measures referenced in the NIS primarily relate to:

- **hydrostatic testing abstraction limits (e.g. 10% of Q95),**
- **abstraction velocity controls,**
- **water quality protection measures.**

These measures do not apply to permanent operational abstraction during drought conditions and do not mitigate lake level drawdown during low-inflow periods.

Accordingly, the conclusion of "No potential for effects, following mitigation" is not supported by mitigation measures addressing the relevant hydrological mechanism for this SAC.

Ornithological and Functional Use

Although designated as an SAC, the shoreline and littoral habitats of Lough Derg, North-east Shore also contribute to the wider functional habitat resource for waterbirds using Lough Derg and associated SPAs (e.g. feeding, roosting, loafing areas in shallow margins).

Changes in water level can:

- **compress or remove shallow-water foraging zones,**
- **expose or inundate roost sites at critical times,**
- **alter invertebrate and macrophyte communities forming the base of the food web.**

The NIS does not systematically assess whether abstraction-related changes in lake level during low-flow periods could result in functional habitat loss or compression of littoral zones within the SAC, nor whether such changes could have implications for the broader Shannon wetland network.

4.3.4 Compliance with Article 6(3) Habitats Directive

Article 6(3) requires the competent authority to be satisfied, beyond reasonable scientific doubt, that the Proposed Project will not adversely affect the integrity of Lough Derg, North-east Shore SAC.

While the NIS acknowledges hydrological connectivity and models lake level variation, it does not:

- **translate modelled drawdown into ecological impact assessment,**
- **assess habitat sensitivity to hydroperiod alteration,**
- **evaluate groundwater–shoreline interaction,**
- **examine repeated or cumulative drought impacts,**
- **demonstrate that habitat extent, structure and function would be maintained under all reasonably foreseeable conditions.**

The assessment equates compliance with the Normal Operating Band and similarity to historic fluctuations with absence of ecological effect. This equivalence is not demonstrated.

In the absence of ecological analysis linking abstraction-induced drawdown to habitat response, reasonable scientific doubt remains.

4.3.5 Interaction with Article 4 Water Framework Directive

Lough Derg forms part of a heavily regulated water body within the Shannon IRBD and is subject to Water Framework Directive objectives, including:

- **prevention of deterioration in ecological status or potential;**
- **achievement of Good Ecological Potential in the context of its modified regime;**
- **protection of associated Protected Areas, including SACs along its shore.**

The Proposed Project introduces a permanent, high-volume abstraction from a system already constrained by operational water level limits. The NIS does not demonstrate that:

- **low-flow and drought-period lake levels would remain compatible with the hydrological requirements of shoreline habitats;**
- **hydromorphological conditions necessary for Good Ecological Potential would be maintained under combined regulation and abstraction;**
- **Protected Area objectives for Lough Derg, North-east Shore SAC would be secured under all reasonably foreseeable operating conditions.**

In the absence of such demonstration, compliance with Article 4 WFD cannot be clearly established, which is relevant to the integrity assessment under Article 6(3).

Table 4.3 **Key Failures in the Assessment: Lough Derg, North-east Shore SAC [002241]**

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
Hydrological pathway	Hydrological linkage acknowledged; only possible mechanism is change in lake level due to abstraction at Parteen.	While the pathway is acknowledged, the ecological consequences of altered lake level regime are not assessed.	Article 6(3) requires effects to be ruled out, not merely pathways acknowledged.
Reliance on 52-year modelling (“99% unaffected”)	No perceptible impact in 99% of simulated years. Effects only during 1995 and 2018 droughts.	Article 6(3) requires protection during reasonably foreseeable extreme conditions. Ecological impacts often occur during drought years, not average years.	Statistical rarity does not satisfy the “no adverse effect on integrity” test.
Normal Operating	Modelled levels remain	Operational water level bands are	Compliance with operational

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
Band (NOB) compliance	within ESB Normal Operating Band, even during drought + abstraction.	management thresholds, not ecological thresholds. No demonstration that habitat structure and function are protected within NOB limits.	regime ≠ compliance with conservation objectives.
Magnitude of additional drawdown (13–17 cm)	Additional drawdown considered minor and within historic fluctuations.	No translation of vertical drawdown into lateral shoreline recession, habitat compression or hydroperiod alteration. Shallow bathymetry may amplify ecological impact.	No assessment is presented of habitat extent and function, directly undermines Article 6(3).
Historic fluctuation comparison	Modelled changes fall within range of historically recorded lake level fluctuations.	No evidence that historic fluctuations did not cause ecological stress or habitat change. Historic variability is not an ecological impact assessment.	"Within historic range" historic variability is not equivalent to ecological evaluation.
Low-flow / drought sensitivity	Effects limited to extreme drought years and short post-drought periods.	No assessment of increasing drought frequency under climate projections; no evaluation of repeated or cumulative drought stress.	Article 6(3) requires assessment under reasonably foreseeable conditions, including climate change.
Frequency and duration of low-water events	Focus on minimum level reached.	No analysis of duration of low-water periods, altered hydroperiod timing, or frequency of lower-band occupancy.	Habitat integrity depends on hydroperiod dynamics, not just minimum depth.
Groundwater–shoreline interaction	Hydraulic connectivity acknowledged in principle.	No site-specific assessment of groundwater head response or saturation dynamics in fringing wetlands.	Groundwater-supported habitats require explicit assessment under both Article 6(3) and Article 4 WFD.
Ecological translation of modelling outputs	Hydrological modelling relied upon to conclude no effect.	Model outputs not translated into habitat response metrics (extent, zonation, vegetation structure, wet woodland viability).	Article 6(3) requires ecological certainty, not hydrological reassurance alone.
Mitigation measures	"No potential for effects following mitigation." Mitigation focuses on testing-phase abstraction limits and water quality controls.	Proposed Q95 restrictions apply only to hydrostatic testing. No mitigation addresses permanent operational abstraction during drought.	Mitigation effectiveness is not demonstrated for operational abstraction, effects remain unmitigated.
Cumulative / in-combination effects	Abstraction assessed largely in isolation from lake regulation regime.	No robust assessment of interaction between abstraction, ESB regulation, and drought stress.	Article 6(3) requires assessment alone and in combination.
Water Framework Directive compliance	Compliance asserted; no deterioration anticipated.	No demonstration that abstraction would not contribute to hydromorphological pressure or undermine Good Ecological Potential under low-water scenarios.	Failure to demonstrate Article 4 compliance undermines Protected Area obligations.
Precautionary principle	Residual impacts dismissed as unlikely.	Scientific uncertainty regarding shoreline habitat response and groundwater coupling remains unresolved.	Where doubt remains, consent cannot lawfully be granted under Article 6(3).

4.3.6 Conclusion for Lough Derg, North-east Shore SAC

Lough Derg, North-east Shore SAC comprises hydrologically sensitive shoreline and fringing wetland habitats directly dependent on lake level magnitude, timing and seasonal variability. These habitats respond to water level extremes rather than long-term averages.

The NIS acknowledges hydrological connectivity but concludes no effect on the basis that modelled lake level changes remain within the Normal Operating Band and within the range of historic fluctuations. However, the assessment does not examine the ecological implications of repeated or prolonged low-water conditions, nor does it evaluate abstraction effects during multi-season drought or constrained operational scenarios.

Small vertical changes in lake level can produce disproportionate lateral recession of shallow littoral habitats, with implications for habitat extent, zonation and structure. These sensitivities are not quantitatively assessed.

Accordingly, in the absence of a robust evaluation of lake level behaviour and shoreline habitat response under ecologically critical conditions, it cannot be concluded beyond reasonable scientific doubt that the integrity of Lough Derg, North-east Shore SAC would not be adversely affected.

4.4 Site-Specific Assessment: River Shannon Callows SAC [000216]

4.4.1 Site Overview and Qualifying Interests

The River Shannon Callows SAC is designated for Annex I floodplain and wet grassland habitats whose ecological integrity is fundamentally dependent on hydrological processes, including seasonal flooding, shallow groundwater levels, and hydraulic connectivity with the River Shannon. The site supports extensive areas of callow grassland, a habitat type characterised by periodic inundation during winter and spring followed by gradual drawdown through the summer months.

In addition to callow grassland habitats, the SAC includes approximately 15 ha of Annex I habitat Alkaline Fens [7230] located south of Portumna Bridge and south-east of Portumna town. This fen system occupies low-lying land corresponding to a former embayment at the northern end of Lough Derg and is dependent on sustained high groundwater levels and stable hydraulic gradients. According to NPWS (2022), the fen requires groundwater levels at or near the surface for much of the year and may be partially sustained by spring-fed, base-rich flushing. The ecological integrity of this habitat is therefore closely linked to regional groundwater conditions and lake–river hydraulic interactions within the Shannon system. The Priority Habitat Alluvial forest* [91E0] occurs on islands below Meelick Weir and is subject to regular flooding.

The conservation objectives for the River Shannon Callows are set out in NPWS (2022). These objectives for the SAC require the maintenance and restoration of habitat extent, structure and function, including the hydrological regime that sustains seasonal inundation patterns, soil moisture conditions, nutrient dynamics and associated ecological communities. The ecological functioning of the Callows is therefore inseparable from river stage, groundwater–surface water interaction, and the timing and duration of flooding events.

