Our Case Number: ACP-323980-25

An Coimisiún Pleanála

River Shannon Environmental Protection Alliance Cc
c/o Elaine Doyle
3 Newtown Park
Castletroy
Co. Limerick
V94 HTD1

Date: 04 August 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 submission in relation to the above-mentioned proposed development and will take it into consideration in its determination of the matter.

The Commission will revert to you in due course in respect of this matter.

Please be advised that a copy of all submissions/observations received in relation to the application will be made available for inspection on the Commission's website at the following link: https://www.pleanala.ie/en-ie/case/323980.

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,

pp CÓR

Eimear Reilly
Executive Officer
Direct Line: 01-8737184

PA09

Eimear Reilly

From:	Lauren Griffin
Sent:	Friday 24 July 2026 12:47
To:	Eimear Reilly
Subject:	FW: ACP Case Number-323980-25- Eastern and Midland Pipeline Project.

From: LAPS
Sent: Monday 20 July 2026 10:36
To: 'elaine doyle' <doyle_elaine@hotmail.com>
Cc: 'rivershannonprotectionalliance@gmail.com' <rivershannonprotectionalliance@gmail.com>
Subject: RE: ACP Case Number-323980-25- Eastern and Midland Pipeline Project.

Dear Ms. Doyle,

The Commission acknowledges receipt of your email; official correspondence will issue in due course.

Kind regards,
Lauren

From: elaine doyle <doyle_elaine@hotmail.com>
Sent: Friday 17 July 2026 14:44
To: LAPS <laps@pleanala.ie>
Cc: River Shannon Protection Alliance <rivershannonprotectionalliance@gmail.com>; elaine doyle <doyle_elaine@hotmail.com>
Subject: ACP Case Number-323980-25- Eastern and Midland Pipeline Project.

Dear Sir/Madam.
Please find attached the River Shannon Environmental Protection Alliance submission document in response to Water Supply Project Eastern and Midlands Region Response to Submissions Report ('RtS Report') dated May 2026, (585 pages, 28 chapters, 114 submissions addressed).
Pls also see inclusion of report from Sabrina Joyce Kemper who is an adviser to RSEPA and we are adopting the issues and findings in nher report into our own submission.

Pls confirm receipt and let me know asap if all is in order and if this should be uploaded onto the portal or payment or additional steps need to be taken.

Kind regards,

Elaine Doyle,
Director and Secretary of The River Shannon Environmental Protection Alliance Address:
3 Newtown Park, Castletroy,
Limerick,

V94 HTD1
Doyle_elaine@hotmail.com
Mobile 087 9083727
ACP Case Number-323980-25

Our Case Number: ACP-323980-25

An Coimisiún Pleanála

River Shannon Environmental Protection Alliance Company Ltd
c/o Elaine Doyle
3 Newtown Park
Castletroy
Co. Limerick
V94 HTD1

Date: 20 July 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.
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 inspection on the Commission's website at the following link:
https://www.pleanala.ie/en-ie/case/323980

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,

pp Lauren

Eimear Reilly
Executive Officer
Direct Line: 01-8737184

PA04

An Coimisiún Pleanála

SID Online Observation

Online Reference
SID-OBS-005770

Online Observation Details

Contact Name
Elaine Doyle

Lodgement Date
17/07/2026 17:08:13

Case Number / Description
323980

Payment Details

Payment Method
Online Payment

Cardholder Name
Elaine Doyle

Payment Amount
€50.00

Fee Refund Requisition

Please Arrange a Refund of Fee of
€ 50

Lodgement No
LDG— 089295 - 26

Reason for Refund
No Fee for further information submission

Documents Returned to Observer
☐ Yes ☑ No

Request Emailed to Senior Executive Officer for Approval
☑ Yes ☐ No

Signed
Lauren Coff
EO

Date
20/7/26

Finance Section

Payment Reference
ch_3TuEJ7B1CW0EN5FC12dor0wh

Checked Against Fee Income Online

EO/AA (Accounts Section)

Amount
€

Refund Date

Authorised By (1)

SEO (Finance)

Authorised By (2)

Chief Officer/Director of Corporate Affairs/SAO/Board Member

Date

Date

AN COIMISIÚN PLEANÁLA

STRATEGIC INFRASTRUCTURE DEVELOPMENT

Case Reference: ACP-323980-25

FORMAL SUBMISSION

IN OBJECTION TO THE PROPOSED WATER SUPPLY PROJECT Response to the Submission Report prepared by the WSP on behalf of Uisce Eireann.

Eastern and Midlands Region

Counties Clare, Limerick, Tipperary, Offaly, Kildare and Dublin

Submitted by	Elaine Doyle, Director and Secretary of The River Shannon Environmental Protection Alliance Address: 3 Newtown Park, Castletroy, Limerick, V94 HTD1 doyle_elaine@hotmail.com Mobile 087 9083727 ACP Case Number-323980-25
Applicant	Uisce Éireann
Document in response to	Water Supply Project Eastern and Midlands Region Response to Submissions Report ('RtS Report'), May 2026, (585 pages, 28 chapters, 114 submissions addressed)
Submission deadline	21 July 2026 (per ACP letter of 26 June 2026, correcting clerical error in letter of 24 June 2026)
Date	Friday 17th July 2026
Status	Formal submission not privileged; may be published on the ACP public file

I. Table of Contents

Executive Summary and Core Propositions

Every independent legal, technical, and scientific review of this application has reached the same conclusion: the proposed Water Supply Project, as assessed and presented, does not demonstrate compliance with binding EU environmental law, and planning consent cannot lawfully be granted on the information currently before the Commission.

The five foundational propositions of this submission are:

Proposition 1 Leakage before abstraction

Nationally 43% of already-treated, already-pumped, already-paid-for water is been lost through infrastructure leakage. Before abstracting a single additional litre from the River Shannon, this waste must be quantified, costed, and demonstrated to be irreducible under Article 4(7)(d) WFD. It has not been.

Proposition 2 The 2% figure is legally impermissible

The proposed abstraction is not '2% of average Shannon flow'. That arithmetic artefact uses annual mean discharge. Ecological and legal impact is determined by low-flow, drought-period conditions in which the same abstraction volume represents 30–50% of available flow. ESB FOI data demonstrates 74 consecutive days in 2018 when the pipeline could not have operated without breaching the statutory compensation flow. The EIAR has not been backtested against this scenario.

Proposition 3 The 1929 baseline is legally circular

The 10m³/s statutory minimum compensation flow in the Old River Shannon below Parteen was set in 1929 as an engineering compromise for the Ardnacrusha hydroelectric scheme. It has never been assessed against WFD ecological objectives, Habitats Directive conservation requirements, or current climate projections. Using it as the fixed ecological baseline for this application is circular and legally inadequate.

Proposition 4 The alternatives assessment is legally deficient

The alternatives assessment desalination, groundwater, Poulaphouca, demand management, leakage elimination was conducted at strategic plan level between 1994 and 2022. It has never been repeated at project EIA level with current costs, current climate data, or current demand figures. The two Wallingford Hydrological Reports underpinning the original screening have never been placed in the public domain. This renders the EIAR alternatives chapter legally deficient under Article 5(1)(d) EIA Directive.

Proposition 5 The ecological system is already in crisis

The Lower Shannon and Lough Derg are already under severe ecological pressure. Atlantic salmon in the Lower Shannon are estimated to be at approximately 5% of their conservation limits (Tipperary County Council statutory submission), with the Castleconnell spawning beds representing the last known wild Atlantic salmon spawning grounds in the Shannon. NPWS conservation objectives identify the Common Tern breeding population of the Lough Derg SPA as having collapsed, with no breeding pairs recorded during the 2024 survey (pending further survey confirmation). Against this backdrop, any additional abstraction must be demonstrated, beyond reasonable scientific doubt, not to adversely affect the integrity of European sites.

2. The RtS Report: Status and Provenance

The RtS Report (585 pages, 28 chapters, dated 6 May 2026) was prepared by WSP at the instruction of Uisce Éireann. It is an advocacy document, not an independent assessment. Every conclusion it reaches including blanket assertions of compliance with the EIA Directive (para 140), the Habitats Directive (para 54), and the WFD (para 56/2862) is a conclusion reached by the Applicant's own team. An Coimisiún Pleanála has not verified any of these conclusions, and no court or independent body has examined them.

A structural issue that the ACP Inspector should be specifically alerted to is the repeated use of cross-references to other chapters in response to substantive objections, rather than addressing the issue where it is raised. The River Shannon Environment Protection River Shannon Environmental Protection Alliance has undertaken a systematic audit of these cross-references and identified numerous instances where they defer, rather than resolve, the matters in question. This issue is examined in Section 23, with the full chapter audit provided in Section 27.

3. Preliminary Matters

3.1 Status of the RtS Report as an Advocacy Document

For the reasons stated at Section 2, ACP must approach the RtS Report with the rigour that its provenance demands. The repeated blanket compliance assertions do not constitute independent verification and must be tested against the grounds set out in this submission.

3.2 Procedural Concern: Adequacy of Response Period Aarhus Convention

The River Shannon Environment Protection River Shannon Environmental Protection Alliance draws ACP's attention to the chronology of correspondence:

- ACP letter dated 24 June 2026 deadline for response understood to be in August 2026
- ACP letter dated 26 June 2026 (Eimear Reilly, Executive Officer) advised the 24 June letter contained a clerical error; corrected deadline is 21 July 2026
- ACP letter dated 30 June 2026 formal notice under section 37J(3) that the Commission will not determine the application within the statutory 18-week objective period and intends to determine it before 2 July 2027

The corrected 21 July deadline gave the River Shannon Environment Protection River Shannon Environmental Protection Alliance fewer than four weeks to respond to a 585-page technical document. The Commission is taking one full year beyond the statutory objective period to reach its own conclusion. Requiring civil society objectors to respond in 4 weeks while the Commission takes 12 months is inconsistent with Aarhus Convention Article 6(7) requirements for fair, equitable and timely public participation. The River Shannon Environment Protection River Shannon Environmental Protection Alliance has formally requested an extension of the response deadline to no earlier than 29 August 2026 and reserves the right to rely upon this procedural prejudice in any future judicial review proceedings.

> **Aarhus Convention, Article 6(7)**
> The public participation procedure shall allow the public to submit, in writing or as appropriate at a hearing or inquiry, any comments, information, analyses or opinions that it considers relevant to the proposed activity.

3.3 Request for an Oral Hearing

The River Shannon Environment Protection River Shannon Environmental Protection Alliance formally requests that ACP convene an Oral Hearing under section 134 of the Planning and Development Act 2000 (as amended). This application involves:

- One of the most consequential infrastructure planning decisions in the history of the State
- Live, unresolved scientific disputes about hydrological modelling, drought-flow impacts, and ecological effects on the Lower River Shannon SAC
- Contested legal questions under the Habitats Directive, EIA Directive, and WFD that cannot be resolved by reference to documents prepared by the Applicant alone
- Significant divergence between the Applicant's technical positions and those of three County Councils, Inland Fisheries Ireland, LAWPRO, and multiple prescribed bodies

An Oral Hearing would enable cross-examination of the Applicant's expert witnesses, allow independent scientific evidence to be tested, and enable the Inspector to reach a properly evidenced view on disputed factual matters. Without one, ACP risks determining an application of this magnitude on the basis of unverified advocacy documents prepared by one party.

3.4 Access to Information Requests Documents Not on Public File

The River Shannon Environment Protection River Shannon Environmental Protection Alliance has made, or is making, formal requests under the European Communities (Access to Information on the Environment) Regulations 2007–2018 (AIE Regulations) and the Freedom of Information Act 2014 for the following documents. ACP should note these requests and consider whether the absence of this material from the public record is itself a procedural deficiency:

- The foundational Wallingford Hydrological Reports (understood to date from approximately 1994 and 2007), which underpin the NWRP alternatives screening and have never been placed in the public domain; and the HR Wallingford External Assurance Review (2024), commissioned by the CRU as a Public Spending Code compliance review and considered by the MPAG.
- The full NWRP alternatives-screening matrices and weightings in all iterations to enable assessment of whether the criteria remain valid against current climate and cost data.
- The Preliminary Business Case and all CBA model inputs including discount rate, time horizon, and ecological cost monetisation methodology underlying the 10:1 benefit-cost claim.
- The underlying model files, input datasets and complete numerical outputs supporting EIAR Appendix A9.1 and Annex A, including the 1995 and 2018 drought periods and all abstraction, climate-change and environmental-flow simulations.
- The evidence, analysis and decision-making records underpinning the NIS Article 6(3) integrity conclusions for all affected European sites, including the Lower River Shannon SAC and the Lough Derg SPA, and the basis for concluding that there is no reasonable scientific doubt as to the absence of adverse effects on site integrity notwithstanding the acknowledged 'minor residual effects' (RtS, para. 49).
- Correspondence between EPA and Uisce Éireann on the scoping of the water abstraction licence EIA, and the timeline for the ESB abstraction/impoundment licence application.

4. EIA Directive Failure to Conduct a Lawful Alternatives Assessment

4.1 The Legal Standard

Article 5(1)(d) of Directive 2011/92/EU (as amended by 2014/52/EU) requires the EIAR to include 'a description of the reasonable alternatives studied by the developer which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment.' The requirement is substantive, not formal.

In Case C-87/02 (Commission v Italy, 2004), the CJEU confirmed an alternatives assessment must be genuine comparative analysis, not post-hoc justification of a pre-selected option. In Kelly v An Bord Pleanála [2019] IEHC 84, the Irish High Court quashed a permission where the alternatives chapter was conducted for a pre-selected option rather than as a genuine comparative exercise.

4.2 Strategic Screening Substituted for Project-Level Assessment

Throughout Chapter 5, for every alternative raised leakage reduction, desalination, groundwater, Poulaphouca, rainwater harvesting, demand management the Applicant gives the same near-verbatim response:

> *"...the assessment of reasonable alternatives in respect of the Proposed Project, did not re-consider strategic alternatives that had been considered and discounted by the NWRP... the reasonable alternatives in respect of the Proposed Project did not include [groundwater / desalination / rainwater harvesting / alternative sources]."* *RtS Report, paras 361, 365, 378, 382, 388*

The legal effect: no alternative to the chosen abstraction source, route, or scale was assessed at the EIA stage supporting this planning application. The Applicant concedes this explicitly at para 382, where desalination discussion is offered 'by way of general information and background' and is 'not the reasonable alternatives assessment.' This is a concession that no comparative project-level alternatives assessment was conducted for desalination. The same logic applies to every alternative addressed in Chapter 5.

Material changes since alternatives were last screened (1994–2022) that required project-level re-assessment:

- Capital cost has increased from €800m–€1.4bn to €4.58–5.96bn more than a fourfold escalation
- Ireland enacted the Climate Action and Low Carbon Development Acts 2015–2021 with binding carbon budgets and 2050 neutrality objective
- The Water Environment (Abstractions and Associated Impoundments) Act 2022 created an entirely new licensing regime
- ICARUS and Met Éireann have published progressively stronger evidence of increasing Shannon drought frequency and severity
- National leakage is now confirmed by the CRU at 43% (correct definition), with leakage rising in 2022, 2023 and 2024 — the opposite of the falling trajectory assumed in the demand model
- The renewable energy cost curve for alternatives such as desalination has shifted dramatically

4.3 The SEA/EIA Structural Gap: *effet Utile*

The Applicant's position (RtS para 137) that the NWRP/Eastern and Midlands Plan was subject to SEA, and that this satisfies the project-level alternatives requirement is legally incoherent. If this argument were correct, the SEA of any major national infrastructure plan would permanently relieve every derived project from any meaningful Article 5(1)(d) alternatives assessment. This renders Article 5(1)(d) a dead letter for all plan-derived projects incompatible with the EIA Directive's purpose and with the EU principle of effectiveness (*effet utile*).

The CJEU in Commission v Ireland (C-50/09) confirmed that EIA obligations must be met at project level regardless of prior strategic assessments. The fact that a prior SEA identified a 'preferred option' does not exempt the EIAR from genuine project-level comparative assessment using the project-specific environmental data, costs, and technology information that only becomes available at EIAR stage.

4.4 The HR Wallingford Reports and the Missing Public Record

Two hydrological assessments of the River Shannon system — understood to have been prepared by Wallingford Hydrosolutions (formerly the Institute of Hydrology) in approximately 1994 and 2007 — are understood to underpin the alternatives screening conducted under the NWRP. These foundational reports have never been placed in the public domain and are distinct from the HR Wallingford External Assurance Review of 2024, which was commissioned by the CRU as a Public Spending Code value-for-money review (addressed in Section 12 of this submission). The 2024 review did not assess the environmental or ecological adequacy of the alternatives analysis — only its financial and governance compliance. The alternatives assessment in the EIAR cannot be evaluated for legal compliance with Article 5(1)(d) without sight of the methodology, criteria, and conclusions of those foundational assessments. ACP should require Uisce Éireann to place both reports on the public file before determining this application.

4.5 Poulaphouca/Pollaphuca: An Inadequately Assessed Alternative

Poulaphouca Reservoir has a total storage capacity of approximately 166 billion litres (active storage 148 billion litres), a surface area of 22.26 km², and existing integration with Ballymore Eustace WTP and the Greater Dublin Area water supply system. It is located 115km closer to Dublin than Parteen Basin. The RtS Report (para 374) treats Poulaphouca optimisation as outside the formal alternatives assessment, noting only that any increases 'would need to be carefully planned.' This acknowledgment of conceivable additional yield was never examined at project level with current engineering and environmental data. The failure to do so is an independent Article 5(1)(d) deficiency.

5. EIA Directive Four Additional Grounds on Alternatives

The Consolidated Formal Submission (4) addresses the alternatives assessment failure under Article 5(1)(d) EIA Directive in detail. This section adds four further arguments that reinforce and extend the legal case.

5.1 'Feasible' Means Viable: A Logical Contradiction in Uisce Éireann's Own Language

At RtS Report para 368, Uisce Éireann states it 'assessed over 1,100 unconstrained options, narrowing them to 594 feasible alternatives including groundwater, reservoirs, and transfer schemes.'