4.4.2 Pathways for Effect

The NIS acknowledges that the River Shannon Callows SAC lies within the hydrogeological Zone of Influence of the Proposed Project. The abstraction at Parteen Basin occurs approximately 36 km downstream (straight-line distance), within the same regulated river–lake system.

The NIS asserts that the only possible mechanism of impact is via abstraction-induced changes in water levels within the regulated Lough Derg–Shannon system and that upstream effects are hydraulically limited to Meelick Weir.

However, the SAC spans both upstream and downstream of Meelick Weir, and includes groundwater-dependent habitats located south of Portumna Bridge within the regulated Lough Derg–Shannon reach.

Accordingly, potential pathways for effect include:

- **abstraction-induced modification of lake storage behaviour at Lough Derg;**
- **altered discharge management at Parteen and Ardnacrusha;**
- **changes in river stage within the low-gradient Shannon floodplain;**
- **modification of floodplain inundation frequency, timing or duration;**
- **abstraction-induced changes in groundwater heads affecting shallow floodplain soils and alkaline fen habitats;**
- **cumulative interaction with existing regulation and abstraction pressures.**

While hydrological connectivity is acknowledged in principle, the NIS does not present quantitative hydraulic modelling demonstrating that abstraction during low-flow or drought conditions would not influence upstream river stage or groundwater gradients within the SAC.

4.4.3 Assessment of Effects on Conservation Objectives
Hydrological Regime and Floodplain Function

The integrity of the River Shannon Callows SAC depends on the maintenance of a naturalised seasonal flooding regime, including the timing, duration and extent of inundation events that shape vegetation structure, species composition and soil conditions within callow habitats.

The NIS relies heavily on the fact that Lough Derg is managed within a 460 mm Normal Operating Band (NOB) and states that even during the worst modelled drought event (2018), abstraction-induced changes remain within this band and within the range of historical water level variability.

However, the Normal Operating Band is an operational control envelope designed for hydropower and embankment safety. It is not an ecological threshold. Compliance with the NOB does not demonstrate that:

- **seasonal flood duration remains unchanged,**
- **flood recession timing is unaltered,**
- **groundwater heads are maintained,**
- **floodplain soil saturation regimes are preserved.**

The NIS further argues that natural wind-driven lake level variation (averaging ~110 mm and occasionally exceeding 400 mm) exceeds the magnitude of modelled abstraction-induced change, and that such changes would therefore be "indistinguishable" to littoral vegetation.

This comparison is hydro dynamically and ecologically flawed.

Wind effects are:

- **short-duration,**
- **oscillatory,**
- **spatially variable,**
- **non-cumulative.**

Abstraction-induced storage deficits are:

- **directional,**
- **potentially sustained during low-flow periods,**
- **cumulative over time,**
- **associated with altered discharge management.**

Short-term wind setup is not functionally equivalent to sustained abstraction-induced drawdown during ecologically critical periods.

The conservation objectives for the SAC relate to habitat structure and function, which are driven by hydrological processes, particularly the timing and duration of inundation, rather than compliance with an engineering operating range.

Groundwater–Surface Water Interactions

The River Shannon Callows function as a shallow floodplain system with strong groundwater–surface water interaction. Seasonal flooding, soil moisture retention and habitat persistence are supported by high groundwater tables maintained through hydraulic connectivity with the River Shannon.

Under the Water Framework Directive, groundwater bodies and surface waters are recognised as hydraulically continuous systems. Abstraction-induced changes at Parteen Basin have the potential to alter groundwater heads and hydraulic gradients across the floodplain, particularly during extended dry periods when recharge is limited.

The NIS does not robustly assess whether abstraction could result in:

- **sustained lowering of shallow groundwater levels within the Callows;**
- **reduced groundwater contribution to floodplain soil moisture;**
- **progressive drying of callow habitats during drought sequences.**

In the absence of such assessment, it has not been demonstrated that groundwater-dependent ecological functions within the SAC would be maintained under all reasonably foreseeable operating conditions.

Sensitivity to Low-Flow and Drought Conditions

The ecological sensitivity of the River Shannon Callows SAC coincides with the hydrological conditions least examined in the assessment. Late summer drawdown, multi-season drought and prolonged low-flow conditions represent periods of heightened vulnerability for floodplain habitats, particularly where abstraction pressures interact with existing regulation of lake levels and river flows.

The NIS states that perceptible modelled impacts occur only in 2 out of 52 years (1995 and 2018), representing approximately 1% of the simulation period.

Article 6(3) of the Habitats Directive is not a frequency test. It requires that adverse effects on site integrity be excluded under reasonably foreseeable conditions. Severe drought conditions are demonstrably foreseeable in Ireland, and climate projections indicate increasing summer drying and evapotranspiration pressure.

The fact that modelled differences arise primarily during drought periods is ecologically significant, as these are precisely the conditions under which floodplain habitats and groundwater-dependent fens are most vulnerable.

Upstream Hydraulic Boundary at Meelick Weir

The NIS states that abstraction-related hydrological effects are limited upstream to Meelick Weir. However, the River Shannon Callows SAC extends both upstream and downstream of this structure. No detailed hydraulic modelling or sensitivity analysis is presented to demonstrate that abstraction at Parteen Basin would not alter upstream river stage, floodplain inundation patterns, or groundwater gradients under low-flow or drought conditions. In low-gradient floodplain systems, even small variations in river stage can produce disproportionate changes in lateral inundation extent.

Moreover, even if hydraulic independence upstream of Meelick Weir were demonstrated through robust modelling, the SAC also encompasses downstream groundwater-dependent habitats that remain hydrologically connected to the regulated Shannon system.

Given the highly regulated nature of the Shannon, and the dynamic interaction between lake level management, turbine operation and discharge control structures, the identification of Meelick Weir as a fixed upstream boundary represents an operational assumption rather than a demonstrated hydraulic conclusion. In the absence of quantitative evidence resolving this uncertainty, it is not possible to conclude beyond reasonable scientific doubt that the integrity of the River Shannon Callows SAC would not be affected.

4.4.4 Compliance with Article 6(3) of the Habitats Directive

Article 6(3) of the Habitats Directive requires that consent may only be granted where it can be concluded, beyond reasonable scientific doubt, that the Proposed Project will not adversely affect the integrity of the River Shannon Callows SAC, having regard to its conservation objectives.

While the NIS acknowledges hydrological connectivity, its assessment:

- **relies on compliance with the Normal Operating Band,**
- **compares abstraction effects to wind-driven variability,**
- **evaluates magnitude but not flood duration or groundwater response,**
- **does not provide upstream stage or groundwater sensitivity modelling,**

- does not assess drought-period habitat response.

The conclusion of "no potential for effects" is therefore not supported by site-specific hydrological or ecological analysis of floodplain process variables.

In the presence of unresolved uncertainty regarding flood duration, groundwater levels and fen hydrology under low-flow abstraction scenarios, the precautionary principle applies.

4.4.5 Interaction with Article 4 of the Water Framework Directive

The River Shannon Callows SAC is a Protected Area under the Water Framework Directive. Article 4 requires:

- prevention of deterioration,
- protection of groundwater-dependent ecosystems,
- maintenance of hydromorphological conditions necessary for ecological status.

The NIS does not demonstrate that abstraction during drought or constrained operational scenarios would not alter hydrological conditions supporting Molinia meadows, hay meadows, alluvial forest or alkaline fen habitats.

Unresolved uncertainty regarding groundwater–surface water interaction and flood duration therefore raises potential non-compliance with Article 4 WFD. Such uncertainty directly undermines confidence in compliance with Article 6(3) of the Habitats Directive.

Table 4.4 Key Failures – River Shannon Callows SAC [000216]

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Tests
Hydrological pathway	SAC acknowledged as hydrologically connected within regulated Shannon system.	Pathway acknowledged but ecological consequences not quantitatively assessed under low-flow or drought abstraction scenarios.	Under Article 6(3), once a pathway exists, its ecological effects must be excluded beyond reasonable scientific doubt.
Upstream boundary at Meelick Weir	Effects asserted to be limited upstream to Meelick Weir.	No hydraulic modelling demonstrating no measurable change in upstream stage or groundwater gradients under drought + abstraction scenarios. Boundary treated as structural assumption rather than demonstrated ecological independence.	Article 6(3) requires demonstration, not assertion. Unresolved upstream hydraulic uncertainty leaves reasonable scientific doubt.
Reliance on Normal Operating Band (NOB)	Lake levels remain within 460 mm operating band; therefore no significant effect predicted.	NOB is an engineering control envelope, not an ecological threshold. No assessment of flood duration, recession timing or groundwater response within NOB.	Compliance with operational band does not demonstrate maintenance of habitat structure and function as required by conservation objectives.
Use of frequency statistic ("99% of years unaffected")	Modelled impacts occur only in 2 of 52 years; therefore effects negligible.	Article 6(3) is not a probability test. Severe droughts are reasonably foreseeable and ecologically critical. No assessment of ecological response during those drought years.	Integrity must be protected under all reasonably foreseeable conditions, not on average frequency.