The logical contradiction in Uisce Éireann's own words

At RtS para 365, Uisce Éireann states: 'UÉ does not agree there are suitable alternative sources of water available, therefore, the reasonable alternatives considered in respect of the Proposed Project did not include alternative sources. 'At RtS para 368, Uisce Éireann states it narrowed 1,100 options to '594 feasible alternatives.' These two statements cannot both be true. If 594 options were feasible by the Applicant's own word, meaning viable to some degree then some of them were suitable alternatives. The Applicant cannot simultaneously assert that no suitable alternatives exist and that 594 alternatives were feasible. This is a direct logical contradiction.

Angela Ryan, Asset Strategy Management with Uisce Eireann in response to arguments from us RSEPA that not enough thought went into alternative options. Ms Ryan said 'alternatives are not feasible, pointing to the vital role that dams play in significant amounts of water to be extracted from rivers without causing environmental concerns. Ireland has only four suitable damned rivers the Shannon, the Liffey, the Lee and the Erne. The Lee has been earmarked for a new project piping water to west Cork, so the Shannon is best placed to solve supply issues to Dublin and the Midlands. When you are taking water supply from a river , the difference in volume you can take if there is and if there isn't a dam is enormous'' Ms Ryan said.

We the RSEPA were astounded with this revelation. If they knew they always wanted a damned river, why did they spend from 2014 to September 2024 going through the motions of considering non damned options? Why did Irish Water does not declare this to Department in 2014 and save the taxpayer the €67,624,953, and the ten years spent on technical assessment of all alternatives.

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The word 'feasible' has a precise meaning in engineering and planning practice: viable to some degree; capable of being done; workable and achievable. By characterising 594 options as feasible, Uisce Éireann confirmed in its own language that each was viable to some degree at the time of screening. The legal consequences are direct:

- Article 5(1)(d) EIA Directive requires description of the 'reasonable alternatives studied by the developer which are relevant to the proposed project.' An alternative that is 'feasible' viable to some degree is potentially a 'reasonable alternative' within the meaning of this provision. The Applicant has confirmed 594 such alternatives existed.
- The Applicant cannot simultaneously claim to have identified 594 feasible alternatives and assert that no reasonable alternatives are available (RtS para 365). These two statements are in direct logical contradiction, and ACP should require the Applicant to resolve it.
- None of the screening of those 594 feasible alternatives was conducted at project EIA level with current (2026) cost data, current climate projections, or project-specific environmental baseline data. All screening occurred at NWRP strategic plan level, between 1994 and 2022.

5.2 At Least 100 of the 594 Feasible Options Warrant Project-Level Assessment

The narrowing from 1,100 to 594 represented the elimination of options that were genuinely non-feasible physically impossible, legally prohibited, or demonstrably unsuitable at any scale. The 594 that remained were, on the Applicant's own characterisation, viable to some degree. Within those 594, it is reasonable to expect that a substantial number the River Shannon Environment Protection River Shannon Environmental Protection Alliance submits conservatively at least 100 incorporated approaches that have never received project-level EIA assessment, including:

- Options incorporating Poulaphouca reservoir optimisation as a primary long-term supply source

- Options incorporating sustainable groundwater yield from the Kildare aquifer system
- Options incorporating multiple eastern river abstractions (Barrow, Boyne, Slaney, Liffey) in combination
- Options incorporating demand management as a primary rather than supplementary measure
- Options incorporating staged or phased supply development contingent on demonstrated demand materialisation
- Options incorporating desalination as a coastal supplementary source reducing the Shannon abstraction volume required

None of these received a project-level EIA alternatives assessment using current data. A generic reference to NWRP screening methodology from 2014–2022 does not satisfy Article 5(1)(d) for these options, all of which were feasible by the Applicant's own characterisation.

Request to ACP — 5.2

ACP should require Uisce Éireann to: (a) confirm what the 594 feasible alternatives were; (b) explain what criteria were used to narrow from 594 to the preferred single option; (c) confirm those criteria were applied using current (2026) cost, climate, and environmental data; and (d) identify which of the 594 involved Poulaphouca optimisation, eastern river incremental development, or demand management as a primary measure. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests that these documents be placed on the public file before any determination

5.3 A Smaller, Trigger-Conditioned Lough Ree Abstraction as Part of a Multi-Source Supply Matrix

Uisce Éireann rejected abstraction from Lough Ree on two grounds (RtS para 372): ESB minimum operation levels were not maintained during the 1995 drought without an abstraction, and such abstraction 'would likely have a negative environmental impact.' Both grounds were applied to a full-scale abstraction at the scale envisaged for the Shannon Pipeline 300+ Mld as a standalone single source.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies a genuinely different option that Uisce Éireann's screening did not consider: a smaller, environmentally tolerable abstraction from Lough Ree as one component of a diversified multi-source supply matrix, not as a standalone replacement for the Shannon Pipeline. At a reduced scale, with appropriate trigger conditions, both rejection grounds may be manageable:

- Trigger mechanisms suspending Lough Ree abstraction below defined flow thresholds would address the drought-resilience concern analogous to the ESB minimum level trigger already applicable at Parteen
- Seasonal abstraction restricted to periods of high flow, with Poulaphouca compensating during low-flow periods, would address both resilience and environmental impact concerns
- Condition-based adaptive management abstraction ceasing automatically if ecological indicators cross defined thresholds provide a level of protection not available in the current Parteen design

Uisce Éireann's rejection of Lough Ree as a full-scale standalone alternative does not constitute assessment of Lough Ree as a component of a diversified portfolio approach. These are legally and operationally different options. The EIA Directive requires genuine consideration of the former not to preclude genuine consideration of the latter.

5.4 The Cost-Benefit of a 50km Shorter Pipeline A Question Never Asked

Lough Ree is approximately 55km upstream of Lough Derg/Parteen Basin. The proposed pipeline from Parteen Basin to Dublin is 172km. A pipeline originating at Lough Ree would be approximately 122km a reduction of roughly 50km.

At the MPAG-confirmed upper cost range of €10.4bn (RCF P90/95), the pipeline infrastructure cost per kilometre is substantial. A 50km reduction in pipeline length represents a capital saving of potentially hundreds of millions of euros before pumping energy, operational costs, and 60-year maintenance are factored in. No cost-benefit analysis comparing the Parteen option against a Lough Ree option even one acknowledging the latter's lower dry-weather yield has ever been published or placed on the public file.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that this question was never properly asked in the NWRP alternatives screening or in the EIAR, and that it should be answered before this application is determined. ACP should require Uisce Éireann to confirm whether the cost-benefit of a Lough Ree origin pipeline was ever quantified. If it was not, this is a gap in the alternatives assessment. If it was, it should be on the public file.

6. Habitats Directive Three Additional Operational Grounds

The Consolidated Formal Submission (5 and 12) addresses the Habitats Directive compliance case in detail. Three further grounds arise from the operational realities of Lough Derg and Parteen Basin that have not been fully developed.

6.1 Ardnacrusha Already Idles 20 Days Per Year — Drawdown Is an Annual Routine

At RtS Report para 2643 in extreme droughts, ESB would cease generation at Ardnacrusha as they 'already do on average 20 days per year already

Ardnacrusha's turbines already shut down for an average of approximately 20 days per year under current conditions — without any pipeline abstraction in place. The 74-day 2018 shutdown was an extreme version of a phenomenon that occurs every year The 74-day 2018 shutdown was therefore not a once-per-generation anomaly but an extreme version of a phenomenon that occurs which we are to understand from Met Eireann and ICHARUS data will occur every two years and possibly every year. Ardnacrusha is idle, for an average of about 20 full days each year due to lack of water flow. Note on current conditions (17 July 2026): OPW gauge data shows the Shannon at Athlone (Station 26027) has fallen to approximately 17 m³/s. Met Éireann forecasts no significant rainfall for at least 20 days. Ireland is in hydrological drought. The two-week lag between meteorological and hydrological drought means conditions at Parteen Basin will continue to deteriorate through the coming weeks.

The cumulative consequences over the operational life of the project have not been assessed:

- The EIAR's drought scenario modelling presents the 2018 event as a worst-case scenario. The correct framing based on the Applicant's own RtS para 2643 admission is that some degree of lake storage drawdown will occur every year.
- The NIS's Article 6(3) integrity conclusion does not address the cumulative ecological effect of routine annual plus drawdown events on qualifying interests of the Lower River Shannon SAC, the Lough Derg SPA and other affected European sites over the operational life

ACP should require the Applicant to supplement the EIAR and NIS with an assessment of the cumulative drawdown effect on Lough Derg lake levels over the full 60-year operational life, incorporating the routine annual idling periods alongside periodic significant drought events.

6.2 Emergency Derogation from the Normal Operating Band: The Mechanism Gap

The critical gap in the Article 6(3) compliance case

The Applicant's entire Article 6(3) Appropriate Assessment rests on the proposition that Lough Derg/Parteen lake levels will be maintained within the Normal Operating Band throughout the operational life of the pipeline. However, there is no legally binding mechanism identified in the planning application, the EIAR, or the NIS that will prevent emergency derogation from the Normal Operating Band if a prolonged drought makes this operationally necessary.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies this as a specific and foreseeable scenario. During a prolonged drought when Ardnacrusha has already been idle for weeks, when Lough Derg is at the lower end of its Normal Operating Band, and when Dublin is experiencing acute water shortage the political, operational, and societal pressure to continue pipeline abstraction will be overwhelming. 'Emergency permissions' under section 181A of the Planning and Development Act 2000 exist precisely to allow infrastructure to operate outside normal consent conditions during a declared national emergency.

If emergency permissions were granted in such circumstances to draw Lough Derg below the Normal Operating Band:

- This would breach the habitat thresholds that form the entire foundation of the Article 6(3) integrity conclusion.
- The NIS's 'no adverse effect on integrity' conclusion would be simultaneously falsified by the operational reality it was supposed to prevent.
- There is no identified legal mechanism planning condition, licence condition, or statutory agreement that would make such derogation impossible.

Under Waddenzee (C-127/02) and Sweetman (C-258/11), the 'no reasonable scientific doubt' standard requires that the ecological protections underpinning the Article 6(3) conclusion be legally guaranteed, not merely operationally intended. A promise of operational restraint that can be overridden by emergency planning permission is not a legal guarantee. It is a conditional assurance that collapses in precisely the circumstances where it matters most.

Request to ACP — §6.2

ACP should require Uisce Éireann to identify the specific, legally binding mechanism planning condition, licence condition, or statutory agreement that would prevent emergency derogation from the Normal Operating Band during a prolonged drought. If no such mechanism can be identified, the Article 6(3) integrity conclusion falls, because it rests on an assurance that cannot survive a national water emergency.

6.3 Lough Derg Is a Protected SAC and SPA: It Cannot Be Operated as a Demand Management Reservoir

The operational logic of the proposed project during drought conditions relies on drawing upon water stored within Lough Derg where inflows are insufficient to satisfy both the proposed abstraction and the statutory compensation flow. In effect, the proposed project treats Lough Derg as a storage reservoir whose water level can be managed to meet downstream demand. Lough Derg is not simply a water supply reservoir. It is

- A designated Special Area of Conservation (Lower River Shannon SAC, site code 002165) under the Habitats Directive (92/43/EEC), supporting qualifying interests including Atlantic salmon, lamprey, freshwater pearl mussel, otter, and alluvial forests.
- A component of the Lough Derg (Shannon) SPA and the Shannon Callows SPA European sites with qualifying bird species (common tern, whooper swan, Greenland white-fronted goose) whose habitats and conservation objectives are influenced by the hydrological regime.
- A natural lake water body under the Water Framework Directive. Lough Derg is not designated as a Heavily Modified Water Body (HMWB); only Parteen Basin has HMWB status.
- A waterbody subject to the objectives and Programme of Measures established under the Water Framework Directive, including environmental flow requirements.

Operating Lough Derg as a demand-management reservoir by drawing down lake levels during drought conditions to maintain pipeline supply is fundamentally incompatible with the conservation objectives of these protected sites and the obligations arising under the Habitats and Water Framework Directives. Unless

Uisce Éireann can demonstrate beyond reasonable scientific doubt, that such a scenario would not adversely affect the integrity of the affected European sites, the proposed development cannot satisfy the requirements of Article 6(3) of the Habitats Directive.

As the River Shannon Environment Protection River Shannon Environmental Protection Alliance has established in the main submission (12), approximately 179km of Lough Derg shoreline (including islands) would be exposed during a sustained drawdown event. Any deterioration of SAC-qualifying habitats or significant disturbance of SPA qualifying species resulting from drawdown below the Normal Operating Band is could constitute deterioration within the meaning of Article 6(2) of the Habitats Directive regardless of whether emergency conditions apply.

6.4. Lough Derg Evaporation: A Significant but Insufficiently Examined Component of the System Water Balance

A significant but insufficiently examined pressure on the water budget

The EIAR's hydrological modelling assesses the proposed pipeline abstraction (3.47 m^3/s at peak) as the primary new demand on the Lough Derg/Parteen Basin system. Although evaporation has been incorporated into the model, its magnitude is not readily apparent within the assessment. Expressing evaporation losses as equivalent continuous flows demonstrates that, during warm summer conditions, evaporation represents a water loss comparable to, or greater than, the proposed abstraction. For example, on a hot summer drought day — precisely the conditions of maximum stress on the Shannon system — Lough Derg loses between 354 and 708 million litres of water per day to evaporation. At the upper range, this evaporative loss is equivalent to 8.19 m^3/s — more than twice the proposed pipeline abstraction and more than 80% of the entire statutory compensation flow. This is not a minor background factor. It is a major, temperature-sensitive, drought-coincident pressure on the water budget. Given its potential influence on modelled lake levels during drought, the importance of evaporation, the methodology adopted to estimate it, and the associated uncertainty warrant far more explicit consideration within the assessment.

Summer temperatures will rise most directly increasing evaporation from Lough Derg the Shannon catchment's PET will increase by 13.5% by 2080 Gharbia et al. (2018) cited in this report found that *"for the Shannon River Basin this could result in the PET being 13.5% larger in 2080 than today."* PET is potential evapotranspiration — the amount of water evaporated and transpired. A 13.5% increase in PET over the pipeline's operational life means the net water available in the Shannon catchment after evaporation losses will be progressively smaller. This directly supports the River Shannon Environment Protection River Shannon Environmental Protection Alliance's Section 39 evaporation argument and the climate-stranded baseline ground

Fealy et al. (2018): *"Summer (June, July, August) and Autumn (September, October, November) will see the largest increases with 3.1°C warming expected during Autumn by the end of the Century."* Summer is when Lough Derg evaporation is highest and Shannon inflow is lowest, as temperatures increase, the evaporative loss from Lough Derg's 118 km^2 surface will increase, making the unmodelled evaporation demand progressively larger over the pipeline's operational life.

Surface evaporation from open water bodies is governed by four primary variables: water surface temperature, air temperature, wind speed, and atmospheric humidity. The critical and counter-intuitive feature of evaporation as a water budget factor is this: the conditions that maximise evaporation are precisely the same conditions that define a hydrological drought.

During a summer drought in Ireland:

- Air and water temperatures are elevated — increasing the vapour pressure differential that drives evaporation
- Humidity is reduced — allowing faster evaporation into a drier atmosphere
- Clear skies and strong sunshine increase direct solar heating of the water surface
- Dry, warm winds carry moisture away from the lake surface, maintaining the vapour pressure differential

All four variables that increase evaporation are simultaneously present during the drought conditions that the EIAR identifies as the period of maximum stress on the Shannon system. This is not a coincidence — it is a physical relationship. The same meteorological conditions that reduce Shannon inflows also accelerate water loss from the Lough Derg surface. The EIAR does not account for this compounding effect.

Lough Derg has a surface area of approximately 118 km² (118 million m²). Using standard open water evaporation rates applicable to Irish summer conditions at air temperatures around 25°C:

Scenario	Evaporation rate (mm/day)	Daily volume lost (million litres)	Equivalent flow (m³/s / cumecs)	As % of statutory 10m³/s comp. flow
Mild warm day (light wind, some cloud)	3 mm/day	354 million litres	4.09 m³/s	41% of compensation flow
Hot summer day (moderate wind, sunny)	4.5 mm/day	531 million litres	6.15 m³/s	61% of compensation flow
Hot drought day (strong wind, clear sky)	6 mm/day	708 million litres	8.19 m³/s	82% of compensation flow
For comparison: Proposed pipeline abstraction	—	300 Mld (peak)	3.47 m³/s (peak)	35% of compensation flow

The figures in the table are derived from standard hydrological methodology for open water evaporation (Penman open water evaporation method, widely used in Irish catchment hydrology). The River Shannon Environment Protection River Shannon Environmental Protection Alliance acknowledges that the precise evaporation rate on any given day will vary with actual meteorological conditions. The range of 3–6 mm per day represents a conservative to moderate estimate for Irish summer conditions; rates above 6 mm/day are possible during extended heatwaves of the type that are becoming more frequent under climate change projections.

The Conversion to Flow Equivalents

To understand evaporation as a component of the system water budget, it is necessary to convert the daily volume to an equivalent continuous flow in cubic metres per second (cumecs) — the same unit used throughout the EIAR for abstraction, compensation flow, and inflow assessments.

The conversion is:

Daily volume (m^3) ÷ 86,400 seconds per day = equivalent flow (m^3/s)

- 3 mm/day evaporation: 354,000 m^3 ÷ 86,400 = 4.09 m^3/s
- 4.5 mm/day evaporation: 531,000 m^3 ÷ 86,400 = 6.15 m^3/s
- 6 mm/day evaporation: 708,000 m^3 ÷ 86,400 = 8.19 m^3/s

For comparison, the proposed pipeline abstraction at peak operation is 3.47 m^3/s, and the statutory minimum compensation flow to the Old River Shannon is 10.0 m^3/s.

On a hot summer drought day with evaporation at 6 mm/day, Lough Derg loses water to the atmosphere at a rate equivalent to 8.19 m^3/s — approximately 2.4 times the proposed pipeline abstraction, and 82% of the entire statutory compensation flow. This evaporative loss occurs whether or not the pipeline is operational, whether or not Ardnacrusha is generating, and whether or not the drought conditions persist.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance presents below a simple system water budget for Lough Derg/Parteen Basin during a hot drought day, incorporating the evaporation loss. All figures are in m^3/s:

Demand on Lough Derg system	Flow (m^3/s)	Daily volume (million litres)	Notes
Statutory minimum compensation flow (Old River Shannon)	10.0 m^3/s	864 Ml	Legally required minimum at all times
Limerick City supply (Clareville WTP)	0.6 m^3/s	52 Ml	Current abstraction; growing. Limerick City supply is entirely dependent on Parteen Basin source water; demand projected to grow.

Demand on Lough Derg system	Flow (m^3/s)	Daily volume (million litres)	Notes
Proposed Dublin Pipeline (peak abstraction)	3.47 m^3/s	300 Ml	Proposed new demand on the system
Surface evaporation from Lough Derg (hot drought day — 6mm)	8.19 m^3/s	708 Ml	Incorporated in the hydrological model; however, the magnitude and associated uncertainty are not explicitly presented, and the sensitivity of modelled lake levels to evaporation assumptions has not been examined.
TOTAL SYSTEM DEMAND (hot drought day, pipeline operating)	22.26 m^3/s	1,924 Ml/day	Against total Shannon low flow at Parteen of ~20m^3/s in drought

The critical finding from the system water budget

During a hot drought day with the proposed pipeline operating at peak capacity, the total demand on the Lough Derg/Parteen system from the statutory compensation flow, Limerick supply, pipeline abstraction, and surface evaporation is approximately 22.26 m^3/s. The total natural inflow to Parteen Basin from the Shannon during the 2018 drought was approximately 10–11 m^3/s (based on ESB FOI data showing Ardnacrusha took zero water for 74 days, consistent with inflows at or near the 10m^3/s compensation flow level). On a hot drought day, total system demand exceeds available inflow by approximately 12 m^3/s. Every one of those 12 m^3/s must come from Lough Derg Lake storage not just the pipeline's 3.47 m^3/s. Water budget table.

The EIAR's hydrological model accounts for the compensation flow, the Limerick abstraction, and the pipeline abstraction as demands on lake storage during drought. It does not account for surface evaporation. The omission is material because:

- Evaporation at 6 mm/day (8.19 m^3/s equivalent) is the largest single demand on the system after the statutory compensation flow, exceeding the proposed pipeline abstraction by a factor of 2.4.

- Unlike the other demands, evaporation cannot be controlled, suspended, or reduced — it is a physical process driven by meteorological conditions that are independent of operational decisions.
- The conditions that maximise evaporation (heat, low humidity, wind, sunshine) are exactly the conditions that define a hydrological drought and that simultaneously minimise Shannon inflow — creating a compound effect is not explicitly examined within the assessment. PET (evaporation/transpiration) is accelerated by the same effects upstream on Lough Ree. Our figs calculate the loss from the surface of Lough Derg. There will be a cascade effect of a drought across the midlands and so water we assume reaches Lough Derg, may not, because of PET losses upstream on Lough Ree etc.
- Under climate change projections (ICARUS, met Éireann), summer temperatures and drought frequency in the Shannon Midlands are projected to increase — meaning the evaporative loss per drought event will increase over the 60-year operational life of the pipeline.

6.4.1 The Ecological Consequence: The Importance of Evaporation During Drought

The EIAR's modelled worst-case lake level drawdown of 134 mm (2018 drought analogue; RtS Report, para. 1421) is derived from a hydrological model that incorporates catchment inflows, direct precipitation, evaporation and operational outflows. Evaporation becomes an increasingly important component of the water balance during drought conditions, when inflows are simultaneously reduced and evaporative losses are greatest. Consequently, confidence in the predicted drawdown is dependent on the methodology used to estimate open-water evaporation and the associated uncertainty.

The assessment does not present a sensitivity analysis demonstrating how alternative, but reasonable, evaporation estimates would influence the predicted 134 mm drawdown or the conclusions of the ecological assessment.

Given the importance of evaporation to the system water balance during drought conditions:

- Reduced inflows and increased evaporation occur simultaneously, placing maximum pressure on the Lough Derg water balance. The assessment does not explicitly examine the sensitivity of the predicted drawdown to this combination of conditions.
- The report demonstrates that evaporation increases under climate change, but it does not explain how sensitive the predicted drawdown and ecological conclusions are to those increased evaporation losses.
- The NIS's Article 6(3) integrity conclusion relies on modelled lake levels derived from assumptions regarding evaporation, but the implications of uncertainty in those assumptions for the ecological assessment are not discussed.
- The 20-day average annual Ardnacrusha idle period (RtS para 2643, addressed in §36.1 of this submission), during which the Lough Derg is already drawing down, occurs predominantly in warm summer conditions when evaporation rates are highest, compounding pressure on the lake water balance.

6.4.2 Why This Is Legally Significant

The treatment of evaporation, together with the limited assessment of uncertainty associated with its estimation, has the following legal implications:

- Under Article 5(1) of the EIA Directive, the EIAR must contain adequate information on the likely significant effects of the proposed development. As evaporation is a major component of the Lough Derg water balance during drought conditions, the assessment should demonstrate that the adopted evaporation methodology and its associated uncertainty have been adequately considered.
- Under Article 6(3) of the Habitats Directive and the Waddenzee standard of 'no reasonable scientific doubt,' the NIS's conclusion that lake levels will remain within the Normal Operating Band during drought depends on a hydrological model that is sensitive to assumptions regarding open-water evaporation. In the absence of such analysis, it is unclear whether uncertainty in the estimation of evaporation has been reduced to the level required by the Article 6(3) standard of no reasonable scientific doubt.
- Under the WFD Article 4(1) no-deterioration requirement as interpreted in Weser (C-461/13). The WSIAR's conclusion that there will be no deterioration in quality elements of the affected water bodies relies on outputs from the hydrological model, yet the report does not examine how uncertainty in those outputs could influence the assessment of WFD quality elements.
- Under WFD Article 4(7)(d), the 'no significantly better environmental alternative' test requires confidence in the assessment of the proposed option's environmental impacts. The implications of uncertainty in the estimation of open-water evaporation for predicted lake levels and the assessment of alternatives are not explicitly examined.

What the EIAR Should Contain and Does Not

The Hydrological Modelling Report incorporates evaporation as part of the Lough Derg water balance, estimating open-water evaporation using the Oudin potential evaporation method, scaled to observations from the Met Éireann Gurteen station and converted to open-water evaporation using the Finch formula. Given the importance of evaporation to the lake water balance during drought conditions, additional information on the validation of this methodology, the associated uncertainty and the sensitivity of modelled lake levels to alternative evaporation estimates would improve confidence in the assessment.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance has not had access to the underlying model datasets or calibration and sensitivity analyses supporting the hydrological model. In light of the importance of evaporation to the predicted lake levels during drought conditions, further information demonstrating the robustness of the adopted methodology would assist in evaluating the reliability of the model outputs.

Note on the River Shannon Environment Protection River Shannon Environmental Protection Alliance's own calculation

The figures in this section are calculated by the River Shannon Environment Protection River Shannon Environmental Protection Alliance using standard open-water evaporation methodology applied to Lough Derg's surface area (118 km²). The River Shannon Environment Protection River Shannon Environmental Protection Alliance is not a hydrological modelling organisation and does not claim the precision of a peer-reviewed engineering study. The purpose of presenting these figures is to demonstrate order of magnitude of evaporation losses from Lough Derg when expressed as equivalent continuous flows. They are intended to provide context for the importance of evaporation within the lake water balance rather than to replicate or replace the Applicant's hydrological model.

Requests to An Coimisiún Pleanála

1. Require the Applicant to provide additional information on the validation of the Oudin‑Finch evaporation methodology, including the basis for its selection, any calibration or validation undertaken, and the sensitivity of modelled lake levels to uncertainty in the adopted evaporation estimates.

2. Require the Applicant to demonstrate that the adopted evaporation methodology provides an appropriate representation of open-water evaporation for Lough Derg, or to justify why alternative recognised methodologies were not adopted.

3. Require the Applicant to demonstrate the sensitivity of the predicted 134 mm worst-case drawdown (2018 drought analogue; RtS para. 1421) to uncertainty in the adopted evaporation methodology and to confirm whether the conclusions of the NIS remain robust under reasonable alternative evaporation assumptions.

   Require the Applicant to assess whether the conceded 'measurable effects during extreme drought periods' (RtS para 2626 remain robust having regard to the assumptions adopted in estimating evaporation and the associated uncertainty, and to address this in the context of the NIS's Article 6(3) integrity conclusion.

4. Require the Applicant to demonstrate that the projected increases in evaporation incorporated within the hydrological model under future climate scenarios do not materially affect the Article 6(3) integrity conclusions or the Water Framework Directive assessment over the operational life of the project.

The Roadmap for the Lower River Shannon (2021)

This was a report that was prepared by CDM Smith, a specialist international fish passage engineering firm, commissioned by the **Department of Housing, Local Government and Heritage.** It is the Irish State's own commissioned expert report on the ecological condition of the Lower River Shannon and what needs to be done to restore it. The Steering Group that commissioned it included Irish Water (now Uisce Éireann) as a named member.

The findings that directly support the River Shannon Environment Protection River Shannon Environmental Protection Alliance's case, in order of importance:

The 10m³/s compensation flow is explicitly stated not to represent current best practice

At page 12 (Section 2.2.2), the report states:

"Minimum flow provision represents best practice for hydropower schemes. However, the low and unvaried compensation flow of the Shannon Scheme do not present current international best practice."

And at Section 8.1, Conclusion/Basic Considerations:

"The minimum flow provision at Parteen Weir represents European and international best practice for hydropower schemes, in general. However, the comparatively low and uniform compensation flow practice does not present current best practice."

This is the Irish State's own expert consultants, commissioned by a government department, in a document to which Uisce Éireann was party as a Steering Group member, stating in plain terms that the 10m³/s compensation flow does not meet current best practice. The River Shannon Environment Protection River Shannon Environmental Protection Alliance's entire WFD baseline circularity argument (6.2 of the consolidated submission) rests on the proposition that this flow was set in 1929 for engineering reasons and has never been assessed against WFD ecological objectives. This report from 2021, commissioned by the Irish State confirms it.

Environmental flows of 17–50 m³/s are needed not 10 m³/s

Section 7.4.2 contains the expert EFlow recommendation for the Shannon Scheme. The report proposes:

- A raised baseflow of **17 m³/s** during normal flow conditions (compared to current 10 m³/s)
- Freshets of **21–31 m³/s** weekly during the March–September migration period
- Freshets of up to **65 m³/s** during October–December

The ecologically appropriate flow for the Old River Shannon is substantially higher than 10 m³/s the baseline the WSIAR uses for its entire WFD 'no deterioration' assessment. If the ecologically appropriate flow is 17–65 m³/s and the current flow is 10 m³/s, then:

- The current baseline is already below the ecologically required level
- 'No deterioration relative to 10m³/s baseline' says nothing meaningful about WFD compliance
- Adding a pipeline abstraction that competes for the same water budget makes achieving the required EFlow even harder

The report explicitly considers Irish Water's proposed abstraction and flags it as a constraint

At Section 8.2.4 (Concept U2), the report states: *"The impact of increasing the EFlow on other potential users of the flow also needs to be considered. In our EFlow concept, applying a hydrological approach, we considered the proposal by Irish Water to abstract 4 m³/s on average from the Parteen Basin."*

The State's own 2021 roadmap specifically modelled Irish Water's proposed abstraction as a competing demand when assessing the EFlow requirements for fish passage. The EFlow concept and the pipeline abstraction are not independent of each other the report acknowledges they compete for the same flow budget. Yet the EIAR and NIS treat the compensation flow as a fixed baseline without acknowledging this competition.

Uisce Éireann (then Irish Water) was at the table when this report was being produced. It was aware in 2021 that the State's own expert consultants had concluded that the 10m³/s compensation flow does not represent best practice and that ecologically appropriate flows for fish passage are substantially higher. It proceeded to submit a planning application for a pipeline abstraction that competes for the same water budget, without disclosing this finding in its NIS or WSIAR. This is a deliberate omission from the public record.

The existing fish passes at Parteen and Ardnacrusha do not represent best practice

Section 8.2.2 and 8.1 confirm that the Parteen Weir fish pass and Ardnacrusha fish lock "do not facilitate multi-fish species passage, and cannot be brought up to present best practice, which is why we recommend that they be completely revised/replaced."

This is directly relevant to the NIS's treatment of the ESB hatchery and fish passage infrastructure as adequate mitigation. If the State's own 2021 roadmap recommends complete replacement of the existing fish passes, then the NIS's reliance on the existing passes as part of the ecological management regime for the SAC qualifying interests (salmon, lamprey) is relying on infrastructure that the State's own experts have said is not fit for purpose.

Atlantic salmon catches dropped from 414,000 pounds to 42,000 pounds — immediately after Ardnacrusha was built

Section 1.1 cites the historical record: *"according to Reale (2011) 'the effect of the scheme was well documented in the local media at the time and it is estimated that catches of salmon on the Limerick fishery dropped from 414,000 pounds, to 42,000 pounds after the scheme was built.'"*

A 90% collapse in salmon catches in the decade following the Ardnacrusha scheme provides the historical baseline for the River Shannon Environment Protection River Shannon Environmental Protection Alliance's argument that the Shannon system is in ecological crisis: it has been degraded for nearly 100 years and the EIAR proposes to add a further pressure on a population that is already at 5% of conservation limits.

A required increase in compensation flow would directly conflict with the pipeline abstraction

This is the logical trap that the report sets up, though it does not close it explicitly. The EFlow recommendation requires flows of 17–65 m³/s to restore ecological function. The statutory minimum is currently 10 m³/s. If the RBMP process eventually requires higher compensation flows which this 2021 Government-commissioned report recommends the pipeline abstraction will physically constrain delivery of that flow during drought conditions. This is the 'climate-stranded baseline' and 'stranded compensation flow asset' argument from the consolidated submission.

The number of days at minimum baseflow would need to reduce from 11 months to 2 months per year

Table 13 (Section 7.4.2) in the report shows that under the recommended EFlow regime, days with minimum baseflow (10 m³/s) in an average year would reduce from approximately 340 days (current) to approximately 66 days. Currently the Old River Shannon runs at the minimum statutory 10 m³/s for approximately 11 months of the year. The recommended regime would deliver ecologically meaningful higher flows for approximately 10 months of the year. The proposed pipeline abstraction works directly against this transition.

(WFD 1929 baseline circularity): The Irish State's own expert consultants, in a report commissioned by the Department of Housing in 2021 to which Uisce Éireann was a party, found that the 10m³/s compensation flow "does not present current best practice." The WSIAR's use of this same flow as the fixed ecological baseline for its WFD 'no deterioration' analysis cannot withstand scrutiny in light of this finding.

(Habitats Directive — qualifying interests not fully assessed): The 2021 Government roadmap recommends complete replacement of the Parteen Weir fish pass and Ardnacrusha fish lock as unfit for multi-species passage. The NIS's reliance on these structures as part of the ecological management regime for the SAC is relying on infrastructure the State's own experts have condemned as inadequate.

(Ardnacrusha 20 days idling — annual drawdown): The report's EFlow modelling considers the pipeline abstraction as a competing demand. The EFlow concept and the pipeline compete for the same flow budget. The EIAR has never modelled what the pipeline abstraction does to the feasibility of achieving the EFlow regime that the State's own experts have recommended.

(Article 4(7) — no derogation assessment): Article 4(7)(d) WFD requires demonstration that the objectives cannot be achieved by a significantly better environmental option. The 2021 roadmap recommends a specific EFlow regime requiring flows of 17–65 m^3/s. The pipeline abstraction competes with this objective. If the beneficial objective — ecological restoration of the Old River Shannon SAC to Good Ecological Potential — requires higher flows than currently exist, and the pipeline abstraction reduces the available water budget during drought conditions, then the pipeline cannot pass the Article 4(7)(d) test.

The most powerful single argument: Uisce Éireann was at the table when this report was produced. It cannot claim ignorance of these findings. Its failure to disclose them in the NIS and WSIAR, while submitting a planning application for an abstraction that competes with the recommended EFlow regime, is a material omission from the public record that ACP should treat with the seriousness it deserves.

The CDM Smith report 2021, commissioned by the ESB, proposes a comprehensive fish-passage restoration strategy centred on increasing and diversifying flow through the Old River Shannon channel, rather than maintaining the current static statutory minimum. This strategy includes:

- Elevated Baseline Flow: A generally higher baseline flow in the Old River channel to provide a viable fish passage beyond Ardnacrusha, thereby mitigating entrainment in the tailrace.

  Seasonal Water Releases: Weekly water releases during spring and summer, strategically timed to facilitate upstream salmon migration.
- Nocturnal Autumn Spills: Night-time water spills in autumn, designed to support the safe downstream migration of eels during their peak migratory period.
- Enhanced Fish Passes: Upgraded fish passes at both Ardnacrusha and Parteen Weir to improve fish bypass capabilities.
- Exclusionary Measures: Implementation of barriers or exclusion mechanisms to prevent fish from entering hazardous areas, such as the turbine tailrace.

The core principle of these recommendations is variability. Instead of a single, fixed compensatory flow throughout the year, CDM Smith's model advocates for a flow regime that incorporates pulsed increases during biologically critical periods (e.g., spring/summer for salmon, autumn nights for eels), in addition to an elevated baseline.

Implications for Pipeline Development.

It is asserted that the seasonally augmented flow regime of this variable could be jeopardized if the pipeline's abstraction is sanctioned under the existing minimum compensation flow. A drought-period abstraction of 300 Ml/d would compete for the same water volumes that the CDM Smith plan seeks to reserve, often during critical periods when migration flows are most crucial and water margins are most constrained. Anglers advocates for the ACP to conduct a combined assessment of both proposals, ensuring that the pipeline's permitted abstraction does not inadvertently limit the higher, pulsed flows deemed necessary by the fish-passage roadmap, even prior to its finalization.

We contend that independent evaluations of the pipeline and the fish-passage roadmap enable each project to disclaim accountability for potential adverse impacts on the other. In reality, both initiatives draw upon the same finite flow budget at Parteen, meaning a decision regarding one effectively limits the possibilities for the other.