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Tests
Wind-driven variability comparison	Abstraction-induced changes comparable to natural wind-driven fluctuations.	Wind effects are short-term and oscillatory; abstraction deficits may be sustained and cumulative. No demonstration of ecological equivalence.	Unsupported analogy does not satisfy precautionary standard required by Article 6(3).
Floodplain inundation regime	No significant upstream water level change predicted.	No modelling of changes in inundation duration, spatial extent, or recession timing of callow habitats.	Callow grasslands are defined by flood regime; in the absence of analysis, it is not possible to conclude the integrity test has been met.
Groundwater–surface water interaction	Hydraulic connectivity acknowledged in general terms.	No assessment of groundwater head response within floodplain soils or alkaline fen during prolonged low-flow abstraction scenarios.	Groundwater-dependent habitats require protection under both Article 6(3) and Article 4 WFD.
Alkaline fen [7230] sensitivity	Downstream fen acknowledged within SAC.	No site-specific modelling of groundwater gradients or lake-stage influence on fen hydrology.	Fen habitat requires near-surface groundwater; unresolved hydrological sensitivity leaves scientific doubt.
Drought-period assessment	Model includes drought years (1995, 2018) but focuses on magnitude within NOB.	No evaluation of ecological process variables (flood days, soil moisture persistence, groundwater recovery time).	Magnitude-only analysis insufficient where conservation objectives depend on process-based hydrology.
Cumulative interaction with regulation	Abstraction assessed within regulated Shannon system.	No testing of cumulative interaction between abstraction, turbine shutdown, compensation flows and prolonged drought conditions.	Article 6(3) requires assessment alone and in combination; omission leaves material uncertainty.
Water Framework Directive compliance	Compliance with WFD objectives concluded.	No demonstration that abstraction would not contribute to deterioration of hydrological regime supporting a Protected Area.	Article 4 WFD non-deterioration and Protected Area obligations directly inform Article 6(3) assessment.
Precautionary principle	“No potential for effects” concluded subject to mitigation.	Scientific uncertainty regarding upstream stage behaviour, flood duration and groundwater support not resolved through modelling.	Where doubt remains, consent cannot lawfully be granted under Article 6(3).

4.4.6 Conclusion for River Shannon Callows SAC

The River Shannon Callows SAC is a low-gradient floodplain system whose ecological integrity depends on the timing, duration and extent of seasonal inundation and on sustained shallow groundwater levels. Its qualifying habitats, including callow grasslands and alkaline fen, are fundamentally hydrologically driven.

The NIS asserts that abstraction-related effects are limited upstream to Meelick Weir and therefore would not influence the SAC. However, no hydraulic modelling or sensitivity analysis is presented to demonstrate that abstraction during low-flow or drought conditions would not alter upstream river stage, floodplain inundation patterns or groundwater gradients. Furthermore, the SAC extends both upstream and downstream of Meelick Weir, including groundwater-dependent fen habitats within the regulated system.

In low-gradient floodplain systems, even modest changes in stage or groundwater head may result in disproportionate changes in lateral inundation extent and soil moisture conditions. These sensitivities are not evaluated under worst-case hydrological conditions.

In the absence of quantitative evidence resolving these uncertainties, it is not possible to conclude beyond reasonable scientific doubt that the Proposed Project would not adversely affect the integrity of the River Shannon Callows SAC.

4.5 Site-Specific Assessment: Lough Derg (Shannon) SPA [004058]

4.5.1 Site Overview and Special Conservation Interests

Lough Derg (Shannon) SPA is designated under the Birds Directive for both breeding and wintering waterbird assemblages. The Special Conservation Interests (SCIs) are:

- **Cormorant (*Phalacrocorax carbo*) [A017]**
- **Tufted Duck (*Aythya fuligula*) [A061]**
- **Goldeneye (*Bucephala clangula*) [A067]**
- **Common Tern (*Sterna hirundo*) [A193]**
- **Wetland & Waterbirds [A999]**

The SPA encompasses the open water body of Lough Derg together with its islands, shoreline and littoral habitats. It supports:

- **nationally important breeding colonies of Common Tern and Cormorant;**
- **breeding populations of Tufted Duck, Great Crested Grebe and other waterbirds;**
- **nationally important wintering populations of Tufted Duck and Goldeneye;**
- **additional Annex I species including Whooper Swan, Greenland White-fronted Goose (historically) and Hen Harrier (winter roosting in marginal reed beds).**

The conservation objectives for Lough Derg (Shannon) are set out in NPWS (2024). These objectives require:

- **maintenance or restoration of the favourable conservation condition of the SCI species; and**
- **maintenance of wetland habitats as a resource for regularly occurring migratory waterbirds (NPWS 2024).**

The integrity of the SPA is therefore directly dependent on:

- **the availability, extent and configuration of open water and shallow littoral habitat;**
- **water depth distribution and shoreline configuration;**
- **the seasonal pattern of lake level fluctuation;**
- **prey accessibility within depth-sensitive feeding zones.**

Unlike a terrestrial SPA where effects may be spatially discrete, the SPA designation relates to the lake water body itself. Consequently, hydrological alteration to lake level dynamics is inherently relevant to site integrity.

4.5.2 Pathways for Effect

The NIS states that the Proposed Project does not overlap with the SPA and is located approximately 4 km from its mapped boundary. It further asserts that the hydrogeological Zone of Influence does not extend to the SPA and that abstraction represents approximately 2% of the annual mean flow at Parteen Basin.

However, these characterisations misrepresent the functional hydrological relationship.

Lough Derg forms part of the same regulated lake–river system from which abstraction occurs at Parteen Basin. Abstraction is hydrologically coupled to:

- **lake storage levels;**
- **turbine operation at Ardnacrusha;**
- **discharge control at Parteen Weir;**
- **maintenance of the 460 mm Normal Operating Band (NOB).**

Accordingly, potential pathways for effect are hydrologically mediated and include:

- **alteration of lake level magnitude, timing and rate of drawdown;**
- **increased frequency or duration of minimum operating band conditions;**
- **modified seasonal refill behaviour following drought;**
- **lateral recession or compression of shallow littoral habitat;**
- **redistribution or reduction of depth-sensitive foraging zones.**

Because the SPA designation relates to the lake water body and its associated habitats, abstraction is not a remote or secondary pressure but operates within the same hydrological unit as the protected receptor.

A clear source–pathway–receptor relationship therefore exists.

4.5.3 Functional Habitat Dependency of SCI Species

The SCI species are strongly depth-dependent in their habitat use.

Diving Ducks (Tufted Duck, Goldeneye)

Diving ducks forage on benthic invertebrates and molluscs and are sensitive to:

- **water depth distribution;**
- **compression of optimal depth bands;**
- **prey accessibility in shallow zones;**
- **displacement when shallow areas contract.**

Even modest vertical lake level changes (e.g. 15–30 cm) may produce substantial horizontal recession of shallow-water habitat where bathymetry is gently sloping. Habitat loss in such systems is non-linear: small vertical drops can translate into disproportionately large lateral habitat reduction.

Winter survey data demonstrate that nationally important numbers of Tufted Duck regularly occur within the wider lake system and Parteen Basin. Distribution patterns show preference for shallow western margins and sheltered littoral areas, precisely the habitats most sensitive to water level variation.

Common Tern and Cormorant (Breeding)

Breeding Common Tern colonies occur on islands within the lake. Although island management has mitigated nest flooding risk historically, breeding success remains dependent on:

- **stability of lake levels during the breeding season;**
- **avoidance of rapid drawdown or inundation events;**
- **maintenance of foraging habitat within suitable commuting distance.**

Cormorant colonies and breeding grebes similarly rely on stable hydrological conditions and sufficient prey availability.

Wetland & Waterbirds

The Conservation Objectives requires maintenance of wetland habitat as a functional resource. This extends beyond species presence to habitat extent, quality and persistence through seasonal cycles.

The NIS does not evaluate how abstraction-induced changes in lake level behaviour may affect:

- **shallow feeding margins;**
- **roosting areas;**
- **benthic invertebrate communities;**
- **macrophyte distribution;**
- **winter aggregation behaviour.**

4.5.4 Assessment of Effects on Conservation Objectives

The conservation objectives for Lough Derg (Shannon) SPA require the maintenance of:

- **the population size and distribution of SCI species;**
- **the availability, extent and quality of wetland habitats supporting those species;**
- **the hydrological processes underpinning habitat function.**

The NIS concludes that abstraction will not affect lake levels or associated habitats on the basis that:

- **abstraction represents approximately 2% of annual mean flow at Parteen Basin;**
- **modelled lake levels remain within the 460 mm Normal Operating Band (NOB);**
- **modelled abstraction-related differences are small relative to natural variability.**

However, the assessment does not demonstrate that the ecological requirements of the SCI species will be maintained under all reasonably foreseeable hydrological conditions.

Reliance on Annual Mean Flow

The use of annual mean flow as the primary metric does not address ecological sensitivity, which is greatest during:

- **prolonged low inflow periods;**
- **drought conditions;**
- **late summer drawdown;**
- **turbine-constrained operational scenarios.**

A relatively small percentage of annual mean flow may represent a materially greater proportion of available storage during low-flow conditions. The assessment does not quantify abstraction effects under Q95 or multi-season drought scenarios in ecological terms.

Operation Within the Normal Operating Band

The fact that modelled levels remain within the 460 mm NOB does not equate to ecological neutrality. The NOB is an operational control range established for embankment safety and system management; it is not defined by ecological thresholds.