7. Alternatives Copenhagen Benchmark, Kildare Groundwater, and the Modular Framework

The Consolidated Formal Submission (4 and 17) addresses the alternatives assessment failure in detail. Three further dimensions of the alternatives case are developed here.

A. 7.1 The Copenhagen / HOFOR Benchmark

Copenhagen is a European capital city with population and surface area comparable to Dublin and similar temperate maritime climate. HOFOR (Hovedstadens Forsyningsselskab) is the water authority supplying the Copenhagen metropolitan area. The comparison with the proposed Shannon-Dublin Pipeline is instructive and is presented to ACP as admissible evidence of what genuine supply resilience looks like in a comparable modern city:

Parameter	Copenhagen HOFOR	Dublin / Greater Dublin Area
Population served	1 million+ consumers	2 million (GDA)
Primary water source	100% groundwater borehole matrix	River Liffey (current); River Shannon (proposed)
Number of sources	Distributed matrix across the region	Single river currently; single pipeline proposed
Treatment required	No chlorination naturally clean groundwater	Full treatment: coagulation, flocculation, UV, chlorination
THM formation risk	Minimal groundwater very low in NOM	High Shannon high NOM from peatland catchments
Network leakage rate	6% (current operational)	43% (correct CRU definition, 2024)
Resilience	High failure of any single borehole does not affect supply	Low single pipeline failure halts supply to GDA
Ecological impact	Minimal no river abstraction, no SAC disturbance	Significant abstraction from Lower River Shannon SAC
Capital cost model	Distributed investment; no mega-project required	€4.58–10.4bn single pipeline proposed

The HOFOR system is not theoretical. It is fully operational, supplying over one million consumers, meeting EU Drinking Water Directive standards, with a network leakage rate of 6% against Ireland's correct national rate of 43% (CRU definition, 2024).

The River Shannon Environment Protection River Shannon Environmental Protection Alliance does not contend that Copenhagen's model can be transplanted to Dublin without modification. The purpose of the comparison is more precise:

- It demonstrates that a capital city of comparable size and climate can be served from distributed groundwater without a single large-scale river abstraction, without a 172km long-distance pipeline, and without the ecological disruption of abstracting from a protected SAC
- It demonstrates that 6% leakage is achievable in a modern, comparable urban water system as a current operational reality not an aspirational 2040 target. Ireland's 43% national rate is not inevitable; it reflects decades of underinvestment in network renewal that has continued while a €10.4bn pipeline has been promoted

- It demonstrates that true resilience multiple sources, no single critical point of failure is achievable without a single mega-project, using distributed investment rather than concentrated infrastructure

Ireland is not Copenhagen. But the question the EIA Directive requires to be answered is whether there is a 'significantly better environmental option that is technically feasible and not disproportionately costly' (WFD Article 4(7)(d)). A distributed groundwater approach achieving 6% leakage in Copenhagen suggests that Ireland's trajectory 43% leakage and a €10.4bn single-source pipeline is not the only available model. It is a choice, and it is a choice that has not been subjected to genuine project-level comparative assessment.

7.2 Kildare Groundwater: A Feasible Alternative Never Project-Level Assessed

The Kildare limestone aquifer system including the south Kildare Karst and the major unconfined limestone aquifer belt running through Counties Kildare and Laois is one of the most significant groundwater resources in Ireland. Its potential for sustainable water supply to the Greater Dublin Area has not been quantified or presented in the EIAR alternatives assessment at project level.

Kildare groundwater was among the 594 'feasible alternatives' identified at NWRP level. It was eliminated at strategic plan stage without project-level EIA assessment of: its sustainable yield under current and projected climate conditions; the capital cost of developing a distributed borehole network; the environmental impact compared to the proposed Shannon abstraction; the water quality characteristics relative to Shannon source water (including THM precursor content); and its potential contribution as part of a multi-source supply matrix alongside Poulaphouca and demand management.

ACP should require Uisce Éireann to provide this assessment before determining the application.

7.3 The Multi-Point Modular Supply System: The Correct Legal Framework

The correct question for this planning application is not 'is there a supply gap and can the Shannon pipeline fill it?' The correct question under the EIA Directive, the WFD, and the Habitats Directive is: 'what is the least environmentally damaging, most resilient, most cost-effective combination of measures that can sustainably meet the projected demand?'

That question has never been asked or answered at project EIA level. Only the Shannon pipeline has been developed to planning application stage. No alternative or combination of alternatives has been subjected to equivalent engineering, environmental, or economic assessment at project level.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that the following combination of measures which it terms a multi-point modular supply matrix is a legitimate and potentially superior environmental option under WFD Article 4(7)(d) that has never been genuinely assessed:

- Poulaphouca reservoir optimisation as the primary long-term supply buffer (148 billion litres active storage, already owned, already connected to the treatment and distribution network, already being used by Uisce Éireann as an interim measure see 34 of the Consolidated Formal Submission).
- Kildare groundwater matrix as a distributed baseload supply component with no river abstraction and minimal ecological impact. Incremental eastern river development (Barrow, Boyne, Slaney, Liffey) at environmentally tolerable abstraction rates, varied seasonally and by flow conditions.

- Aggressive demand management leakage reduction to 15% or below (EU/international standard); commercial user water efficiency requirements; progressive metering.
- A smaller, trigger-conditioned Lough Ree component (see 35.3 above) contributing to seasonal supply flexibility.

This approach delivers diversified supply from multiple catchments, no single point of failure, no 172km critical infrastructure entity, and no large-scale abstraction from the Lower River Shannon SAC. Its capital cost anchored to an asset (Poulaphouca) that already exists would be a fraction of the €4.58–10.4bn Shannon Pipeline. It has not been assessed. That assessment is required before this application can be lawfully determined.

8. Ecological Irreversibility the 1% Failure Rate and the Waddenzee Standard

The Consolidated Formal Submission (5) addresses the Habitats Directive standard under Article 6(3) and the specific internal contradiction in RtS Report para 49. This section addresses a further and equally fundamental dimension of the Habitats Directive case: the incompatibility of ecological irreversibility with any probability-based acceptance of harm.

8.1 The Core Ecological Principle

Environmental ecological impact is frequently irreversible and usually has long-lasting consequences. Sustaining habitats and protected SACs is not something that tolerates a failure rate however low that rate is expressed as a percentage of years or events. Even though extreme drought events may be rare and brief, like a forest fire, they cannot be factored into any modelling as 'acceptable.'

This is not an emotional argument. It is the scientific and legal basis of the Habitats Directive. Protected status is assigned to European sites precisely because the habitats and species concerned cannot recover from ecological harm within timescales relevant to human planning decisions. The salmon that fail to spawn in a drought year cannot be retrospectively restored. The common tern colony that is displaced from Lough Derg by a drawdown event cannot be recalled. The freshwater pearl mussel population damaged by low dissolved-oxygen conditions in a drought summer may not recover for a generation.

8.2 Why the EIAR's Concession Is Legally Fatal

Uisce Éireann's modelling concedes (RtS para 2626) that 'there would be measurable effects during extreme drought periods such as those in 1995 and 2018.' The EIAR presents these as rare events affecting perhaps 1–2% of modelling years and implicitly asks ACP to accept that the ecological consequences of 1–2% of years are a price worth paying for water supply security in the other 98–99%.

This framing is legally impermissible under the Habitats Directive. The reasons are specific:

- Atlantic salmon spawning beds: at 5% of conservation limits (Tipperary County Council, statutory submission), salmon eggs exposed during a drought drawdown event die. One failed spawning season at this population level is not recoverable within any operationally relevant timeframe. There is no margin for a 1% failure rate.
- Common tern breeding population on Lough Derg: NPWS conservation objectives identify the breeding population as having collapsed, with no breeding terns recorded during the 2024 survey. In these circumstances, even a short-duration drought-induced drawdown cannot simply be assumed to be acceptable for a qualifying SPA species.
- Alluvial forest and wetland habitats along 179km of Lough Derg shoreline: exposure of littoral habitat during drawdown affects plant communities, invertebrate populations, and the species that depend on them. These effects are not reversible when water levels return to normal.
- Freshwater pearl mussel critically endangered in the Shannon catchment, among the longest-lived invertebrates in Ireland, protected under Annex II of the Habitats Directive is highly sensitive to low-flow, low dissolved-oxygen conditions in summer drought. Populations that take decades to establish can be eliminated by a single adverse event.

8.3 The Waddenzee Standard Applied

The forest fire principle that a small probability of irreversible harm cannot be modelled as acceptable is the plain-English version of the CJEU's standard in Case C-127/02 (Waddenzee, 2004):

> *"The competent national authorities are to authorise the activity only if they have made certain that it will not adversely affect the integrity of that site. That is so when there is no reasonable scientific doubt as to the absence of such effects."* *CJEU, Case C-127/02, Waddenzee, 2004*

'No reasonable scientific doubt' is fundamentally incompatible with a 1% or 2% probability of ecological harm. The moment the EIAR concedes that there will be 'measurable effects during extreme drought periods' however rare, it has conceded the existence of reasonable scientific doubt. That concession ends the Article 6(3) assessment. It cannot be rescued by characterising the probability as low or the event as infrequent.

Under the precautionary principle (Article 191(2) TFEU) and the Habitats Directive standard as interpreted by the CJEU, a small but non-zero probability of irreversible ecological harm requires refusal, not consent with mitigation promises. The EIAR concedes the probability of harm. It does not establish and cannot establish the certainty of its absence.

Request to ACP — §8.3

ACP should require the NIS to address, for each qualifying interest of the Lower River Shannon SAC and associated SPAs, the ecological consequences of the 1995 and 2018 drought scenarios which the Applicant concedes will produce measurable effects for the conservation status of that qualifying interest over the 60-year operational life of the pipeline. The question is not whether these effects will occur: the Applicant concedes they will. The question is whether they constitute adverse effects on site integrity, and what the cumulative consequence of periodic such events is for the long-term conservation status of each qualifying interest. This analysis is missing from the NIS. Until it is provided, the Article 6(3) conclusion cannot be established to the Waddenzee standard of no reasonable scientific doubt.

9. Additional Requests to An Coimisiún Pleanála Arising from Sections 34–38

In addition to the consolidated requests at Section 32 of the Consolidated Formal Submission, the River Shannon Environment Protection River Shannon Environmental Protection Alliance makes the following specific additional requests arising from the new grounds advanced in Sections 34–38:

1. (arising from §10.3 — Drought / Cape Town ground) Require Uisce Éireann to model a three-year consecutive drought scenario in the Shannon catchment and to demonstrate at what point the pipeline would cease to supply the GDA, what Lough Derg lake levels would be at the end of each year, and what the contingency supply would be.
2. (arising from §4.6–4.7 — Feasible alternatives ground) Require Uisce Éireann to provide the full list of the 594 'feasible alternatives' from the NWRP screening, confirm what criteria were used to narrow from 594 to the preferred option, and confirm those criteria were applied using current (2026) cost, climate, and environmental data.
3. (arising from §4.8 — Lough Ree smaller abstraction) Require Uisce Éireann to confirm whether a smaller, trigger-conditioned Lough Ree abstraction as one component of a multi-source matrix was assessed at project EIA level, and if not, to provide that assessment.
4. (arising from §4.9 — 50km pipeline cost saving) Require Uisce Éireann to quantify the capital and operational cost saving from a Lough Ree origin pipeline (approximately 122km) versus the Parteen origin pipeline (172km) as part of a transparent cost-benefit comparison.
5. (arising from §6.1 — Ardnacrusha 20-day idling) Require Uisce Éireann to model the cumulative drawdown effect on Lough Derg lake levels over the 60-year operational life incorporating the routine annual 20-day Ardnacrusha idling periods (RtS para 2643) combined with periodic drought years.
6. (arising from §6.2 — Emergency derogation mechanism gap) Require Uisce Éireann to identify the specific legally binding mechanism planning condition, licence condition, or statutory agreement that would prevent emergency derogation from the Normal Operating Band in a prolonged drought, and to confirm no emergency planning power could override it.
7. (arising from §6.3 — Lough Derg as reservoir) Require Uisce Éireann to confirm that operating Lough Derg lake levels below the Normal Operating Band to maintain pipeline supply even under emergency conditions is legally permissible under the SAC and SPA designations of the water body, and to identify the legal basis on which it would be so.
8. (arising from §7.2 — Kildare groundwater) Require Uisce Éireann to provide a sustainable yield assessment for the Kildare groundwater system as a component of a multi-source GDA supply alternative, and to compare its capital cost, water quality, and environmental impact with the Shannon Pipeline.
9. (arising from §8 — Ecological irreversibility / Waddenzee standard) Require the NIS to address, for each qualifying interest of the Lower River Shannon SAC and associated SPAs, the ecological consequences of the conceded 'measurable effects' in 1995 and 2018 drought analogues over the 60-year operational life, and to demonstrate that these consequences do not constitute adverse effects on site integrity to the standard of no reasonable scientific doubt required under Waddenzee (C-127/02).

10. Habitats Directive Appropriate Assessment Standard Not Met

10.1 The Legal Standard

Article 6(3) of Directive 92/43/EEC permits consent only where the competent authority has ascertained that the project will not adversely affect the integrity of the site meaning no reasonable scientific doubt remains (Waddenzee, C-127/02). In Sweetman (C-258/11), the CJEU confirmed a project liable to undermine conservation objectives must be refused under Article 6(3) unless Article 6(4) derogation is available. In Holohan (C-461/17), the Court held a NIS must identify all aspects of the project likely to affect qualifying interests and must address all scientific evidence. Under People Over Wind (C-323/17), mitigation measures cannot be relied upon to exclude likely significant effects unless precisely defined, scientifically certain, fully secured, and demonstrably capable of eliminating adverse effects.

In the Irish courts: Callaghan v An Bord Pleanála [2018] IEHC 463, Concerned Residents of Treascon [2022] IEHC 595, and the broader body of High Court authority on Holohan confirm these standards are applied with full rigour in Irish law.

10.2 The Internal Contradiction in the RtS Report (Para 49)

Critical legal vulnerability RtS para 49

'While no adverse effects on the integrity of the Lower River Shannon SAC are predicted, some minor residual effects on biodiversity have been identified. However, these residual effects are limited in scale and extent and would not significantly affect the ecological structure, function, or overall biodiversity value of Parteen Basin.'

This formulation is legally incoherent under Article 6(3):

- It simultaneously concedes residual effects and asserts no adverse effect on integrity. Under Sweetman and Holohan, any residual effect on a qualifying habitat or species requires the competent authority to specifically explain, with scientific reasoning, why that effect does not constitute an adverse effect on integrity not simply to assert that it does not.
- The phrase 'would not significantly affect' imports an EIA-style materiality threshold into the Article 6(3) test. These are legally distinct standards. Article 6(3) does not permit a 'significance' filter between 'residual effect' and 'adverse effect on integrity.'
- Para 52 states the NIS 'applied the precautionary principle throughout' but under Waddenzee, the precautionary principle means uncertainty itself defeats the Article 6(3) conclusion. Scientific uncertainty about whether residual effects constitute adverse effects on integrity requires refusal, not a finding of compliance.
- Para 54 asserts Article 6(4) derogation is not required because Article 6(3) compliance has been established. This circular reasoning means ACP would be determining the application without any assessment of whether imperative reasons of overriding public interest, alternatives, and compensatory measures exist all of which are required under Article 6(4) if Article 6(3) is not met.

10.3 In-Combination Assessment Three Gaps

Cases C-293/17 and C-294/17 (Coöperatie Mobilisation, 2018) require in-combination effects across all plans and projects affecting the same European site. Three specific gaps:

- ESB Ardnacrusha scheme: the combined hydrological modification of the Shannon under drought conditions when both the hydroelectric diversion and the proposed abstraction operate against a reduced inflow has not been modelled as a single integrated scenario. The two systems are hydrologically interdependent but assessed in separate processes by separate applicants.
- ESB's pending abstraction/impoundment licence application: the environmental assessment of that application has not yet been conducted. In-combination effects of the two operations have never been assessed by a single competent authority on complete information for both.
- Third-party catchment abstractions: the Shannon supplies numerous other public water supply and industrial abstraction points whose cumulative burden on low-flow conditions during drought has not been specifically assessed in the NIS.

10.4 Qualifying Interests Not Fully Addressed Holohan Lacunae

The Lower River Shannon SAC (site code 002165) the Lough Derg SPA (site code 004058): and the other affected European sites support has multiple qualifying interests and conservation objectives. Holohan requires the NIS to address every qualifying interest that could be affected. Specific lacunae identified:

- Atlantic salmon flow regime thresholds for migration and spawning, sediment transport dynamics for spawning substrate, and the effect of temperature/dissolved oxygen changes under altered abstraction regimes during low-flow scenarios are not demonstrated
- Freshwater pearl mussel critically endangered; highly sensitive to flow regime, sedimentation, and water quality changes. The NIS treatment is inadequate given the species' conservation status
- Sea lamprey, river lamprey, brook lamprey species-specific minimum flow thresholds and seasonal migration cue flow not provided
- Common tern Lough Derg (Shannon) SPA no terns recorded in the 2024 survey. The SPA qualifying interest population has collapsed on the lake. The NIS does not address the contribution of the existing water level management regime to this collapse, or whether the proposed abstraction will further impede restoration
- Shannon Callows SPA no hydro-ecological analysis of whether the proposed abstraction will alter the timing or duration of floodplain inundation affecting the SPA's qualifying bird species (golden plover, lapwing, curlew, Bewick's swan)

10.5 Power v An Bord Pleanála Conservation Objectives

A live CJEU reference (Power v An Bord Pleanála) is awaiting a ruling as to whether a competent authority is precluded from carrying out an Appropriate Assessment without compliant, site-specific conservation objectives in place for the relevant European site. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP to identify whether all Natura 2000 sites within the hydrological zone of influence have adopted, legally compliant conservation objectives, and if any do not, to address this in light of the pending ruling.

11. Water Framework Directive Inadequate Compliance Assessment

11.1 The Legal Standard

Article 4(1)(a)(i) WFD imposes the obligation to prevent deterioration of all bodies of surface water. In Weser (C-461/13) the CJEU confirmed: (a) the prohibition on deterioration is an individually binding obligation at project consent stage; (b) any deterioration of even one quality element triggers the prohibition even if overall status classification is unchanged; (c) the competent authority must itself verify compliance it cannot rely solely on the Applicant's assessment.

SJK's statutory submission (§2.2.1) identifies a specific deficiency: the Water Status Impact Assessment Report (WSIAR) relies on UK Environment Agency guidance rather than the Common Implementation Strategy (CIS) guidance adopted by the European Commission. Post-Brexit UK guidance is not interpretatively authoritative in EU law. CIS Guidance Document No. 36 (2017) requires deterioration to be assessed at the level of individual biological, hydromorphological, and physico-chemical quality elements, with complete, precise, and definitive findings. Any reliance on 'risk-based' or 'not significant' reasoning is legally insufficient.

11.2 The 10m³/s Baseline: A 1929 Engineering Decision

The fundamental circularity

The 10m³/s statutory minimum compensation flow to the Old River Shannon below Parteen was established as part of the arrangements for the Ardnacrusha hydroelectric scheme, constructed 1925–1929. It was not determined by any ecological flow assessment, any WFD quality-element analysis, or any assessment of the conservation requirements of the Lower River Shannon SAC.

The WSIAR acknowledges (RtS para 35) that 'the assessment does not assume that the historic origin of the 10m³/s statutory minimum compensation flow is determinative for WFD compliance' yet it then uses exactly this flow as the operative baseline for its entire 'no deterioration' finding. This is circular: demonstrating 'no deterioration relative to baseline' says nothing about whether the baseline itself is WFD-compliant.

An Taisce (statutory submission) confirms: 'A robust ecological assessment of the 15km old river Shannon channel would likely highlight the need for far higher flows than the standard 10m³/s to meet the requirements of both WFD and Habitats Directive.' The State itself has tendered a project (Ref 7328234) to develop environmental flow recommendations and hydrological modelling for the Shannon scheme exactly the information needed to assess this application and it does not yet exist.

There are no flow-gauging stations on the Old River Shannon between Parteen Basin and the tidal limit at Limerick. The WSIAR's 'no deterioration' conclusion for this stretch is based entirely on modelled, unvalidated data. This is a fundamental evidential deficiency.

11.3 Article 4(8): Shannon Basin Integrity

SJK (§2.4) identifies Article 4(8) WFD: measures implemented must not permanently exclude or compromise achievement of the Directive's objectives in other bodies of water within the same river basin district. The Shannon River Basin District is a single hydrological unit. Permanent inter-basin transfer has never been assessed at the scale of the full Shannon basin's Programme of Measures under the Water Action Plan 2024. The documentation does not demonstrate that the abstraction during critical flow periods will not compromise the Shannon basin's Programme of Measures.

11.4 Article 4(7): Why Was No Derogation Assessment Conducted?

The Applicant states no Article 4(7) derogation analysis was needed because no deterioration is predicted (RtS para 2865). As demonstrated throughout this submission, that no-deterioration conclusion is not established on the available evidence. If there is a credible scientific case which the River Shannon Environment Protection River Shannon Environmental Protection Alliance contends there is that the abstraction will alter the hydromorphological regime of the Old River Shannon and Parteen Basin, the absence of an Article 4(7) analysis is a legal gap. Article 4(7) requires demonstration that: (1) all practicable mitigation steps are taken; (2) reasons are set out in the RBMP; (3) overriding public interest outweighs WFD objectives; and (4) beneficial objectives cannot be achieved by significantly better environmental options. Requirement (4) essentially restates the alternatives assessment obligation at WFD level a project that has not conducted a genuine EIA alternatives assessment has equally not met Article 4(7)(d).

12. Piecemeal Consenting: Abstraction Licence Sequencing

The Proposed Project is a drinking water supply infrastructure project. Its entire operational purpose is to abstract 154–300 Mld from Parteen Basin. Without the abstraction licence, the pipeline and WTP have no function. Yet the SID application seeks consent for the infrastructure without: (a) Uisce Éireann's own EPA abstraction licence even having been lodged; and (b) the ESB abstraction/impoundment licence which is a legal precondition of Uisce Éireann's application having been lodged. The Applicant acknowledges (RtS para 106) it intends to submit its licence application 'as soon as the ESB application is made.'

The HSE's submission (RtS para 101) notes the EIA scoping for the ESB abstraction licence began only in January 2026 after this planning application was substantially finalised. Cumulative and in-combination effects of the two interdependent operations have never been assessed by a single competent authority with access to complete information for both.

The principle that development consent cannot be artificially fragmented to avoid full cumulative environmental assessment is established in CJEU jurisprudence (Kraaijeveld, C-72/95) and in the Irish courts (An Taisce v An Bord Pleanála [2017] IECA 67). The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits ACP should not grant planning permission for this application while the two critical, interdependent abstraction licences remain unapplied-for and unassessed. Any consent should at minimum be conditioned so that construction cannot commence until both licences have been granted following completed EIAR processes.

13.Leakage CRU Enforcement Action, Rising Rates, Misleading Reporting, and the Collapsed Demand Case

The single most consequential set of facts in this submission from the Applicant's own Regulator

1. Leakage nationally went UP in 2022, 2023 and 2024 as confirmed by CRU published documents.
2. The CRU fined Uisce Éireann €20 million for missing its own legally binding leakage reduction targets: 176 million litres per day (Mld) of reduction was required between 2020 and 2024; only 90 Mld was achieved a shortfall of 86 Mld, equivalent to 49% of the committed target.
3. Uisce Éireann has been replacing an average of less than 0.3% of the mains water system per year over the last five years not the 0.4% it has published. The pipeline replacement rate is materially below even the inadequate rate publicly stated.
4. The true national leakage rate in 2024, applying the correct definition recently adopted by the CRU, is 43% not the figures Uisce Éireann has been reporting publicly.
5. Uisce Éireann's claim that leakage in the Greater Dublin Area is down to 29% is unsubstantiated: the CRU does not currently collect leakage data for specific Water Resource Zones (confirmed by CRU Commissioner to Emma Kennedy (consultant and Member of River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance). There is no data to verify this figure.

Every one of these facts was available when Uisce Éireann prepared its application to An Coimisiún Pleanála, and when it prepared its Response to Submissions Report (May 2026). None of them appears in the RtS Report in a form that honestly represents their significance. The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that these facts, taken together, are not peripheral to this application they are fatal to its core justification.

13.1 The Legal and Factual Significance: Why Leakage Is Not a Side Issue

Throughout this application and the RtS Report, Uisce Éireann has treated leakage reduction as a background measure being pursued in parallel with the proposed pipeline, not as an alternative to it. The River Shannon Environment Protection River Shannon Environmental Protection Alliance, the MPAG, and multiple other objectors have repeatedly challenged this framing on legal grounds specifically under Article 4(7)(d) of the Water Framework Directive, which requires demonstration that the project's objectives cannot be achieved by 'significantly better environmental options that are technically feasible and not disproportionately costly.'

The CRU's own enforcement action and the data from its published reports now transform this from a legal argument into a documented factual record. The Regulator not the River Shannon Environment Protection River Shannon Environmental Protection Alliance, not a campaign group has found that:

- Uisce Éireann failed to achieve its own committed leakage reduction targets between 2020 and 2024
- The shortfall is 86 million litres per day nearly half of the committed reduction
- National leakage is rising, not falling, over 2022–2024
- The network renewal rate is below even the already-inadequate rate that has been publicly stated

These are not contested propositions. They are findings of the statutory regulator, confirmed in published CRU documents. ACP cannot determine this application without confronting what they mean for the project's justification.

A. The WFD Article 4(7)(d) Dimension

Article 4(7)(d) WFD requires that the project's objectives cannot be achieved by a 'significantly better environmental option that is technically feasible and not disproportionately costly.' The MPAG Review Note (January 2024, Appendix D of this submission) found independently that the leakage alternatives analysis in the Preliminary Business Case 'did not follow best practice.' That was in January 2024, before the CRU enforcement action.

The CRU enforcement findings which post-date the MPAG review make the Article 4(7)(d) case substantially stronger. We are no longer arguing that leakage reduction is a theoretically viable alternative that was inadequately assessed. We can now demonstrate that leakage reduction has been demonstrably mismanaged; that the targets set were not achieved; that the rates claimed have not been independently verified; and that the publicly stated figures have been challenged by the Regulator itself through a €20 million enforcement action.

An alternative that the Applicant has failed to adequately pursue is not an alternative that has been genuinely tested and found wanting. It is an alternative whose potential has been undermined by poor performance. The question for ACP is whether an additional €4.58–10.4bn pipeline is the appropriate response to that underperformance or whether genuine, properly resourced, independently verified leakage reduction should be demonstrated first.

B. The EIA Directive Dimension

The Applicant's demand projections, and the supply-demand deficit that is the entire foundation of the project need case, are built on the assumption that leakage will be reduced to 25% nationally by 2030. This assumption has now been demonstrated to be unreliable:

- Leakage is going up, not down
- The pipeline replacement rate is below what was publicly stated
- A €20 million regulatory fine has been imposed for missing the 2020–2024 targets. Note: A further CRU enforcement action in July 2026 resulted in an additional penalty, with CRU data showing a leakage-specific reduction of only 59 megalitres per day against a target of 177.5 megalitres per day. ACP should require Uisce Éireann to confirm the full details of all CRU enforcement actions relating to leakage reduction targets in the period 2020–2026

If the leakage reduction trajectory underpinning the demand model is wrong, the supply-demand balance underpinning the project's need case is wrong. An EIAR whose demand projections rest on leakage reduction targets that the Applicant's own Regulator has found were not met is an EIAR that cannot be relied upon as an accurate assessment of the project need.

14. Leakage Went UP in 2022, 2023 and 2024

CRU confirmed: national leakage is rising, not falling

CRU published documents confirm that national leakage increased in 2022, 2023 and 2024. This is the opposite of the trajectory that the Preliminary Business Case, the EIAR demand projections, and the RtS Report all assume. The RSEPA requests that ACP note this finding and require Uisce Éireann to address it specifically in any further information it provides.

The trajectory of leakage as confirmed by CRU data is as follows:

Year	Headline leakage % (UÉ published)	Correct leakage % applying CRU definition (2024 basis)	Direction of travel	Status
2018	**46%**		▼ Falling (claimed)	Baseline: WSP project first proposed
2022	**37%**		**▲ Rising**	CRU: leakage INCREASED
2023	**36%**		**▲ Rising**	CRU: leakage INCREASED
2024	**36%**	**43%**	**▲ Rising**	CRU enforcement action; fined €20m
2030 (planned)	25% (target)		? Unachievable on current trajectory	Target already missed 2020–2024

The River Shannon Environment Protection River Shannon Environmental Protection Alliance draws ACP's attention to the gap in the 2018–2022 column. Uisce Éireann has consistently presented the headline figure of leakage reducing from 46% in 2018 to approximately 36–37% in 2022. This was the figure presented throughout the planning application and repeated in the RtS Report as evidence of the national leakage reduction programme making progress. CRU published documents now establish that over the same period, actual leakage was rising and that the correct national leakage figure, applying the definition the CRU has recently adopted, was 43% in 2024.

The implications are significant:

- The supply-demand balance in the EIAR incorporated a leakage reduction from 46% to a trajectory towards 25% as a reduction in per-capita demand. If the correct figure for 2024 is 43% and rising the assumed demand reduction has not materialised.
- The MPAG Review Note (January 2024) found that Census 2022 data had not been incorporated into the demand analysis. We now know that neither had the correct leakage figures. The demand projections underpinning the project need case are doubly unreliable.
- The 25% target for 2030 built into the EIAR has been demonstrated to be unachievable on the current trajectory given that the 2020–2024 targets were missed by 49%.

B. The €20 Million Regulatory Fine: What It Means

Uisce Éireann fined €20 million by its own Regulator for missing leakage targets

The CRU imposed a €20 million fine on Uisce Éireann for failure to achieve its legally binding leakage reduction targets between 2020 and 2024. The target was to reduce leakage by 176 million litres per day (Mld). The actual reduction achieved was 90 a shortfall of 86 Mld, representing 49% of the committed target undelivered.

This is not an academic observation about performance metrics. It is a formal regulatory enforcement action by the Commission for Regulation of Utilities (CRU) the same body whose HR Wallingford review the Applicant has repeatedly cited in the RtS Report as 'independent' endorsement of the project's business case. The facts are:

Metric	Target 2020–2024	Actual 2020–2024	Shortfall	% of target missed
Leakage reduction (Mld/day)	**176 Mld**	**90 Mld**	**86 Mld**	**49%**
CRU regulatory consequence			**€20 million fine imposed**	

The scale of the regulatory enforcement action is itself significant. A €20 million fine from a regulatory body is not a technical compliance matter. It reflects a finding that Uisce Éireann's performance fell materially below its statutory obligations over a sustained four-year period.

C. What 86 Mld of Unachieved Reduction Represents

The 86 Mld of unachieved leakage reduction is not an abstraction. It is a concrete quantity that can be compared directly with the project's own parameters:

- The initial operational capacity of the proposed Shannon-Dublin Pipeline is 154 Mld
- The 86 Mld unachieved leakage reduction represents 56% of that initial operational capacity
- Had Uisce Éireann achieved its own 2020–2024 leakage reduction target, the supply-demand gap in the Greater Dublin Area would have been reduced by 86 Mld more than half the initial pipeline capacity without any new abstraction, any new treatment plant, any new pipeline, or any environmental impact on the Lower River Shannon SAC
- The remaining shortfall between achieved leakage reduction and the 25% 2030 target is now significantly larger than it was assumed to be when the EIAR was prepared

Put differently: the Irish State is being asked to spend up to €10.4bn building a 172km pipeline to the River Shannon because Uisce Éireann failed to reduce leakage by 86 Mld when it was legally required to do so. The regulatory response to that failure has been a €20 million fine. The planning response to that failure cannot be the approval of a pipeline that will pipe new water into the same leaking network.

The logical position stated plainly

If Uisce Éireann had achieved its own 2020–2024 leakage reduction targets, the supply-demand gap would be approximately 86 Mld smaller than it currently is. The pipeline is being proposed, in part, to fill a gap that should not exist. The appropriate regulatory and planning response to a €20m enforcement action for missing leakage targets is to require those targets to be met before authorising a major new abstraction not to authorise the abstraction as a substitute for meeting them.

D. The CRU/HR Wallingford Endorsement in New Context

Throughout the RtS Report, the Applicant relies on the CRU's HR Wallingford External Assurance Review as evidence of independent endorsement of the project's business case. The River Shannon Environment Protection River Shannon Environmental Protection Alliance has addressed in the main submission (Appendix D, MPAG analysis) that the HR Wallingford review was a Public Spending Code compliance exercise concerned with cost estimation, scheduling, and governance not an environmental or ecological assessment.

There is now a further dimension: the CRU the same body that commissioned the HR Wallingford review subsequently imposed a €20 million enforcement fine on Uisce Éireann for missing its leakage reduction targets. These two CRU actions are in tension. The CRU cannot simultaneously be cited as endorsing the project's demand case (through the HR Wallingford review) while having found through its regulatory enforcement function that the leakage reduction programme whose performance underpins that demand case materially underperformed.

ACP should require the Applicant to specifically address how the CRU's enforcement action affects the demand projections in the EIAR, given that those projections assumed leakage reduction targets that the CRU has now found were missed by 49%.

15. Pipeline Replacement Rate: Below Even the Stated Figure

Uisce Éireann has published a figure of 0.4% of the mains water system being replaced per year. CRU data establishes that the actual average replacement rate over the last five years has been less than 0.3% per year.

This distinction matters for two reasons:

15. 1The Infrastructure Renewal Rate Has Direct Consequences for Leakage

Leakage from water mains is primarily a function of pipe age, pipe material, and ground conditions. The older and more deteriorated the pipe network, the higher the structural leakage rate. A mains replacement rate of less than 0.3% per year means the average mains pipe is not replaced for more than 333 years. At this renewal rate:

- The 2030 leakage reduction target of 25% cannot be achieved by infrastructure renewal alone it would require a simultaneous programme of active leak detection and repair at a scale that has not been resourced
- The structural leakage rate will continue to increase as the network ages further meaning the 'baseline' against which any future leakage reduction is measured is itself deteriorating
- Any supply added through the Shannon Pipeline will flow into a network that is ageing faster than it is being renewed

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that a pipeline replacement rate of less than 0.3% per year, combined with rising leakage rates and a missed 2020–2024 regulatory target, is inconsistent with any claim that the leakage alternative has been genuinely and adequately pursued as a demand-side measure.

15.2 The Published Figure Is Misleading

The gap between the published 0.4% figure and the actual less-than-0.3% figure is not a rounding issue. It represents a material overstatement of network renewal performance by Uisce Éireann. In the context of an application for a €4.58–10.4bn infrastructure project, where the adequacy of the leakage alternative has been repeatedly raised by the River Shannon Environment Protection River Shannon Environmental Protection Alliance, the MPAG, the CRU's own reviewers, and multiple other objectors, the publication of a materially higher renewal rate than has actually been achieved is a serious matter.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance does not characterise the discrepancy as deliberate misstatement. It may reflect different methodological definitions of what constitutes 'mains replacement.' However, the practical consequence is that decision-makers including the MPAG in January 2024, An Coimisiún Pleanála in these proceedings, and the public in the debate about this project have been working with infrastructure renewal data that overstates actual performance. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests that ACP require Uisce Éireann to provide the CRU's own data series on mains replacement rates and to reconcile it with the 0.4% figure published in the project documentation.

15.3 The Correct National Leakage Rate Is 43%, Not 36%

Uisce Éireann has reported national leakage at approximately 36–37% in its recent publications. The CRU has recently adopted a revised definition of leakage consistent with the definition used by water regulators across the EU and the UK under which the correct national leakage rate in 2024 is 43%.