Within this band, abstraction may still:

- **increase the frequency of minimum-level conditions;**
- **extend the duration of low-water periods;**
- **alter seasonal refill timing.**

Shallow littoral habitats and depth-dependent foraging zones respond to timing and duration of exposure rather than absolute exceedance of an operating band.

Comparison with Wind-Induced Variation

The NIS compares abstraction-related changes to wind-induced daily water level differences. However, wind-driven fluctuations are short-term oscillations, whereas abstraction influences storage and drawdown behaviour over sustained periods.

Ecological responses to temporary wind setup are not equivalent to responses to prolonged low storage conditions.

Functional Habitat Implications

The assessment does not quantify:

- **the lateral extent of shallow-water habitat under minimum operating conditions;**
- **the degree of habitat compression associated with additional drawdown;**

- **the potential redistribution of wintering flocks under reduced shallow-water availability;**
- **the implications for prey accessibility in depth-sensitive feeding zones.**

Given that nationally important numbers of Tufted Duck and Little Grebe utilise shallow-water areas within the lake system, and breeding species depend on stable seasonal water levels, the omission limits the ability of the competent authority to conclude the integrity test has been met.

4.5.5 Compliance with Article 6(3) Habitats Directive
Article 6(3) requires certainty beyond reasonable scientific doubt that the Proposed Project will not adversely affect site integrity.

The assessment does not demonstrate that:

- **lake level dynamics under abstraction will remain ecologically neutral;**
- **frequency and duration of low-water conditions will not increase;**
- **shallow feeding habitat used by SCI species will not be compressed;**
- **breeding habitat stability will be maintained under drought conditions;**
- **cumulative interaction with existing regulation pressures will not affect SPA function.**

In the presence of unresolved uncertainty regarding habitat extent and function, the precautionary principle applies.

Accordingly, it has not been demonstrated beyond reasonable scientific doubt that the integrity of Lough Derg (Shannon) SPA would not be adversely affected.

4.5.6 Interaction with Article 4 Water Framework Directive
Lough Derg is a Protected Area under the WFD and a regulated (Heavily Modified) water body with objectives relating to Good Ecological Potential and non-deterioration.

The NIS does not demonstrate that:

- **abstraction will not contribute to hydromorphological pressure;**
- **ecological potential will be maintained under repeated low-water scenarios;**
- **Protected Area objectives linked to the SPA will be secured.**

Unresolved uncertainty under Article 4 WFD directly undermines compliance with Article 6(3).

Table 4.5 Key Failures – Lough Derg (Shannon) SPA [004058]

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
Hydrological pathway	SPA acknowledged within hydrological context of abstraction system	Pathway acknowledged but ecological consequences not quantified	Where a pathway exists, its ecological implications must be ruled out beyond reasonable scientific doubt (Art. 6(3))
Reliance on annual mean flow	Abstraction characterised as ~2% of annual mean flow	Annual mean metrics do not reflect low-flow or drought conditions when ecological sensitivity is greatest	Ecological integrity must be assessed under worst-case foreseeable conditions, not averages
Normal Operating Band	Modelled levels remain within 460 mm NOB	Operational management band is not an ecological threshold; remaining within	Art. 6(3) requires assessment of habitat function, not operational

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test
(NOB)		NOB does not demonstrate ecological neutrality	compliance
Low-flow / drought assessment	Effects limited to extreme drought years; impacts described as minimal	No ecological assessment of frequency, duration or timing of low-level events under abstraction	Does not assess ecologically critical periods leaves reasonable scientific doubt unresolved
Shallow-water habitat extent	No significant habitat impact predicted	No quantification of lateral recession of littoral zones or compression of depth bands used by SCI species	SPA integrity depends on habitat availability and distribution
Wintering duck dependency	Tufted duck and Little Grebe acknowledged as nationally important	No evaluation of how altered lake levels may affect benthic prey access or flock distribution	Functional habitat loss may occur without breach of operational thresholds
Breeding species	Breeding tern and cormorant colonies acknowledged	No assessment of whether altered seasonal water level behaviour could affect island stability or nest security	Seasonal timing of water level fluctuation is integral to breeding success
Wind fluctuation comparison	Abstraction-related change compared to wind-driven variation	Short-term wind oscillation not ecologically equivalent to sustained storage drawdown	Comparison does not resolve long-duration exposure risk
Cumulative interaction	Regulation regime described	No modelling of abstraction + turbine constraint + climate-driven low inflow scenarios	Article 6(3) requires assessment alone and in combination
WFD compliance	Compliance asserted	No demonstration that abstraction would not affect hydromorphological conditions underpinning SPA as Protected Area	Article 4 WFD non-deterioration uncertainty undermines Article 6(3) conclusion
Mitigation reliance	"No potential for effects, following mitigation"	Mitigation relates to water quality and construction; no mitigation addresses hydrological habitat alteration	Mitigation cannot compensate for unresolved uncertainty in hydrological regime

4.5.7 Conclusion for Lough Derg (Shannon) SPA

Lough Derg (Shannon) SPA supports nationally important breeding and wintering waterbird populations whose habitat use is directly influenced by lake level dynamics and the extent of shallow littoral feeding zones.

The NIS concludes that abstraction represents a small proportion of long-term average flow and would not significantly affect lake levels. However, ecological sensitivity in lake systems is governed by low-water events, drought sequences and prolonged drawdown periods rather than annual means. The assessment does not robustly evaluate abstraction effects under Q95 or multi-season drought scenarios, nor does it assess potential compression of shallow feeding habitats used by SCI species.

Given the direct hydrological connection between abstraction and the lake water body, and the functional dependence of SPA species on depth-sensitive feeding zones, unresolved uncertainty remains regarding habitat extent and availability during critical periods.

Accordingly, it has not been demonstrated beyond reasonable scientific doubt that the Proposed Project would not adversely affect the integrity of Lough Derg (Shannon) SPA.

4.6 Site-Specific Assessment: Middle Shannon Callows SPA [004096]

4.6.1 Site Overview and Special Conservation Interests

The Middle Shannon Callows SPA is of international importance as it regularly supports in excess of 20,000 wintering waterbirds. It is also an important breeding site for waders, whose population in Ireland are experiencing significant declines due to habitat loss and other pressures.

The site is designated under the Birds Directive for the following Special Conservation Interests (SCIs):

- **Whooper Swan (*Cygnus cygnus*) [A038]**
- **Wigeon (*Anas penelope*) [A050]**
- **Corncrake (*Crex crex*) [A112]**
- **Golden Plover (*Pluvialis apricaria*) [A140]**
- **Lapwing (*Vanellus vanellus*) [A142]**
- **Black-tailed Godwit (*Limosa limosa*) [A156]**
- **Black-headed Gull (*Chroicocephalus ridibundus*) [A179]**
- **Wetland & Waterbirds assemblage [A999]**

The SPA also supports internationally important populations of Whooper Swan and Black-tailed Godwit, and nationally important populations of Wigeon, Golden Plover, Lapwing and Black-headed Gull.

The conservation objectives for the Middle Shannon Callows are set out in NPWS (2022). These objectives require the maintenance or restoration of the favourable conservation condition of these species and the maintenance of the wetland habitats that support them.

The ecological integrity of the Middle Shannon Callows SPA is therefore fundamentally dependent on:

- **Seasonal floodplain inundation patterns**
- **Timing and duration of flood recession**
- **Maintenance of shallow groundwater levels**
- **Stability of wet grassland sward structure**
- **Availability of suitable nesting, foraging and roosting habitat**

4.6.2 Pathways for Effect

The SPA lies approximately 18 km upstream of the abstraction point at Parteen Basin. The NIS concludes that the SPA lies outside the hydrogeological Zone of Influence and that no hydrological effects would arise.

The NIS asserts hydraulic independence upstream of Meelick Weir but does not present quantitative modelling demonstrating that abstraction would not influence upstream river stage or groundwater gradients under low-flow or drought scenarios.

However:

- **The SPA extends southwards to Portumna, including areas downstream of Meelick Weir.**
- **The site occupies a low-gradient floodplain hydraulically connected to the Shannon system.**

- **Water levels are influenced by both catchment inflow and downstream regulation.**

Potential hydrological pathways therefore include:

- **abstraction-related changes in Lough Derg storage and downstream discharge management;**
- **alteration of hydraulic gradients across Meelick Weir during low-flow conditions;**
- **modification of flood recession timing;**
- **abstraction-induced changes in shallow groundwater levels in downstream portions of the SPA;**
- **cumulative interaction with existing regulation and climate-driven low-flow conditions.**

A source–pathway–receptor relationship cannot therefore be excluded solely on the basis of linear distance.

4.6.3 Assessment of Effects on Conservation Objectives
Flood Regime and Wet Grassland Function

The Middle Shannon Callows are defined by a naturalised flood regime characterised by:

- **winter and spring inundation,**
- **soil saturation into late spring,**
- **gradual summer drawdown.**

Many SCI species depend on:

- **soft, waterlogged soils (e.g., Whooper Swan, Black-tailed Godwit, Lapwing),**
- **short damp swards (e.g., Golden Plover),**
- **late mowing regimes supported by wet ground conditions,**
- **predictable spring flood recession timing.**

The NIS does not assess whether abstraction could:

- **shorten the duration of seasonal inundation,**
- **advance the timing of flood recession,**
- **reduce floodplain soil moisture persistence,**
- **alter groundwater-supported saturation patterns during late spring and summer.**

Reliance on long-term average flow conditions does not address ecologically sensitive low-flow periods when floodplain habitats are most vulnerable.