15.4 Why the Definition Matters

Leakage in water supply networks can be measured and defined in several different ways:

- Real losses: water physically lost from the network through pipe bursts, joint failures, and reservoir leaks the narrowest definition
- Apparent losses: water that was delivered but not metered, billed, or recorded including theft, meter error, and unmetered supply
- Unbilled authorised consumption: water used by firefighting, street washing, and other public services that is not billed

A headline 'leakage' figure that uses only real losses and excludes apparent losses will be systematically lower than a figure using the full definition. The CRU's revised definition which the River Shannon Environment Protection River Shannon Environmental Protection Alliance understands to be consistent with EU and international best practice captures a broader measure of non-revenue water.

The difference between 36% and 43% is not a technicality. It is seven percentage points of national water production representing, at Ireland's total treated water output, hundreds of millions of litres per day of water that is being produced, treated, pumped, and paid for, but never beneficially used. The EIAR's leakage baseline of 36–37% understates the true scale of the problem by a margin that is material to the project need case.

15.5 The Supply-Demand Balance Is Materially Wrong

The supply-demand balance that forms the foundation of the project need case was calculated using the 36–37% leakage figure, not the 43% figure that reflects the correct definition. This means:

- The demand-side saving assumed from achieving the 2030 leakage target of 25% is calculated from a wrong baseline the actual saving from achieving 25% real losses would be larger than calculated, because the true starting point is 43%, not 36–37%
- Conversely, the trajectory to 25% is further from the true baseline than the EIAR assumes, making the 2030 target even harder to achieve than the EIAR's modelling already shows
- The EIAR's analysis of what level of leakage reduction would be required to eliminate or substantially reduce the supply-demand gap is based on incorrect starting data

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that ACP must require Uisce Éireann to recalculate the supply-demand balance using the CRU's correct 43% leakage baseline, and to restate the project need case on that basis. Until that recalculation is produced and independently verified, the demand case for this project rests on foundations that the Regulator's own data has undermined.

15.6 The Greater Dublin Area 29% Figure Is Unverified

No data exists to verify the claimed 29% GDA leakage figure confirmed by CRU Uisce Éireann has stated that leakage in the Greater Dublin Area is down to 29%. The CRU does not currently collect leakage data for specific Water Resource Zones, including the Greater Dublin Area. This was confirmed by CRU. There is therefore no independent data source against which the 29% GDA figure can be verified. It is Uisce Éireann's own figure, unaudited by the regulator, unverifiable by any external party, and unsupported by any data series that is available to ACP, to the public, or to this process.

The significance of this extends well beyond the GDA figure itself. The GDA is the primary demand zone that this pipeline is being built to serve. The supply-demand gap that justifies the project is calculated against the GDA's forecast demand and the GDA's existing and projected supply. If the leakage figure for the GDA the primary variable in that calculation cannot be independently verified because the CRU does not collect Water Resource Zone-level leakage data, then the central demand case for the project is built on unverifiable data.

This is not a peripheral point about data quality. It is a fundamental challenge to the transparency and verifiability of the project need case. Article 5(1) of the EIA Directive requires the EIAR to contain adequate information about the project and its impacts. A demand case built on a GDA leakage figure that neither the regulator nor the public can independently verify is not adequate information. It is an assertion.

15.7 What Independent Verification Would Require

For ACP to be able to assess whether the supply-demand gap in the GDA justifies a €4.58–10.4bn pipeline, it would need at minimum:

- A Water Resource Zone-level leakage dataset, collected and audited by the CRU or an independent verifier, using the correct CRU definition of leakage
- A specific supply-demand balance for the GDA/Eastern Water Resource Zone using that verified dataset
- A sensitivity analysis showing the supply-demand gap under different leakage reduction scenarios (25% by 2030 as planned; 20% by 2035; 15% by 2040 as a European-standard target)
- An independent audit of the GDA supply and demand data, not produced by or on behalf of Uisce Éireann

None of these currently exists. ACP is being asked to determine the largest water infrastructure investment in the history of the Irish State on the basis of a demand case whose primary variable cannot be independently verified.

15.8 The Pattern of Misleading Leakage Reporting

The River Shannon Environment Protection River Shannon Environmental Protection Alliance draws ACP's attention to the cumulative pattern that emerges from the CRU data:

- National leakage stated as 36%; correct figure under CRU definition is 43%
- Network renewal rate stated as 0.4%; actual rate established by CRU data as less than 0.3%
- Leakage trajectory stated as reducing; CRU confirms it rose in 2022, 2023 and 2024
- 2020–2024 leakage reduction target of 176 Mld stated as being pursued; CRU found only 90 Mld achieved; €20 million fine imposed

- GDA leakage stated as 29%; CRU confirms no data exists to verify this figure

Each individual discrepancy might be explained as a methodological difference or a data collection gap. The cumulative pattern in which every stated figure systematically presents a more favourable picture of leakage performance than the data supports is a concern that ACP should address directly.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance is not making an allegation of dishonesty. It is making an evidentiary observation: a project whose demand case rests on leakage data that has been found, in multiple respects and by the project's own regulator, to be materially inaccurate or unverifiable, is a project whose demand case ACP cannot accept at face value. The Regulator's enforcement action confirms this.

15.9 What the CRU Data Does to the Supply-Demand Balance

The combined effect of the correct leakage data 43% nationally (not 36–37%), rising (not falling), with the 2030 target of 25% now demonstrably unachievable on current trajectory on the supply-demand balance that underpins the project need case is profound. The River Shannon Environment Protection River Shannon Environmental Protection Alliance sets out the key implications in summary form:

Parameter	As assumed in EIAR	As established by CRU data	Impact on project need case
National leakage rate (2024)	36–37%	**43%**	Demand baseline understated. True demand gap is different from assumed.
Leakage trend 2022–2024	Falling (projected)	**RISING**	Supply-demand balance worsening faster than projected but NOT because of shortage. Because of uncontrolled loss.
2020–2024 target (176 Mld reduction)	On track (assumed)	**Only 90 Mld achieved. Missed by 86 Mld (49%).**	86 Mld of supply gap should not exist. It exists only because regulatory targets were missed.
2030 target: 25% national leakage	Achievable (projected)	**Unachievable on current trajectory given missed 2020–2024 targets and rising trend.**	Demand-side saving assumed in EIAR will not materialise. Gap will be larger than projected.
GDA leakage rate (29%)	Stated by UÉ	**No independent verification exists. CRU does not collect WRZ-level leakage data. (CRU Commissioner Kennedy)**	Primary demand zone leakage figure is unverifiable. Core demand calculation is based on unaudited data.
Mains replacement rate	0.4% per year (published by UÉ)	**<0.3% per year (CRU data)**	Network renewal rate is below stated figure. Structural leakage will continue to increase. Supply added by pipeline will flow into a deteriorating network.

The bottom line

If the CRU's own data is used instead of Uisce Éireann's published figures, the supply-demand deficit is: (a) larger, because the true leakage baseline is 43% not 36–37%; (b) more slowly closing, because leakage is rising not falling; (c) partly self-created, because 86 Mld of the deficit represents targets Uisce Éireann was legally required to meet and did not; and (d) built on an unverifiable GDA figure that the Regulator cannot independently confirm. The case for an immediate €4.58–10.4bn pipeline on these numbers has not been made.

15.10 Specific Requests to An Coimisiún Pleanála Arising from This Ground

The River Shannon Environment Protection River Shannon Environmental Protection Alliance makes the following specific requests arising from the CRU data, the enforcement action, and the leakage reporting concerns:

1. REQUIRE Uisce Éireann to provide, on the public file, the CRU's own published data series on national leakage rates for 2018–2024, applying the CRU's correct definition, and to reconcile this with the 36–37% figures published in the EIAR and RtS Report.
2. REQUIRE Uisce Éireann to provide a specific statement of the national leakage rate in 2024 applying the CRU's revised definition and to update the supply-demand balance in the EIAR using the correct 43% baseline.
3. REQUIRE Uisce Éireann to confirm the volume of leakage reduction achieved in each year from 2020 to 2024, the target for each year, the cumulative shortfall, and the regulatory consequence including formal acknowledgment of the CRU's €20 million enforcement action.
4. REQUIRE Uisce Éireann to provide the CRU's data on mains replacement rates for the last five years and to reconcile this with the 0.4% figure published in the project documentation.
5. REQUIRE Uisce Éireann to confirm whether any independent, CRU-audited leakage data exists for the Greater Dublin Area / Eastern Water Resource Zone, and if not, to acknowledge that the 29% GDA leakage figure relied upon in the supply-demand balance is an unverified internal estimate.
6. REQUIRE Uisce Éireann to produce a revised supply-demand balance that: (a) uses the 43% correct national leakage baseline; (b) reflects the actual 2020–2024 leakage trajectory (rising, not falling); (c) incorporates a revised leakage reduction trajectory consistent with the actual performance record; and (d) demonstrates the supply-demand gap that would remain if leakage reduction targets from 2025 to 2040 are met in full before any additional abstraction from any source is considered.
7. REQUIRE Uisce Éireann, in the context of the demand case for this project, to specifically address how the CRU's €20 million enforcement action for missing leakage targets affects the demand projections in the EIAR, given that those projections assumed compliance with the targets that were not achieved.
8. NOT GRANT consent for this application until the supply-demand balance has been independently verified using CRU-audited leakage data, and until it has been demonstrated with evidence, not assertion that the achievable demand-side saving from genuine, properly resourced, independently verified leakage reduction to EU-standard levels (15% real losses) has been quantified and compared against the environmental and financial cost of the proposed pipeline.

15.11 Leakage Elimination: A Mandatory Article 4(7)(d) Consideration

Article 4(7)(d) WFD requires that the objectives pursued cannot be achieved by 'significantly better environmental options that are technically feasible and not disproportionately costly.' SJK (§3.2–3.3) identifies that the project documentation does not present:

- A quantified leakage elimination strategy
- A cost-benefit comparison between large-scale abstraction and network renewal
- A business case addressing the cost of treating water (coagulation, flocculation, chemical dosing, UV disinfection, pumping energy, infrastructure maintenance, all OPEX) that is subsequently lost to leakage

- An assessment of the carbon emissions associated with treating and pumping water that is never delivered to end users

Sabrina Joyce Kemper makes the irrationality argument: 'It is prima facie irrational to abstract and treat additional raw water while continuing to permit a substantial proportion of treated water to leak into the subsurface environment.' Uisce Éireann's own figures show 46% treated water loss in 2018 when this project was first proposed, falling to 36% in 2022, with a planned reduction only to 25% by 2030. The independent Maublanc/Hydratec review (An Fóram Uisce, 2019) found that international benchmarks Malta (70% leakage reduction in 12 years), Portugal/Lisbon (70% in 8 years), Scotland (48% in 7 years) demonstrate far more aggressive leakage reduction is achievable than UÉ's targets assume. The RtS Report (Ch 27.6) dismisses the carbon cost comparison as 'not relevant to the SID planning application.' This dismissal is not WFD-compliant: Article 4(7)(d) specifically requires assessment of significantly better environmental alternatives, of which leakage reduction is the most directly relevant.

The Applicant's own dismissal of the carbon comparison (RtS para 3104–3105) is legally deficient

Section 15 of the Climate Action and Low Carbon Development (Amendment) Act 2021 requires ACP, when performing its functions, to have regard to Ireland's carbon budgets. The carbon cost of treating and pumping 36% of the project's yield into the ground is a material omission from EIAR Chapter 13. Referencing the NWRP SEA as the locus of the relevant climate assessment is not a substitute for project-level EIA the NWRP SEA was not conducted under EIAR conditions and did not quantify the carbon cost of the leakage scenario.

16. UKTAG Methodology: Unvalidated and Selectively Applied

Friends of the Irish Environment (RtS para 2983) state that the proposed abstraction exceeds UKTAG low-flow percentage benchmarks when measured against the Q95 value in the Applicant's own modelling data, and that 'compliance with UKTAG river standards has not been demonstrated' on the figures presented.

The Applicant (paras 2985–2992) simultaneously: (a) relies on UKTAG thresholds as confirmation the project passes the relevant hydrological tests ('The Proposed Project passed the UKTAG test' para 2992); and (b) dismisses UKTAG as non-statutory and non-determinative when an objector demonstrates the project may fail those same thresholds. This selective invocation is not intellectually coherent. The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits either UKTAG thresholds are relevant in which case the exceedance at Q95 is a finding ACP must address or they are not relevant, in which case the 'passed the UKTAG test' claim must be withdrawn.

The Applicant also concedes (para 2991) that UKTAG lake-level thresholds have not been 'empirically calibrated against Irish EPA biological class-boundary metrics.' If the thresholds are not calibrated against Irish ecological quality element boundaries, neither a pass nor a failure tells us anything reliable about WFD deterioration making the UKTAG analysis worthless as WFD evidence either way. ACP should require either (a) an Irish-specific calibration of UKTAG thresholds against Irish EPA biological class boundaries; or (b) a WFD compliance assessment based purely on CIS guidance and Irish EPA biological monitoring methodology without UKTAG reliance.

17. Climate Emergency: Ireland's Statutory Obligations

Section 15 of the Climate Action and Low Carbon Development (Amendment) Act 2021 requires public bodies, when performing their functions, to have regard to the national climate objective, climate action plans, and carbon budgets. In Friends of the Irish Environment v An Bord Pleanála [2021] IEHC 50, the High Court confirmed planning bodies must meaningfully engage with climate obligations, not merely note them.

Three climate-specific grounds:

17.1 Project Emissions and Cumulative Sectoral Budget

The Applicant states annualised GHG emissions of 11,628 tCO2eq equivalent to 0.04% of Ireland's 2030 Non-ETS target (para 2109). The 0.04% framing is technically accurate for a single project but misses the cumulative question: does the State have headroom in its sectoral ceilings for this and all other major infrastructure projects competing for the same shrinking carbon budget? The RtS Report does not attempt to answer this. Section 15 of the Climate Action Act requires meaningful engagement with this dimension.

17.2 Drought Modelling: Historical Basis and Compound Events

> *"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."* *River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance, quoted at RtS Report para 1441*

The Applicant's RCP8.5 Upper 75th percentile adjustment applied to the historical model is a genuine attempt at forward projection, but it is an adjustment to historical observations not first-principles climate modelling. This approach underestimates the tails of the distribution: compound, consecutive-year droughts that are most ecologically damaging and are projected by ICARUS (Maynooth University) and Met Éireann to increase in frequency and severity in the Irish Midlands.

17.3 Real-World Evidence on Drought Risk — Cape Town and the Loire

The River Shannon Environment Protection River Shannon Environmental Protection Alliance argues extensively that the Uisce Eireann’s hydrological modelling does not adequately capture compound drought risk, and that the EU Water Resilience Strategy argues against single-source critical infrastructure. The River Shannon Environment Protection River Shannon Environmental Protection Alliance provides two concrete, documented real-world examples that should be before ACP. These are not hypothetical scenarios they are recent events from comparable modern water systems.

Cape Town: 'Day Zero' How a Modern City with Multiple Reservoirs Nearly Ran Dry

Cape Town, South Africa, 2015–2018

Cape Town has several large storage reservoirs and a sophisticated water management system. Between 2015 and 2018, a record three-year drought caused combined reservoir storage to fall to 13% of total capacity a level at which water pressure could not be maintained in the distribution network. The city faced 'Day Zero' the point at which municipal water supply would be shut off and residents required to collect rations from central distribution points. Only aggressive emergency rationing (50 litres per person per day, reduced from 87) averted the shut-off. Recovery took years after rainfall returned.

The lessons for this application are specific and direct:

- Cape Town had multiple reservoirs not a single pipeline from a single distant river. Yet a three-year drought still brought the city to the edge of 'Day Zero.' The proposed Shannon-Dublin Pipeline is a single source from a single river. If an event comparable to Cape Town's 2015–2018 drought struck the Shannon catchment, there would be no fallback.
- The 2018 drought on the Shannon during which ESB data shows Ardnacrusha took zero water for 74 consecutive days is not an outlier. It is a recent, documented analogue for the type of event that brought Cape Town to near-crisis even with multiple reservoirs.
- Climate change projections including ICARUS data on the Shannon Midlands indicate that compound multi-year droughts of the Cape Town type are becoming more probable in Ireland's climate trajectory. The project's hydrological modelling uses a 52-year historical dataset (1972–2023) that contains only two significant drought events (1995 and 2018) and does not model consecutive multi-year drought sequences.
- Cape Town's survival depended on demand restriction to 50 litres per person per day. At the proposed 300 Mld peak abstraction from the Shannon, the supply to the Greater Dublin Area will include large non-domestic users (data centres, industry) whose demand is not obviously compressible in the way domestic demand is. The demand-side flexibility assumptions embedded in the project's drought-scenario analysis have not been tested against a real multi-year drought scenario.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that ACP should require the Applicant to model explicitly the scenario of a Cape Town-type three-year compound drought in the Shannon catchment specifically: at what point in such a drought would the Shannon Pipeline cease to be able to supply the GDA, and what is the proposed contingency supply? The EIAR does not answer this question.

17.4 River-Dependent Infrastructure in a Climate Emergency — France (July 2026)

The River Shannon Environment Protection River Shannon Environmental Protection Alliance notes that in July 2026 flows in several major rivers in France have dwindled with corresponding rise in temperature, forcing the partial or complete shutdown of several nuclear power stations due to lack of cooling water. This is a real-time, contemporaneous example occurring within weeks of this submission being written of river-dependent infrastructure being rendered inoperable by low river flows.

The relevance to this application is straightforward:

- The River Shannon's flow is directly affected by drought in exactly the same way as the Loire. The Shannon at Parteen Basin during the 2018 drought provided zero operational flow for Ardnacrusha for 74 consecutive days.
- The French example demonstrates that even in modern, well-managed European river systems, extreme low-flow events can render river-dependent infrastructure non-operational. France's nuclear programme which is rather more consequential in energy security terms than Dublin's water supply was unable to operate during a summer drought.
- The proposed pipeline is a river-dependent infrastructure system. Its peak demand on hot summer days when Dublin's water consumption is highest will coincide precisely with the Shannon's lowest available flow: summer drought conditions. This is the opposite of a resilient design.

These two real-world examples Cape Town and the rivers in France demonstrate that the risk scenarios the River Shannon Environment Protection River Shannon Environmental Protection Alliance, SJK, and other objectors have identified are not theoretical. They are the type of events that occur in modern, well-managed water and infrastructure systems under climate stress. They should be before ACP as admissible real-world evidence when it assesses the project's resilience case.