Vegetation Transition and Habitat Desiccation Risk

The integrity of the SPA depends on the maintenance of wet grassland communities shaped by recurrent flooding and high groundwater tables.

Even modest, repeated reductions in:

- **inundation duration,**

- **shallow groundwater levels,**
- **soil moisture persistence,**

can, over time, drive vegetation transition from wet callow grassland towards drier mesotrophic or semi-improved grassland communities.

Such transitions may:

- **increase sward rigidity and reduce soil softness,**
- **alter invertebrate assemblages,**
- **reduce probing suitability for waders,**
- **affect breeding habitat quality,**
- **compress foraging habitat.**

This represents a gradual functional habitat degradation pathway, not a sudden or catastrophic change.

The NIS does not evaluate whether abstraction-related hydrological modification could contribute to progressive desiccation or vegetation shift within the SPA, nor does it assess the ecological implications of such change for SCI species.

Under Article 6(3), the maintenance of habitat structure and function must be demonstrated. In the absence of analysis of this pathway, it is not possible to conclude the integrity test has been met.

Water Quality and Pipeline Maintenance

The NIS identifies potential water quality risks during infrequent maintenance discharges and concludes no potential for effects subject to mitigation.

While mitigation for chemical spills and sediment release is described, this does not address hydrological regime alteration, which is the primary ecological driver of the SPA.

Accordingly, mitigation measures directed at water quality do not resolve uncertainty regarding flood regime maintenance.

4.6.4 Compliance with Article 6(3) of the Habitats Directive

Under Article 6(3) of the Habitats Directive (as applied to SPAs via Article 7), consent may only be granted where it can be concluded, beyond reasonable scientific doubt, that the Proposed Project will not adversely affect the integrity of the SPA, having regard to its conservation objectives for the Special Conservation Interest (SCI) species.

For the Middle Shannon Callows SPA, site integrity depends on the maintenance of:

- **the seasonal flood regime sustaining soft, waterlogged callow grasslands;**
- **appropriate timing and duration of flood recession;**
- **soil moisture conditions supporting breeding waders;**
- **sufficient wet grassland extent to sustain internationally and nationally important wintering waterbird populations.**

The NIS concludes that no adverse effect will arise. However, it does not demonstrate that abstraction would not:

- **alter flood duration or extent during low-flow or drought conditions;**
- **modify groundwater-supported soil moisture regimes;**
- **advance or truncate seasonal flood recession;**
- **reduce the functional extent or carrying capacity of wet grassland habitat for SCI species.**

No site-specific modelling or sensitivity analysis is presented to quantify potential changes in inundation patterns, soil saturation, or habitat availability under combined abstraction and drought scenarios.

In the absence of such analysis, it has not been demonstrated beyond reasonable scientific doubt that the conservation objectives for Whooper Swan, Wigeon, Golden Plover, Lapwing, Black-tailed Godwit, Corncrake, Black-headed Gull, or the qualifying wetland and waterbird assemblage would be maintained under all reasonably foreseeable operating conditions.

Where reasonable scientific doubt remains, the precautionary principle applies. The conclusion of no adverse effect on site integrity is therefore not supported.

4.6.5 Interaction with Article 4 of the Water Framework Directive
The Middle Shannon Callows SPA constitutes a Protected Area under the Water Framework Directive.

Article 4 requires:

- **Prevention of deterioration;**
- **Protection of water-dependent habitats and species;**
- **Maintenance of ecological status consistent with Protected Area objectives.**

The NIS does not demonstrate that abstraction during low-flow or drought conditions would not contribute to deterioration of hydromorphological conditions underpinning floodplain wetlands.

Unresolved uncertainty under Article 4 WFD directly undermines confidence in compliance with Article 6(3) of the Habitats Directive.

Table 4.6 Key Failures – Middle Shannon Callows SPA [004096]

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test (Article 6(3))
Hydrological pathway	SPA considered beyond hydrological ZoI; upstream limit assumed at Meelick Weir	SPA extends both upstream and downstream of Meelick Weir; no modelling provided to demonstrate hydrological independence under abstraction and drought scenarios	Absence of quantified assessment of pathway leaves reasonable scientific doubt
Reliance on distance-based screening	SPA 18 km from project footprint; no direct overlap	Distance screening applied to disturbance pathways only; hydrological connectivity not resolved	Article 6(3) requires assessment of functional ecological linkages, not proximity
Flood regime dependency	No significant hydrological effects predicted	No site-specific analysis of flood duration, extent, or recession timing under abstraction + low-flow conditions	SCI species depend directly on seasonal inundation patterns; failure to assess flood regime undermines integrity test
Groundwater–soil moisture	Not assessed in detail	No evaluation of abstraction effects on shallow groundwater levels sustaining callow	Soil moisture conditions underpin habitat quality

Assessment Element	NIS Position	Identified Deficiency	Relevance to Legal Test (Article 6(3))
interaction		grasslands and alkaline fen	
SCI habitat functionality	No habitat loss predicted	No assessment of potential habitat compression, drying, or reduction in carrying capacity for SCI species	SPA integrity depends on habitat availability sufficient to sustain internationally important populations
Breeding waders	No impact predicted	No evaluation of how altered flood recession timing or soil moisture could affect breeding habitat suitability	Article 6(3) requires certainty for both breeding and wintering SCI species
Wintering assemblage (>20,000 birds)	No hydrological effects anticipated	No modelling of how low-water scenarios may alter grazing sward condition or feeding suitability	International importance requires precautionary certainty
In-combination effects	Assessed at high level	No quantitative testing of abstraction in combination with regulation, climate variability, and drought	Cumulative effects must be assessed under Article 6(3)
Precautionary principle	"No potential for effects" concluded	Conclusion reached despite absence of drought-period and floodplain sensitivity modelling	Consent cannot be granted where reasonable scientific doubt remains

4.6.6 Conclusion for Middle Shannon Callows SPA

The Middle Shannon Callows SPA is an internationally important floodplain wetland system whose Special Conservation Interest species are fundamentally dependent on the timing, duration and spatial extent of seasonal inundation and subsequent drawdown. The ecological integrity of the site is inseparable from the hydrological regime of the River Shannon, including river stage behaviour, groundwater–surface water interaction and floodplain soil moisture dynamics.

The NIS concludes that the SPA lies beyond the hydrological Zone of Influence of the Proposed Project on the basis of distance and an asserted upstream hydraulic boundary at Meelick Weir. However, no quantitative hydraulic modelling or sensitivity analysis is presented to demonstrate that abstraction at Parteen Basin, in combination with existing regulation and drought conditions, could not influence river stage, floodplain inundation patterns or shallow groundwater gradients within the SPA.

The assessment relies primarily on long-term average conditions and does not evaluate abstraction effects during ecologically critical low-flow or drought scenarios, when floodplain habitats and the bird populations they support are most vulnerable to hydrological change. In low-gradient floodplain systems such as the Callows, even modest changes in river stage or groundwater head can produce disproportionate changes in lateral inundation extent, soil moisture conditions and habitat suitability.

Furthermore, the SPA extends south of Meelick Weir towards Portumna, reinforcing that hydrological connectivity within the regulated Shannon system cannot be dismissed solely on the basis of structural control points. The functional integrity of the SPA depends not merely on the presence of wet grassland habitat, but on the maintenance of the hydrological processes that sustain its carrying capacity for internationally important populations of birds and the wintering waterbird assemblage exceeding 20,000 individuals.

In the absence of quantitative evidence demonstrating that abstraction would not alter these hydrological processes under reasonably foreseeable operating conditions, including prolonged low-flow and drought periods, it cannot be concluded beyond reasonable scientific doubt that the Proposed Project would not adversely affect the integrity of the Middle Shannon Callows SPA.

Accordingly, the requirements of Article 6(3) of the Habitats Directive have not been demonstrably satisfied in respect of this site.

5. Discussion

This review has examined whether the Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR) for the Proposed Project demonstrate compliance with Article 6(3) of the Habitats Directive and Article 4 of the Water Framework Directive (WFD), having regard to the hydrological complexity and regulatory context of the Shannon International River Basin District.

The Proposed Project involves large-scale abstraction from Parteen Basin within a highly regulated and hydraulically continuous river–lake–floodplain–estuarine system. The NIS acknowledges hydrological pathways for effect to multiple Natura 2000 sites, including sites directly overlapping the abstraction footprint and others connected via surface water, groundwater interaction and regulated lake-level dynamics.

Across the sites examined, three recurring issues arise:

First, while hydrological pathways are acknowledged, the ecological consequences of abstraction under critical conditions, including prolonged low-flow and hydrological drought, are not consistently translated from model outputs into site-specific habitat response assessment.

Second, reliance on operational management parameters (such as the Normal Operating Band) and long-term average flow statistics is used as a proxy for ecological neutrality. However, operational thresholds and statistical averages are not equivalent to conservation thresholds. The conservation objectives of the relevant sites relate to habitat extent, structure, function and supporting hydrological processes, particularly during periods of ecological stress.

Third, the interaction between abstraction, lake regulation, groundwater gradients and downstream discharge is not comprehensively evaluated under combined or cumulative scenarios. In several instances, modelling assumptions (including initial storage conditions and operational routines) favour upper-band starting positions without sensitivity testing across the full operational range.

In low-gradient floodplain and shallow lake systems such as the Shannon, relatively small vertical changes in stage may produce disproportionate lateral habitat effects, alter hydroperiod dynamics, or modify groundwater–surface water interaction. The assessment does not consistently quantify these relationships in ecological terms.

For Special Protection Areas, the documentation does not demonstrate that abstraction-related changes in water level dynamics would not affect the extent, distribution or seasonal reliability of habitat supporting Special Conservation Interest species during sensitive periods.

In respect of the Water Framework Directive, the material reviewed does not fully demonstrate that abstraction under low-flow or drought conditions would not contribute to deterioration in hydromorphological conditions or undermine Protected Area objectives within the hydraulically connected system.

Article 6(3) requires the competent authority to be satisfied, on the basis of complete, precise and definitive findings, that the Proposed Project will not adversely affect the integrity of any European site. That test must be met under all reasonably foreseeable operating conditions, including periods when ecological sensitivity is greatest.

On the basis of the information presented in the NIS and EIAR, and having regard to the hydrological characteristics of the Shannon system and the conservation objectives of the sites examined, residual scientific uncertainty remains in respect of hydrological regime, groundwater interaction and habitat response during low-flow and drought scenarios.

Accordingly, it has not been demonstrated, beyond reasonable scientific doubt, that the Proposed Project would not adversely affect the integrity of the relevant Natura 2000 sites. Nor has compliance with Article 4 of the Water Framework Directive been conclusively established in respect of Protected Area objectives.

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Appendix E ESB Flow Data from EPA

EPA Data from ESB Flows Table 1

Date	Parteen Discharge into old channel (m^3/s)	Parteen Discharge into headrace canal(m^3/s)	Total Discharge at Parteen Weir(m^3/s)	**pipeline abstraction (3.4m3/s) as % of Total Discharge**	
5/20/2018 9:00	10.5	0	10.5	32.38%	
6/2/2018 9:00	10.5	0	10.5	32.38%	
6/3/2018 9:00	10.5	0	10.5	32.38%	
6/15/2018 9:00	10.5	0	10.5	32.38%	
6/16/2018 9:00	10.5	0	10.5	32.38%	
6/17/2018 9:00	10.5	0	10.5	32.38%	
6/18/2018 9:00	10.5	0	10.5	32.38%	
6/19/2018 9:00	10.5	0	10.5	32.38%	
6/20/2018 9:00	10.5	0	10.5	32.38%	
6/21/2018 9:00	10.5	0	10.5	32.38%	
6/22/2018 9:00	10.5	0	10.5	32.38%	
6/23/2018 9:00	10.5	0	10.5	32.38%	

6/24/2018 9:00	10.5	0	10.5	32.38%	
6/25/2018 9:00	10.5	0	10.5	32.38%	
6/26/2018 9:00	10.5	0	10.5	32.38%	
6/27/2018 9:00	10.5	0	10.5	32.38%	
6/28/2018 9:00	10.5	0	10.5	32.38%	
6/30/2018 9:00	10.5	0	10.5	32.38%	
7/1/2018 9:00	10.5	0	10.5	32.38%	
7/3/2018 9:00	10.5	0	10.5	32.38%	
7/4/2018 9:00	10.5	0	10.5	32.38%	
7/5/2018 9:00	10.5	0	10.5	32.38%	
7/6/2018 9:00	10.5	0	10.5	32.38%	
7/7/2018 9:00	10.5	0	10.5	32.38%	
7/8/2018 9:00	10.5	0	10.5	32.38%	
7/9/2018 9:00	10.5	0	10.5	32.38%	
7/10/2018 9:00	10.5	0	10.5	32.38%	
7/11/2018 9:00	10.5	0	10.5	32.38%	
7/12/2018 9:00	10.5	0	10.5	32.38%	

7/13/2018 9:00	10.5	0	10.5	32.38%		
7/14/2018 9:00	10.5	0	10.5	32.38%		
7/15/2018 9:00	10.5	0	10.5	32.38%		
7/16/2018 9:00	10.5	0	10.5	32.38%		
7/17/2018 9:00	10.5	0	10.5	32.38%		
7/18/2018 9:00	10.5	0	10.5	32.38%		
7/19/2018 9:00	10.5	0	10.5	32.38%		
7/20/2018 9:00	10.5	0	10.5	32.38%		
7/21/2018 9:00	10.5	0	10.5	32.38%		
7/22/2018 9:00	10.5	0	10.5	32.38%		
7/23/2018 9:00	10.5	0	10.5	32.38%		
7/24/2018 9:00	10.5	0	10.5	32.38%		
7/25/2018 9:00	10.5	0	10.5	32.38%		
7/26/2018 9:00	10.5	0	10.5	32.38%		
7/27/2018 9:00	10.5	0	10.5	32.38%		
7/28/2018 9:00	10.5	0	10.5	32.38%		
7/29/2018 9:00	10.5	0	10.5	32.38%		

7/30/2018 9:00	10.5	0	10.5	32.38%	
7/31/2018 9:00	10.5	0	10.5	32.38%	
8/1/2018 9:00	10.5	0	10.5	32.38%	
8/2/2018 9:00	10.5	0	10.5	32.38%	
8/3/2018 9:00	10.5	0	10.5	32.38%	
8/4/2018 9:00	10.5	0	10.5	32.38%	
8/5/2018 9:00	10.5	0	10.5	32.38%	
8/6/2018 9:00	10.5	0	10.5	32.38%	
8/7/2018 9:00	10.5	0	10.5	32.38%	
8/8/2018 9:00	10.5	0	10.5	32.38%	
8/9/2018 9:00	10.5	0	10.5	32.38%	
8/10/2018 9:00	10.5	0	10.5	32.38%	
8/11/2018 9:00	10.5	0	10.5	32.38%	
8/12/2018 9:00	10.5	0	10.5	32.38%	
8/13/2018 9:00	10.5	0	10.5	32.38%	
8/14/2018 9:00	10.5	0	10.5	32.38%	
8/15/2018 9:00	10.5	0	10.5	32.38%	

8/16/2018 9:00	10.5	0	10.5	32.38%		
8/17/2018 9:00	10.5	0	10.5	32.38%		
8/18/2018 9:00	10.5	0	10.5	32.38%		
8/19/2018 9:00	10.5	0	10.5	32.38%		
8/20/2018 9:00	10.5	0	10.5	32.38%		
8/21/2018 9:00	10.5	0	10.5	32.38%		
8/22/2018 9:00	10.5	0	10.5	32.38%		
8/24/2018 9:00	10.5	0	10.5	32.38%		
8/25/2018 9:00	10.5	0	10.5	32.38%		
8/26/2018 9:00	10.5	0	10.5	32.38%		
9/29/2018 9:00	10.5	0	10.5	32.38%		
9/30/2018 9:00	10.5	0	10.5	32.38%		
6/29/2018 9:00	10.5	1.7	12.2	27.87%		
8/23/2018 9:00	10.5	5.3	15.8	21.52%		
10/27/2018 9:00	10.5	15.8	26.3	12.93%		
6/14/2018 9:00	10.5	18.8	29.3	11.60%		
7/2/2018 9:00	10.5	20.4	30.9	11.00%		

6/11/2018 9:00	10.5	28.7	39.2	8.67%	
10/28/2018 9:00	10.5	29.1	39.6	8.59%	
10/31/2018 9:00	10.5	29.4	39.9	8.52%	
10/11/2018 9:00	10.5	30.4	40.9	8.31%	
10/12/2018 9:00	10.5	30.6	41.1	8.27%	
6/4/2018 9:00	10.5	31.1	41.6	8.17%	
10/10/2018 9:00	10.5	31.9	42.4	8.02%	
6/5/2018 9:00	10.5	32.8	43.3	7.85%	
11/3/2018 9:00	10.5	33	43.5	7.82%	
10/29/2018 9:00	10.5	33.9	44.4	7.66%	
11/4/2018 9:00	10.5	34.1	44.6	7.62%	
11/2/2018 9:00	10.5	34.5	45	7.56%	
10/30/2018 9:00	10.5	36.6	47.1	7.22%	
5/19/2018 9:00	10.5	38.4	48.9	6.95%	
10/7/2018 9:00	10.5	38.8	49.3	6.90%	
9/4/2018 9:00	10.5	39.4	49.9	6.81%	
9/20/2018 9:00	10.5	39.6	50.1	6.79%	