18 A Smaller, Trigger-Conditioned Lough Ree Abstraction as Part of a Multi-Source Matrix

The Consolidated Formal Submission develops the Lough Ree / Lough Derg inconsistency at length the argument that Uisce Éireann applied an environmental objection to five Lough Derg abstraction points that applies with equal force to Parteen Basin, because they are the same connected lake. River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission adds two further points on Lough Ree that are not in the existing material.

18.1 A Smaller Lough Ree Abstraction, Combined with Other Sources

Uisce Éireann rejected abstraction from Lough Ree on two grounds (RtS para 372): first, that 'ESB minimum normal operation levels for the Shannon at Lough Ree were not maintained during the 1995 drought without an abstraction'; and second, that such abstraction 'would likely have a negative environmental impact.' Both grounds were applied to the full-scale abstraction envisaged at strategic plan level 300+ Mld at full operation.

River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies a point that Uisce Éireann's screening did not consider: a smaller, environmentally tolerable abstraction from Lough Ree, as one component of a multi-source resilient supply matrix, rather than as a standalone full replacement for the Shannon-Dublin Pipeline.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that this is a genuinely different option from the one Uisce Éireann assessed and rejected. The two grounds for rejection ESB minimum levels during drought and negative environmental impact may both be manageable at a smaller abstraction scale, combined with:

- Trigger mechanisms that suspend Lough Ree abstraction below defined flow thresholds (analogous to the ESB minimum level already applicable at Parteen), thus addressing the drought resilience concern
- Seasonal abstraction restricted to periods of high flow, with storage at Poulaphouca compensating for periods when Lough Ree flow is insufficient
- Environmental conditions requiring abstraction to cease if ecological indicators cross defined thresholds a condition-based, adaptive approach rather than a fixed-rate abstraction

A multi-source matrix that includes a modest, trigger-conditioned Lough Ree component, combined with Poulaphouca optimisation, Kildare groundwater, and demand management, has never been assessed at project EIA level. Uisce Éireann's rejection of Lough Ree as a full-scale single alternative does not constitute assessment of Lough Ree as a component of a diversified portfolio approach. These are different options and the EIA Directive requires the former not to preclude assessment of the latter.

18.2 The Cost-Benefit of a 50km Shorter Pipeline — A Question Never Asked

River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance asks a question that does not appear anywhere in the 585-page RtS Report: 'Was the cost-benefit of reducing the pipeline length by 50km considered?'

Lough Ree is approximately 55km north of Lough Derg/Parteen Basin. The proposed pipeline from Parteen Basin to Dublin is 172km. A pipeline originating at Lough Ree would be approximately 122km a saving of roughly 50km of pipeline, which at current infrastructure cost rates represents a saving of hundreds of millions of euros in capital expenditure alone, before accounting for pumping energy, operational costs, and maintenance over a 60-year life.

This is not a trivial consideration to have been left unasked. At the MPAG-confirmed upper cost range of €10.4bn for the Parteen–Dublin option, the cost-per-kilometre of the pipeline infrastructure is substantial. A systematic cost-benefit analysis comparing the Parteen option against a Lough Ree option even one recognising the latter's lower dry-weather yield would provide a quantified basis for the trade-off between cost and drought-condition security. No such analysis has ever been published.

ACP should require Uisce Éireann to confirm whether the cost-benefit of a Lough Ree abstraction with a 122km pipeline, as a partial alternative or supplementary source to the Parteen abstraction, was ever quantified. If it was not, that is a gap in the alternatives assessment. If it was, it should be on the public file.

19. Ardnacrusha

The River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies three connected operational points about the operational reality of Lough Derg/Parteen Basin that are not fully developed in the Consolidated Formal Submission.

19.1 Ardnacrusha

At RtS Report Section 2643, Uisce Éireann states that in extreme droughts, ESB would cease generation at Ardnacrusha as they already do 'on average 20 days per year already.'

This is the Applicant's own data, in its own document, and it is devastating to the project's drought-resilience case. Ardnacrusha's turbines already shut down for an average of approximately 20 days per year under current conditions with no additional abstraction. This means the 74-day 2018 shutdown was an extreme version of a phenomenon that happens every single year.

- During those 20 days per year (approximately 5.5% of the year) when Ardnacrusha already idles, the only water available at Parteen is the statutory $10m^3/s$ compensation flow plus any natural inflow.
- Adding a 3.47 m^3/s pipeline abstraction to those days means that during the routine annual shut-down periods not just extreme drought years the pipeline would need to draw from Lough Derg storage.
- Over the operational life of the project, if Ardnacrusha idles for 20 days per year, the pipeline will be drawing from lake storage for approximately 20 days per year, every year not just in exceptional drought years.
- The cumulative drawdown effect on Lough Derg lake levels over a 60-year operational life, from routine annual 20-day idling periods plus occasional drought years, has not been assessed in the EIAR.

The 20 days per year figure transforms the drought scenario from an exceptional risk to a routine operational challenge. The EIAR presents the 2018 drought as a worst-case scenario affecting 74 days. The correct framing, on Uisce Éireann's own admission, is that conditions requiring lake-storage drawdown will occur every year and that conditions requiring it for weeks at a time will occur regularly, not once per generation.

19.2 Emergency Derogation from the Normal Operating Band — The Mechanism Gap

The River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission — why this must be addressed by ACP

The River Shannon Environment Protection River Shannon Environmental Protection Alliance makes a specific prediction: 'In a drought crisis, emergency/exceptional permissions will be granted to maintain supply to homes and data centres, and UÉ will continue to draw water down below the current ESB Lower Operating Band while the drought persists. But Lough Derg is a protected waterbody. The interference with habitats, especially along the shorelines, is forbidden.'

This prediction goes to the heart of the Habitats Directive compliance case. The Applicant's entire Article 6(3) Appropriate Assessment rests on the proposition that Lough Derg/Parteen lake levels will be maintained within the Normal Operating Band during the operation of the pipeline. River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission identifies the operational reality that the Applicant has not addressed:

- During a prolonged drought when Ardnacrusha has already been idle for weeks, when Lough Derg is already at the lower end of its Normal Operating Band, and when Dublin is short of water the political and operational pressure to continue abstracting water from the pipeline, even if this requires drawing lake levels below the Normal Operating Band, will be overwhelming.
- There is no legally binding mechanism in the planning application or the EIAR that would prevent emergency derogations from the Normal Operating Band in such circumstances. 'Emergency permissions' under section 181A of the Planning and Development Act 2000 exist precisely to allow infrastructure to operate outside normal consent conditions in a declared emergency.
- If emergency permissions are granted to draw Lough Derg below the Normal Operating Band as River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance predicts will happen this will breach the habitat thresholds that form the entire basis of the Article 6(3) 'no adverse effect on integrity' conclusion. The NIS's integrity conclusion is therefore conditional on a promise of operational restraint that cannot be legally guaranteed.
- The Applicant has never addressed what would happen to the Lower River Shannon SAC habitats and qualifying species if the Normal Operating Band were breached during a sustained drought. The NIS models compliance with the Band as a given. It does not model the ecological consequences of Band breach, because it asserts Band breach will not occur. But it cannot guarantee this.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that this is precisely the kind of 'reasonable scientific doubt' that, under Waddenzee (C-127/02) and Sweetman (C-258/11), defeats the Article 6(3) conclusion. If there is a credible, foreseeable scenario and the River Shannon Environment Protection River Shannon Environmental Protection Alliance has identified one with specificity in which the ecological protections relied upon in the NIS will be breached, the precautionary principle requires refusal under Article 6(3), not consent with a crossed-fingers assurance that it will not happen.

19.4 Lough Derg Is a Protected SAC and SPA — It Cannot Be Operated as a Demand-Management Reservoir

River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission identifies a framing issue that goes to the constitutional validity of the project's operational concept: 'The pipeline project intends to treat Lough Derg as a reservoir.'

This is factually accurate and legally significant. The operational logic of the project during drought conditions drawing on Lough Derg Lake storage when flow is insufficient to meet the pipeline abstraction alongside the statutory compensation flow treats the lough as a storage reservoir whose level can be managed up and down to meet downstream demand. But Lough Derg is not a reservoir in the legal sense. It is:

- A designated Special Area of Conservation (Lower River Shannon SAC, site code 002165) under the Habitats Directive (92/43/EEC).
- Part of the Lough Derg (Shannon) SPA and the Shannon Callows SPA, designated under the Birds Directive, supporting qualifying bird species including Common Tern, Whooper Swan and Greenland White-fronted Goose, whose habitats and conservation objectives are influenced by the hydrological regime.

- A Heavily Modified Water Body (Lough Derg HMWB) under the WFD, subject to Good Ecological Potential requirements.
- A waterbody in respect of which Ireland is obligated under the WFD to implement a Programme of Measures that includes environmental flow requirements.

Operating Lough Derg as a demand-management reservoir drawing it down during drought to maintain pipeline supply is incompatible with all of these designations. The interference with habitats along the 179km of Lough Derg shoreline (including islands) that would result from drawing lake levels below the Normal Operating Band is, as River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance states, 'forbidden' under the Habitats Directive. Unless Uisce Éireann can demonstrate not assert how this scenario can be prevented from occurring during a prolonged drought, the pipeline project cannot be permitted to proceed.

This submission is made in mid July 2026. Ireland is currently experiencing an extreme hydrological drought. Met Éireann's Drought Monitor for July 2026 classifies the Shannon Midlands and surrounding regions as experiencing Severe drought conditions (SPEI classification). OPW river gauge #25017 data for the Shannon at Banagher shows level already in the lower 5% band of the annual average flow. As hydrological droughts lag daily weather observations, it remains to be seen how serious this drought becomes, and to what degree and duration low flows into Lough Derg will occur. Ardnacrusha hydroelectric station is already generating with one turbine, only for very short periods, and does so to regulate the water level in Parteen Basin within the normal operating band, to preserve the integrity of the man made walls of the Parteen Basin and Headrace canal.

The specific request to ACP arising from this ground

ACP should require Uisce Éireann to provide a specific, legally binding operational protocol not an EIAR assurance that defines: (a) the precise trigger conditions under which Lough Derg lake level would fall below the Normal Operating Band as a result of the pipeline abstraction during drought; (b) the specific mechanism that would prevent pipeline abstraction from continuing in those circumstances; and (c) the legal instrument (planning condition, licence condition, or statutory agreement) that would make that operational protocol enforceable without the possibility of emergency derogation. If no such mechanism can be identified, the Article 6(3) integrity conclusion falls.

20. The Copenhagen / HOFOR Benchmark

The River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies a specific international benchmark that does not appear anywhere in the 585-page RtS Report and has not been addressed in the existing consolidated submission: the example of Copenhagen's water supply system operated by HOFOR (Hovedstadens Forsyningsselskab).

20.1 The Copenhagen Benchmark

Copenhagen is a European capital city with a population and surface area comparable to Dublin. Its climate and rainfall are similar temperate maritime. It presents an instructive contrast to the proposed Shannon-Dublin Pipeline:

Parameter	Copenhagen (HOFOR)	Dublin / Greater Dublin Area
Population served	1 million+ consumers	2 million (GDA)
City area / climate	Like Dublin; temperate maritime	Temperate maritime
Primary water source	100% groundwater from borehole matrix	River Liffey / currently proposed: River Shannon
Number of sources	Distributed matrix of boreholes across region	Single river (currently); single pipeline (proposed)
Treatment required	No chlorination required naturally clean	Full treatment required: coagulation, flocculation, UV, chlorination
THM formation risk	Minimal groundwater has very low NOM	High Shannon has high NOM from peatland catchments
Network leakage	6% (current)	43% (correct CRU definition, 2024)
Resilience	High failure of any single borehole does not affect supply	Low single pipeline failure halts supply to GDA
Ecological impact	Minimal no river abstraction, no SAC disturbance	Significant abstraction from Lower River Shannon SAC
Capital cost of supply model	Distributed investment; no mega-project required	€10.4bn pipeline proposed

The HOFOR model is not theoretical or experimental. It is a fully operational system that has served over one million consumers in the Copenhagen metropolitan area for decades, meeting EU Drinking Water Directive standards, with a network leakage rate of 6% compared to Ireland's correct national rate of 43% (CRU definition, 2024).

The River Shannon Environment Protection River Shannon Environmental Protection Alliance does not contend that Copenhagen's model can be transplanted to Dublin without modification the geology, the existing infrastructure, and the scale differ. The purpose of the comparison is different and more precise:

- It demonstrates that a capital city of comparable size and climate can be served entirely from distributed groundwater without a single large-scale river abstraction, without long-distance pipeline transfer, and without the ecological disruption associated with abstracting from a protected SAC
- It demonstrates that a 6% leakage rate is achievable in a modern, comparable urban water system not as an aspirational future target, but as a current operational reality. Ireland's 43% national rate is not

inevitable: it is a consequence of underinvestment in network renewal that has persisted while €10.4bn pipeline options have been promoted

- It demonstrates that true resilience multiple sources, no single point of failure is achievable without a single mega-project

20.2 Kildare Groundwater — A Feasible Alternative Never Project-Level Assessed

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that 'a matrix of multiple boreholes across the aquifers of Kildare' as part of a resilient multi-source supply alternative. The Kildare limestone aquifer system including the south Kildare Karst and the major unconfined limestone aquifer belt is one of the most significant groundwater resources in Ireland. Its potential for sustainable water supply to the Greater Dublin Area has not been fully quantified or presented in the EIAR alternatives assessment.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that ACP should require Uisce Éireann to provide a specific assessment of the sustainable yield of the Kildare groundwater system under current and projected climate conditions, the capital cost of developing a distributed borehole network serving the GDA, and the environmental impact of such development compared to the proposed Shannon abstraction. This is not a peripheral option it is one of the 594 'feasible alternatives' that was never assessed at project EIA level.

20.3 7.3 The Multi-Point Modular Supply System — The Correct Legal Framework

The River Shannon Environment Protection River Shannon Environmental Protection Alliance concludes this section with a call for 'a multi-point modular system with inbuilt flexibility to adapt to changes, and allowing for evolution as demand shifts in unexpected directions.' The River Shannon Environment Protection River Shannon Environmental Protection Alliance formally adopts this framing as its own.

The correct question for this planning application is not simply 'is there a supply gap and can the Shannon pipeline fill it?' The correct question under the EIA Directive, the WFD, and the Habitats Directive is: 'what is the least environmentally damaging, most resilient, most cost-effective combination of measures that can sustainably meet the projected demand?' That question has never been asked at project EIA level. Only the Shannon pipeline option has been developed to the level of a planning application. No alternative or combination of alternatives has been subjected to equivalent assessment.

A multi-point modular approach Poulaphouca optimisation, Kildare groundwater matrix, incremental eastern river development, aggressive leakage reduction, and demand management is a legitimate and, the River Shannon Environment Protection River Shannon Environmental Protection Alliance contends, potentially superior environmental option under Article 4(7)(d) WFD. Its dismissal at strategic plan level without project-level EIA assessment, combined with the MPAG's finding that the leakage alternatives analysis was deficient, means that the central legal question of this application has never been properly answered.

21. Ecological Irreversibility — The 1% Failure Rate and the Waddenzee Standard

The River Shannon Environment Protection River Shannon Environmental Protection Alliance identifies a principle of ecological science and law that has not been stated in this form in the Consolidated Formal Submission, and that deserves to be before ACP in terms that are direct and clear.

> *"Environmental ecological impact is frequently irreversible and usually has long lasting consequences. Sustaining habitats and protected SACs is not something that tolerates a 1% failure rate. Even though the occurrences may be rare and brief, like a forest fire, they cannot be factored in to any modelling as 'acceptable'. This is why we have the Habitats Directive, and Protected status assigned to these waterbodies, to speak for the billions of dependent creatures that do not have a voice."* *Christopher Campion, submission of 14 July 2026*

This statement is not merely rhetorical. It articulates, in plain language, the legal standard that the CJEU has applied in Habitats Directive cases since Waddenzee (C-127/02): the standard of 'no reasonable scientific doubt.' The precautionary principle in environmental law Article 191(2) TFEU exists precisely because ecological harm, unlike economic harm, is frequently irreversible. You cannot un-extinguish a species population. You cannot un-damage a spawning bed. You cannot restore a shoreline habitat that has been exposed, dried, and ecologically disrupted during a multi-week drought drawdown of a lake level.

21.1 Why the EIAR's Concession Is Legally Fatal

Uisce Éireann's modelling concedes (RtS para 2626) that there would be 'measurable effects during extreme drought periods such as those in 1995 and 2018.' The EIAR presents these as rare events affecting perhaps 1–2% of the years in the modelling period and in effect asks ACP to accept that the ecological consequences of 1–2% of years are an acceptable price for water supply security in the other 98–99% of years.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance's forest fire analogy precisely captures why this framing is legally impermissible. A forest fire may be a 1% event occurring rarely and briefly. But the ecological damage is not proportionate to its frequency. Old-growth woodland destroyed in a single fire may take centuries to recover, if it recovers at all. The same logic applies to:

- Atlantic salmon spawning beds exposed and dewatered during a sustained lake level drawdown in drought conditions salmon eggs exposed to air die. The spawning event for that year is lost. At the 5% of conservation limits level already documented by Tipperary County Council, there is no margin for even one failed spawning year, let alone repeated failures during periodic drought years.
- Common tern nesting habitat on Lough Derg the population has already collapsed on the lake (National Parks and Wildlife Service (NPWS), Conservation Objectives: Lough Derg (Shannon) SPA 004058, Version 1, Department of Housing, Local Government and Heritage, 2024.). A further disturbance during a drought-induced water level drawdown event, however brief, cannot be modelled as 'acceptable' for a species whose breeding population that has already collapsed on the lake.
- Alluvial forest and wetland habitat along the 179km of Lough Derg shoreline exposure of shoreline habitat during drawdown, even for weeks, affects littoral plant communities, invertebrate populations, and the species that depend on them. These effects are not reversible when water levels return to normal.
- Freshwater pearl mussel one of the longest-lived invertebrates in Ireland, protected under the Habitats Directive, critically endangered in the Shannon catchment is especially sensitive to low-flow,

low-oxygen conditions during summer drought. A brief but severe drought-drawdown event could damage or eliminate populations that take decades to establish.