6/12/2018 9:00	10.5	40.3	50.8	6.69%		
9/21/2018 9:00	10.5	40.9	51.4	6.61%		
9/7/2018 9:00	10.5	41.1	51.6	6.59%		
11/1/2018 9:00	10.5	41.3	51.8	6.56%		
9/22/2018 9:00	10.5	42.2	52.7	6.45%		
6/9/2018 9:00	10.5	42.6	53.1	6.40%		
10/22/2018 9:00	10.5	43.1	53.6	6.34%		
6/13/2018 9:00	10.5	43.9	54.4	6.25%		
8/27/2018 9:00	10.5	44.1	54.6	6.23%		
10/23/2018 9:00	10.5	44.1	54.6	6.23%		
10/25/2018 9:00	10.5	44.8	55.3	6.15%		
10/26/2018 9:00	10.5	44.8	55.3	6.15%		
10/24/2018 9:00	10.5	45.2	55.7	6.10%		
11/5/2018 9:00	10.5	45.2	55.7	6.10%		
9/1/2018 9:00	10.5	45.4	55.9	6.08%		
9/19/2018 9:00	10.5	45.9	56.4	6.03%		
10/17/2018 9:00	10.5	46.1	56.6	6.01%		

10/8/2018 9:00	10.5	47.1	57.6	5.90%	
10/14/2018 9:00	10.5	47.4	57.9	5.87%	
6/6/2018 9:00	10.5	47.6	58.1	5.85%	
10/15/2018 9:00	10.5	47.6	58.1	5.85%	
6/1/2018 9:00	10.5	49.5	60	5.67%	
10/18/2018 9:00	10.5	49.5	60	5.67%	
10/20/2018 9:00	10.5	49.7	60.2	5.65%	
10/13/2018 9:00	10.5	50.4	60.9	5.58%	
9/11/2018 9:00	10.5	50.6	61.1	5.56%	
10/6/2018 9:00	10.5	50.6	61.1	5.56%	
10/9/2018 9:00	10.5	51.4	61.9	5.49%	
10/19/2018 9:00	10.5	52.3	62.8	5.41%	
9/8/2018 9:00	10.5	53.3	63.8	5.33%	
5/31/2018 9:00	10.5	53.6	64.1	5.30%	
8/29/2018 9:00	10.5	53.6	64.1	5.30%	
9/5/2018 9:00	10.5	53.6	64.1	5.30%	
5/30/2018 9:00	10.5	53.8	64.3	5.29%	

5/18/2018 9:00	10.5	54	64.5	5.27%	
9/10/2018 9:00	10.5	54.4	64.9	5.24%	
5/17/2018 9:00	10.5	54.8	65.3	5.21%	
9/6/2018 9:00	10.5	54.9	65.4	5.20%	
9/3/2018 9:00	10.5	55.3	65.8	5.17%	
9/9/2018 9:00	10.5	55.7	66.2	5.14%	
8/31/2018 9:00	10.5	56.3	66.8	5.09%	
5/21/2018 9:00	10.5	56.6	67.1	5.07%	
9/15/2018 9:00	10.5	58.5	69	4.93%	
11/7/2018 9:00	10.5	58.5	69	4.93%	
9/2/2018 9:00	10.5	58.7	69.2	4.91%	
11/6/2018 9:00	10.5	58.7	69.2	4.91%	
5/16/2018 9:00	10.5	59.1	69.6	4.89%	
8/30/2018 9:00	10.5	59.1	69.6	4.89%	
9/28/2018 9:00	10.5	59.4	69.9	4.86%	
10/16/2018 9:00	10.5	59.4	69.9	4.86%	
9/27/2018 9:00	10.5	59.6	70.1	4.85%	

10/5/2018 9:00	10.5	61.9	72.4	4.70%	
10/2/2018 9:00	10.5	62.1	72.6	4.68%	
9/12/2018 9:00	10.5	62.3	72.8	4.67%	
9/25/2018 9:00	10.5	62.4	72.9	4.66%	
9/26/2018 9:00	10.5	62.4	72.9	4.66%	
10/4/2018 9:00	10.5	62.4	72.9	4.66%	
8/28/2018 9:00	10.5	62.6	73.1	4.65%	
10/3/2018 9:00	10.5	65.3	75.8	4.49%	
9/13/2018 9:00	10.5	66.2	76.7	4.43%	
9/14/2018 9:00	10.5	66.4	76.9	4.42%	
9/16/2018 9:00	10.5	66.4	76.9	4.42%	
9/18/2018 9:00	10.5	67.3	77.8	4.37%	
10/21/2018 9:00	10.5	69	79.5	4.28%	
6/7/2018 9:00	10.5	69.6	80.1	4.24%	
9/17/2018 9:00	10.5	72	82.5	4.12%	
9/24/2018 9:00	10.5	72.8	83.3	4.08%	
6/8/2018 9:00	10.5	74.3	84.8	4.01%	

5/15/2018 9:00	10.5	74.6	85.1	4.00%	
11/8/2018 9:00	10.5	78	88.5	3.84%	
5/5/2018 9:00	10.5	78.4	88.9	3.82%	
5/6/2018 9:00	10.5	78.8	89.3	3.81%	
5/29/2018 9:00	10.5	79.9	90.4	3.76%	
5/28/2018 9:00	10.5	80.1	90.6	3.75%	
6/10/2018 9:00	10.5	80.8	91.3	3.72%	
5/14/2018 9:00	10.5	81	91.5	3.72%	
10/1/2018 9:00	10.5	85.3	95.8	3.55%	
5/7/2018 9:00	10.5	85.7	96.2	3.53%	
5/4/2018 9:00	10.5	87.6	98.1	3.47%	
5/26/2018 9:00	10.5	90.8	101.3	3.36%	
5/13/2018 9:00	10.5	91.7	102.2	3.33%	
5/22/2018 9:00	10.5	93.6	104.1	3.27%	
5/23/2018 9:00	10.5	94.7	105.2	3.23%	
5/27/2018 9:00	10.5	95.6	106.1	3.20%	
9/23/2018 9:00	10.5	95.8	106.3	3.20%	

11/10/2018 9:00	10.5	98.8	109.3	3.11%	
11/9/2018 9:00	10.5	102.2	112.7	3.02%	
4/22/2018 9:00	10.5	104.5	115	2.96%	
5/24/2018 9:00	10.5	105.6	116.1	2.93%	
3/30/2018 9:00	10.5	108.6	119.1	2.85%	
5/8/2018 9:00	10.5	108.8	119.3	2.85%	
5/25/2018 9:00	10.5	111	121.5	2.80%	
11/20/2018 9:00	10.5	112.3	122.8	2.77%	
11/29/2018 9:00	10.5	114	124.5	2.73%	
11/28/2018 9:00	10.5	115.1	125.6	2.71%	
5/3/2018 9:00	10.5	115.3	125.8	2.70%	
11/21/2018 9:00	10.5	122.6	133.1	2.55%	
5/12/2018 9:00	10.5	124.1	134.6	2.53%	
4/29/2018 9:00	10.5	125.4	135.9	2.50%	
5/11/2018 9:00	10.5	125.6	136.1	2.50%	
5/2/2018 9:00	10.5	125.8	136.3	2.49%	
5/9/2018 9:00	10.5	128.8	139.3	2.44%	

11/22/2018 9:00	10.5	128.8	139.3	2.44%	
4/19/2018 9:00	10.5	128.9	139.4	2.44%	
5/10/2018 9:00	10.5	130.3	140.8	2.41%	
11/19/2018 9:00	10.5	132.8	143.3	2.37%	
4/30/2018 9:00	10.5	134.3	144.8	2.35%	
11/27/2018 9:00	10.5	138.2	148.7	2.29%	
11/26/2018 9:00	10.5	139.1	149.6	2.27%	
11/25/2018 9:00	10.5	144.2	154.7	2.20%	
11/18/2018 9:00	10.5	145.1	155.6	2.19%	
4/24/2018 9:00	10.5	145.3	155.8	2.18%	
4/16/2018 9:00	10.5	145.5	156	2.18%	
11/24/2018 9:00	10.5	146.1	156.6	2.17%	
11/17/2018 9:00	10.5	149.6	160.1	2.12%	
4/25/2018 9:00	10.5	152.6	163.1	2.08%	
4/15/2018 9:00	10.5	152.8	163.3	2.08%	
11/23/2018 9:00	10.5	153.8	164.3	2.07%	
11/14/2018 9:00	10.5	155.4	165.9	2.05%	

4/2/2018 9:00	10.5	156	166.5	2.04%	
11/15/2018 9:00	10.5	156.4	166.9	2.04%	
3/26/2018 9:00	10.5	156.6	167.1	2.03%	
11/13/2018 9:00	10.5	157.1	167.6	2.03%	
11/16/2018 9:00	10.5	157.5	168	2.02%	
4/23/2018 9:00	10.5	157.7	168.2	2.02%	
11/11/2018 9:00	10.5	158.6	169.1	2.01%	
11/12/2018 9:00	10.5	160.9	171.4	1.98%	
3/31/2018 9:00	10.5	168	178.5	1.90%	
3/24/2018 9:00	10.5	168.2	178.7	1.90%	
3/21/2018 9:00	10.5	171.2	181.7	1.87%	
5/1/2018 9:00	10.5	173.1	183.6	1.85%	
11/30/2018 9:00	10.5	175.5	186	1.83%	
3/23/2018 9:00	10.5	175.9	186.4	1.82%	
3/28/2018 9:00	10.5	175.9	186.4	1.82%	
3/27/2018 9:00	10.5	176.8	187.3	1.82%	
4/18/2018 9:00	10.5	177.3	187.8	1.81%	

4/20/2018 9:00	10.5	177.5	188	1.81%		
4/3/2018 9:00	10.5	177.6	188.1	1.81%		
3/25/2018 9:00	10.5	179.4	189.9	1.79%		
3/22/2018 9:00	10.5	180.9	191.4	1.78%		
4/14/2018 9:00	10.5	185.1	195.6	1.74%		
12/1/2018 9:00	10.5	186.2	196.7	1.73%		
4/1/2018 9:00	10.5	189.9	200.4	1.70%		
4/6/2018 9:00	10.5	190.7	201.2	1.69%		
12/3/2018 9:00	10.5	191.6	202.1	1.68%		
4/17/2018 9:00	10.5	192.9	203.4	1.67%		
3/29/2018 9:00	10.5	193.9	204.4	1.66%		
4/7/2018 9:00	10.5	194.1	204.6	1.66%		
4/5/2018 9:00	10.5	195.2	205.7	1.65%		
4/21/2018 9:00	10.5	197.9	208.4	1.63%		
12/4/2018 9:00	10.5	198.4	208.9	1.63%		
4/4/2018 9:00	10.5	200.3	210.8	1.61%		
4/28/2018 9:00	10.5	206.4	216.9	1.57%		

4/27/2018 9:00	10.5	206.6	217.1	1.57%	
4/26/2018 9:00	10.5	208.3	218.8	1.55%	
3/14/2018 9:00	10.5	210	220.5	1.54%	
3/12/2018 9:00	10.5	211.1	221.6	1.53%	
3/19/2018 9:00	10.5	213.4	223.9	1.52%	
3/20/2018 9:00	10.5	213.6	224.1	1.52%	
3/18/2018 9:00	10.5	213.9	224.4	1.52%	
3/6/2018 9:00	10.5	218.6	229.1	1.48%	
12/2/2018 9:00	10.5	219.9	230.4	1.48%	
3/11/2018 9:00	10.5	230.8	241.3	1.41%	
3/13/2018 9:00	10.5	232.9	243.4	1.40%	
3/17/2018 9:00	10.5	248.3	258.8	1.31%	
12/5/2018 9:00	10.5	256.3	266.8	1.27%	
4/9/2018 9:00	10.5	260.8	271.3	1.25%	
4/8/2018 9:00	10.5	264.9	275.4	1.23%	
3/15/2018 9:00	10.5	274.5	285	1.19%	
2/27/2018 9:00	55.9	278.4	334.3	1.02%	

12/18/2018 9:00	10.5	278.6	289.1	1.18%		
3/7/2018 9:00	10.5	279.6	290.1	1.17%		
12/13/2018 9:00	10.5	280.3	290.8	1.17%		
4/11/2018 9:00	10.5	281.3	291.8	1.17%		
2/26/2018 9:00	55.8	282	337.8	1.01%		
12/16/2018 9:00	10.5	285.6	296.1	1.15%		
3/1/2018 9:00	55.7	288.4	344.1	0.99%		
4/13/2018 9:00	10.5	289.5	300	1.13%		
2/28/2018 9:00	55.8	289.9	345.6	0.98%		
12/8/2018 9:00	10.5	291	301.5	1.13%		
4/12/2018 9:00	10.5	291.9	302.4	1.12%		
4/10/2018 9:00	10.5	292.1	302.6	1.12%		
12/9/2018 9:00	10.5	294	304.5	1.12%		
12/14/2018 9:00	10.5	295.5	306	1.11%		
12/10/2018 9:00	10.5	299.4	309.9	1.10%		
3/2/2018 9:00	55.6	305.1	360.7	0.94%		
3/5/2018 9:00	10.5	305.4	315.9	1.08%		

12/15/2018 9:00	10.5	305.8	316.3	1.07%	
3/4/2018 9:00	54.9	306	360.9	0.94%	
3/3/2018 9:00	55.2	307.9	363	0.94%	
3/10/2018 9:00	10.5	307.9	318.4	1.07%	
12/7/2018 9:00	10.5	310.5	321	1.06%	
12/30/2018 9:00	10.5	317.3	327.8	1.04%	
2/20/2018 9:00	55	318.8	373.8	0.91%	
3/16/2018 9:00	10.5	318.8	329.3	1.03%	
12/11/2018 9:00	10.5	320.6	331.1	1.03%	
3/8/2018 9:00	10.5	325.7	336.2	1.01%	
12/12/2018 9:00	10.5	326.1	336.6	1.01%	
3/9/2018 9:00	10.5	329.8	340.3	1.00%	
12/17/2018 9:00	10.5	330.6	341.1	1.00%	
2/24/2018 9:00	55.5	333.6	389	0.87%	
12/6/2018 9:00	10.5	333.6	344.1	0.99%	
12/19/2018 9:00	10.5	336.6	347.1	0.98%	
12/31/2018 9:00	10.5	336.6	347.1	0.98%	

2/23/2018 9:00	55.5	338.3	393.7	0.86%		
2/25/2018 9:00	55.4	339.6	394.9	0.86%		
1/13/2018 9:00	96.6	356.6	453.2	0.75%		
1/12/2018 9:00	96.5	363.8	460.3	0.74%		
1/16/2018 9:00	95.4	363.9	459.3	0.74%		
1/14/2018 9:00	95.4	365.8	461.2	0.74%		
1/17/2018 9:00	96.2	366.9	463.1	0.73%		
1/15/2018 9:00	95.6	367.5	463.1	0.73%		
12/23/2018 9:00	10.5	369.2	379.7	0.90%		
2/8/2018 9:00	136.9	369.8	506.7	0.67%		
12/21/2018 9:00	10.5	371.6	382.1	0.89%		
12/22/2018 9:00	10.5	372.4	382.9	0.89%		
2/11/2018 9:00	136.4	374.1	510.5	0.67%		
1/18/2018 9:00	95.8	376.1	471.9	0.72%		
2/5/2018 9:00	176.3	376.9	553.3	0.61%		
12/28/2018 9:00	10.5	376.9	387.4	0.88%		
2/7/2018 9:00	137.9	377.7	515.6	0.66%		

12/26/2018 9:00	10.5	377.8	388.3	0.88%	
1/19/2018 9:00	95.8	378.9	474.8	0.72%	
2/10/2018 9:00	136	378.9	515	0.66%	
12/27/2018 9:00	10.5	379.5	390	0.87%	
12/29/2018 9:00	10.5	379.7	390.2	0.87%	
2/12/2018 9:00	104.1	379.9	483.9	0.70%	
12/24/2018 9:00	10.5	379.9	390.4	0.87%	
1/31/2018 9:00	248.1	380.1	628.1	0.54%	
1/20/2018 9:00	95.9	380.3	476.2	0.71%	
2/9/2018 9:00	136.4	380.8	517.2	0.66%	
2/1/2018 9:00	247.8	381.2	629	0.54%	
2/4/2018 9:00	179.9	381.4	561.3	0.61%	
12/25/2018 9:00	10.5	381.9	392.4	0.87%	
2/2/2018 9:00	223.7	382.7	606.4	0.56%	
12/20/2018 9:00	10.5	383.8	394.3	0.86%	
2/19/2018 9:00	55	385.5	440.5	0.77%	
2/3/2018 9:00	211.7	385.9	597.6	0.57%	

1/1/2018 9:00	53.9	386.1	440	0.77%		
1/2/2018 9:00	54.2	386.1	440.3	0.77%		
1/30/2018 9:00	243	386.8	629.8	0.54%		
2/22/2018 9:00	55	389.1	444	0.77%		
1/5/2018 9:00	97.1	389.8	486.9	0.70%		
2/18/2018 9:00	97.2	390.4	487.6	0.70%		
2/17/2018 9:00	97.3	390.8	488.1	0.70%		
2/16/2018 9:00	97.5	390.9	488.4	0.70%		
2/6/2018 9:00	146.3	391.6	538	0.63%		
2/15/2018 9:00	97.4	391.7	489.1	0.70%		
2/21/2018 9:00	55	391.8	446.9	0.76%		
2/13/2018 9:00	97.1	391.9	489	0.70%		
2/14/2018 9:00	97.1	392.1	489.1	0.70%		
1/11/2018 9:00	95.8	393.4	489.1	0.70%		
1/4/2018 9:00	92.9	393.6	486.4	0.70%		
1/3/2018 9:00	54.3	394.9	449.2	0.76%		
1/28/2018 9:00	213	395.1	608.1	0.56%		

1/23/2018 9:00	171.5	395.3	566.7	0.60%	
1/25/2018 9:00	213.2	395.3	608.4	0.56%	
1/24/2018 9:00	207.3	395.4	602.7	0.56%	
1/8/2018 9:00	96.6	395.6	492.2	0.69%	
1/21/2018 9:00	96.9	396.6	493.4	0.69%	
1/10/2018 9:00	96.3	397.5	493.8	0.69%	
1/9/2018 9:00	96.6	397.9	494.5	0.69%	
1/26/2018 9:00	213	397.9	610.9	0.56%	
1/27/2018 9:00	212.3	398.1	610.3	0.56%	
1/7/2018 9:00	96.9	399.8	496.6	0.68%	
1/22/2018 9:00	134.1	400.7	534.8	0.64%	
1/29/2018 9:00	213.5	401.6	615.2	0.55%	
1/6/2018 9:00	96.9	402	498.9	0.68%	