21.2 The Waddenzee Standard Applied

The River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission states that 'sustaining habitats and protected SACs is not something that tolerates a 1% failure rate' is the plain-English version of the CJEU standard in Waddenzee:

> *"The competent national authorities are to authorise the activity only if they have made certain that it will not adversely affect the integrity of that site. That is so when there is no reasonable scientific doubt as to the absence of such effects."* *CJEU, Case C-127/02, Waddenzee, 2004*

'No reasonable scientific doubt' is incompatible with a 1% or 2% probability of ecological harm. The moment the EIAR concedes that there will be 'measurable effects during extreme drought periods’ even rare ones it has conceded the existence of reasonable scientific doubt. That is the end of the Article 6(3) assessment. It cannot be rescued by classifying the probability as low or the event as rare. Under the Habitats Directive, a small probability of irreversible harm is treated as a certainty of harm for the purposes of the precautionary principle.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that this principle articulated by the River Shannon Environment Protection River Shannon Environmental Protection Alliance through the forest fire analogy and grounded in CJEU jurisprudence in Waddenzee and Sweetman is the single clearest statement of why the NIS's Article 6(3) conclusion cannot stand. The integrity of the Lower River Shannon SAC during drought years is not something that can be modelled, averaged, and accepted at a 1–2% failure rate. It requires certainty, not probability. The EIAR concedes the probability of harm. It cannot establish the certainty of its absence.

The request to ACP arising from this ground

ACP should specifically require the NIS to address, for each qualifying interest and conservation objectives of the Lower River Shannon SAC, the Lough Derg SPA and the other affected European sites, the ecological consequences of the specific drought scenarios (1995 and 2018 analogues) in which the Applicant concedes there will be measurable effects. The question is not whether these effects will occur the Applicant concedes they will. The question is whether they constitute adverse effects on integrity of the site in those years, and what the cumulative consequence of periodic adverse years is for the long-term conservation status of each qualifying interest. Until that analysis is before ACP, the Article 6(3) conclusion cannot be established to the Waddenzee standard.

21.3 Additional Requests to An Coimisiún Pleanála

1. Require Uisce Éireann to model a Cape Town-type three-year consecutive drought scenario for the Shannon catchment, and to demonstrate at what point in such a drought the pipeline would cease to be able to supply the GDA and what the contingency supply would be.
2. Require Uisce Éireann to provide the full list of the 594 'feasible alternatives' from the NWRP screening, and to explain with reference to 2026 data why each has been excluded from the project-level EIA alternatives assessment.
3. Require Uisce Éireann to confirm whether a smaller, trigger-conditioned Lough Ree abstraction as one component of a multi-source supply matrix was assessed at project EIA level, and if not, to provide that assessment.
4. Require Uisce Éireann to quantify the capital cost saving from a Lough Ree origin pipeline (approximately 122km) versus the Parteen origin pipeline (172km), and to present this as part of a transparent cost-benefit comparison of alternatives.
5. Require Uisce Éireann to specifically address RtS para 2643 (Ardnacrusha already idles 20 days per year on average) and to model the cumulative drawdown effect on Lough Derg lake levels over the 60-year operational life arising from routine annual idle periods combined with periodic drought years.
6. Require Uisce Éireann to identify the specific, legally binding mechanism planning condition, licence condition, or statutory agreement that would prevent emergency derogation from the Normal Operating Band in a prolonged drought, and to confirm that such a mechanism exists and is proposed as a condition of any consent.
7. Require Uisce Éireann to address specifically whether treating Lough Derg as a drought-buffer reservoir drawing its levels down to maintain pipeline supply is compatible with the SAC designation, the SPA designation, and the WFD HMWB Good Ecological Potential obligations applicable to the water body.
8. Require Uisce Éireann to provide a sustainable yield assessment for the Kildare groundwater system as a component of a multi-source GDA supply alternative, and to compare its capital and environmental cost with the Shannon Pipeline.
9. Require Uisce Éireann to respond specifically to the 1% failure rate / forest fire principle: for each qualifying interest of the Lower River Shannon SAC, what are the ecological consequences of the 1995 and 2018 drought analogues conceded by the Applicant to produce measurable effects for the conservation status of that qualifying interest? How many such years can occur during the 60-year operational life without constituting an adverse effect on site integrity?

21.4 10.3 The Compensation Flow as a Climate-Stranded Asset

The entire WFD and Habitats Directive compliance case rests on the permanence of the 10m³/s compensation flow. The Applicant acknowledges (paras 43, 2859) this regime 'may be revised in future via the RBMP process.' This admission confirms the current 10m³/s figure is not treated as a permanently valid ecological reference only as the current regulatory position. In a climate emergency with increasing drought frequency, there is a realistic prospect the RBMP will require an increased compensation flow. If that happens, the fixed Parteen infrastructure may physically constrain delivery of an increased compensation flow during drought. This long-term, cumulative risk has not been assessed.

21.5 10.4 The Ardnacrusha 1.2% Renewable Energy Concession

At RtS para 2130, the Applicant summarises the River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission that 'removal of Ardnacrusha would reduce the renewable share by only 1.2 percentage points.' The RtS Report does not contest this figure anywhere in Chapter 16. The River Shannon Environment Protection River Shannon Environmental Protection Alliance submits it should be treated as conceded. A 1.2 percentage point reduction in renewable generation cannot constitute the 'overriding public interest' required to override Habitats Directive obligations for a system in ecological collapse.

22. Further grounds Advanced by Sabrina Joyce-Kemper

Sabrina Joyce-Kemper, Planning and Environmental Consultant holding an Advanced Diploma in Planning and Environmental Law from the Honourable Society of King's Inns, has made a non-statutory consultation submission (March 2025). The River Shannon Environment Protection River Shannon Environmental Protection Alliance endorses and adopts her issues and findings in our own submission some of these are as follows:

22.1 WFD Article 4(8): Inter-Basin Transfer and Basin Integrity

Article 4(8) requires that measures implemented do not permanently exclude or compromise achievement of the Directive's objectives in other bodies of water within the same river basin district. The Shannon River Basin District is a single hydrological unit. Permanent abstraction from its headwaters to the Eastern River Basin District has never been assessed at the scale of the Shannon basin's full Programme of Measures under the Water Action Plan 2024.

22.2 Environmental and Subsurface Impacts of Leakage in Dublin

SJK (§4) identifies a EIAR gap: the geotechnical and hydrological impacts of chronic subsurface leakage in Dublin's water network. These include sinkhole formation and ground subsidence; weakening of building foundations; increased sewer and infrastructure failure; groundwater contamination; and soil chemistry alteration from residual disinfectants. Under Article 191(2) TFEU, the precautionary principle and preventive action principle apply. Continuing systemic leakage while expanding abstraction conflicts with both. The RtS Report (Ch 27.2) dismisses this as 'not relevant to the SID planning application.' This dismissal is inadequate: the geotechnical costs of continued leakage are directly relevant to the Article 4(7)(d) alternatives assessment; and Article 3(1) of the EIA Directive requires assessment of indirect effects, which include increasing the volume of treated water entering the Dublin subsurface via leakage when 300 Mld of new supply is added to a network losing 36%.

22.3 People Over Wind: ESB Operational Management as Inadmissible Mitigation

The NIS repeatedly relies on ESB operational management of Lough Derg within a 'Normal Operating Band' to exclude adverse effects. Where the avoidance of adverse effect depends on ongoing operational adjustments, those measures constitute mitigation. Under People Over Wind (C-323/17), mitigation at AA stage may only be relied upon where it is precisely defined, scientifically certain, fully secured, and demonstrably capable of eliminating adverse effects beyond reasonable scientific doubt. The NIS does not demonstrate that maintenance within the Normal Operating Band ensures conservation objectives will be achieved under all hydrological scenarios.

22.4 Zone of Influence Artificially Constrained

The NIS defines the abstraction Zone of Influence between Meelick Weir and Limerick Dock based on hydraulic control points. This excludes altered flow variability across the wider catchment; modified seasonal drawdown patterns affecting floodplain ecology; reduced natural flood pulses; cumulative interaction with climate-induced low-flow periods; and changes in assimilative capacity of waterbodies due to pollution inputs during extreme weather events. SJK specifically asks: how many wastewater treatment plants and industrial discharge licences exist within the hydrologically linked catchment, and have worst-case-scenario discharge loads been fed into the EIAR and NIS models for both? Both EIA and AA require worst-case, not average, scenario assessment.

22.5 11.5 Article 4(7)(d) The Five-Part Test Not Met

CIS Guidance No. 20 and No. 36 require, if deterioration cannot be excluded, a five-part sequential Article 4(7) analysis: (i) identification of specific quality elements at risk; (ii) demonstration that all practicable mitigation is taken; (iii) reasoned analysis of overriding public interest; (iv) structured alternatives assessment showing no significantly better environmental option; and (v) compliance with Article 4(8) basin-wide integrity. No such analysis is presented. This omission is legally material and, absent demonstration that each condition is met, the application cannot satisfy Article 4(7) as a derogation route.

23 . The MPAG Review Note: What It Is and Why It Matters

The Major Projects Advisory Group (MPAG) is a body established by the Department of Public Expenditure, NDP Delivery and Reform under Project Ireland 2040. Its purpose is to support the application of Ireland's Infrastructure Guidelines (formerly the Public Spending Code) and to provide independent oversight of major public investment proposals before they receive Government approval to proceed.

The MPAG Review Note dated 25 January 2024 reviewed the Preliminary Business Case (PBC) for the Water Supply Project, Eastern and Midlands Region, at Approval Gate 1the first formal decision point in the Government's capital project lifecycle. The documents considered by MPAG included the Preliminary Business Case itself, the HR Wallingford External Assurance Review (prepared on behalf of the Commission for Regulation of Utilities (CRU)), the DHLGH Report, a Leakage Position Paper, and extensive sensitivity analyses.

Critical clarification on the 'Wallingford Report'

The MPAG Review Note of January 2024, which references and summarises the HR Wallingford External Assurance Review as one of 12 documents it considered. The two foundational hydrological assessments of the River Shannon system (understood to date from approximately 1994 and 2007) referred to in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's main submission as the 'Wallingford Reports' are separate documents that remain unpublished and have not been placed on the public file. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's AIE requests for those documents remain outstanding. The MPAG Review Note reviewed here is a governance document, not a hydrological assessment.

Notwithstanding this clarification, the MPAG Review Note is highly significant for for the following reasons:

- It contains findings made by the Irish Government's own project oversight bodynot by objectors, not by interest groups, not by campaign organisations. These are the State's own conclusions about the adequacy of the project's business case.
- Several of its findings directly corroborate and reinforce the legal and technical grounds advanced in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Consolidated Formal Submission, particularly on leakage reduction, the cost-benefit analysis, schedule risk, judicial review risk, Habitats Directive compliance, and the adequacy of the alternatives analysis.
- The MPAG Review Note was issued in January 2024before the SID planning application was lodged with An Coimisiún Pleanála meaning that its findings represent a contemporaneous, independent assessment of the state of the project's evidence base at the time the application was being prepared.
- The HR Wallingford External Assurance Review, which the MPAG considered, was commissioned by the CRU. In the consolidated submission and earlier critique documents, the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance has challenged the characterisation of CRU's role as an 'independent environmental reviewer.' The MPAG Review Note itself confirms that the HR Wallingford review was a Public Spending Code compliance review a financial and governance assessment not an environmental or ecological assessment.

23.1 MPAG Findings: Verbatim and Significance for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance

The following table maps each of the MPAG's substantive findings against the relevant grounds in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Consolidated Formal Submission. The MPAG paragraph references are to the Review Note as numbered. Direct quotations are from the MPAG document itself.

MPAG	MPAG finding (verbatim / summarised)	Significance for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission	Flag
2.3	Insufficient analysis has been carried out within the options analysis of longer term leakage reduction strategies. Longer term leakage reduction strategies were not included in the options analysis brought forward and the external reviewers were not assured that the company had followed best practice in this regard.	MPAG independently confirms the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's core leakage ground (Consolidated Submission 8): that leakage reduction was not adequately assessed as an alternative. The MPAG's own reviewer (HR Wallingford) 'was not assured the company had followed best practice' on leakage options. This is a finding by the State's own governance process, not by an objector.	**CRITICAL**
2.4	The level of leakage in the current water supply infrastructure is high and should be prioritised in line with the WSP, as the new Shannon Source will be piped into the existing water supply pipeline.	MPAG confirms that new Shannon water will be piped into the same leaking infrastructure the factual predicate for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Article 4(7)(d) WFD irrationality argument (Consolidated Submission 8). If the State's own advisory body says leakage must be prioritised alongside the project, it cannot be 'not relevant' to the planning application.	**CRITICAL**
2.2	The census 2022 figures have not yet been incorporated into the project need analysis raising concerns about whether the project remains at an appropriate scale and whether the population trends outlined in the preliminary business case remain appropriate.	MPAG independently confirms An Taisce's and the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's demand-projection ground (Consolidated Submission 21.1). The State's own project oversight body found in January 2024 that the demand forecasts underpinning the project may be based on outdated data. The RtS Report's assertion that demand projections use 'trusted national sources' (para 91) does not address whether 2022 census data was incorporated the MPAG found it had not been at PBC stage.	**HIGH**
3.4	The preliminary business case does not examine the affordability of this scheme, therefore not meeting a key requirement of the Infrastructure Guidelines. The level of funding required for this project is not contained within existing NDP allocations. Non-domestic revenues would not meet the operating cost of the proposal.	MPAG found the project failed to meet a 'key requirement of the Infrastructure Guidelines' on affordability. This reinforces the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's ground (Consolidated Submission 18) that the 10:1 CBA is based on undisclosed	**HIGH**

MPAG	MPAG finding (verbatim / summarised)	Significance for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission	Flag
		methodology. It also reveals that the project's own funding sources were unresolved at PBC stage a significant governance gap that the planning application does not address.	
3.1	The eBCR of 12.25 had previous values of 3.25 (Indecon, 2016) and 8.87 (EY, 2023) in the economic appraisals carried out during the options analysis, with BCR increasing despite rises in estimated costs. This is a result of additional benefit criteria being incorporated.	MPAG reveals that the benefit-cost ratio has tripled (from 3.25 to 12.25) across successive appraisals despite costs increasing significantly. MPAG attributes this to 'additional benefit criteria being incorporated' in each iteration. This confirms the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's concern (Consolidated Submission 18) that the CBA methodology is insufficiently transparent and that the inputs driving the ratio have changed without independent verification.	**HIGH**
4.4 / 4.5	The cost forecast should incorporate the RCF P90/95 as the upper range. Given the high degree of risk for the schedule potentially needing to be extended as a result of delays in the judicial reviews or delays in the construction timeline, analysis into how this would impact cost forecasts should be presented.	MPAG identifies that the RCF P90/95 upper cost range is €9.255–10.405bnsubstantially higher than the €5.96bn presented in the RtS Report as the upper range. If delays arising from judicial review or CJEU reference materialise, the true project cost could approach €10bn. This has never been presented to ACP. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits this cost range should be before ACP when it assesses the Article 4(7)(iii) overriding public interest test.	**HIGH**
4.7	The proposal requires consideration/analysis into the possibility of failing to meet the ambitious project delivery date and the impact this would have on the options analysis (versus desalination in particular) and costings.	MPAG itself identifies desalination as a relevant comparator if the project delivery date is not met directly reinforcing the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's alternatives assessment ground (Consolidated Submission 4). If the State's own project oversight body considers desalination a relevant comparator under schedule delay scenarios, the dismissal of desalination from the formal alternatives assessment is even harder to sustain.	**HIGH**
4.8	There is significant risk of judicial review and delays arising from legal challenges in Ireland, and potentially at EU level, which could result in the project being set back a number of years.	MPAG identifies the risk of Irish judicial review and EU-level legal challenge as 'significant.' This is the State's own project oversight body acknowledging that the legal grounds advanced by the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance and others are credible and consequential enough to constitute a project risk registered in the business case. The schedule does not include allowance for this risk.	**HIGH**

MPAG	MPAG finding (verbatim / summarised)	Significance for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission	Flag
5.1 / 5.2	Outstanding issues include requirements within the Habitat Directive at Parteen Basin. Concerns exist over planning permission requirements. Clarity is needed as to whether there are other Natura 2000 sites along the project route and if the EIA is complete.	MPAG at the PBC stage in January 2024found that Habitats Directive compliance at Parteen Basin was an outstanding unresolved issue, that it was unclear whether all Natura 2000 sites along the route had been identified, and that the EIA was not confirmed as complete. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that the SID planning application cannot be determined until it is confirmed that all of these gaps identified by the State's own oversight process have been fully and demonstrably resolved.	**CRITICAL**
5.5	EPA has not provided Uisce Éireann with indicative acceptable abstraction levels in advance of the coming into force of this crucially relevant legislation.	As of January 2024, the EPA had not confirmed acceptable abstraction levels. This confirms the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's ground on abstraction licence sequencing (Consolidated Submission 7): the planning application was lodged and progressed before the fundamental regulatory question of what abstraction volume the EPA considers environmentally acceptable had been determined.	**CRITICAL**
5.7	The project schedule does not include allowance for a potential judicial review of any grant of planning permission, nor of a reference to the European courts.	MPAG expressly flags the absence of judicial review and European Court reference allowance from the project schedule. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that this acknowledged planning risk is not a reason to rush determination it is a reason for ACP to ensure its decision is legally unimpeachable, which requires the grounds identified in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's consolidated submission to be fully addressed.	**NOTED**
10	HR Wallingford External Assurance Process found that the Preliminary Business Case meets the requirements of the Public Spending Code / Infrastructure Guidelines and should progress to Approval Gate 2. HR Wallingford recommended: (a) any updates to key data should be reported to CRU; (b) affordability and financing should be further examined.	This confirms what the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance has stated in the consolidated submission (8.1, 19 of the gap analysis): the HR Wallingford review was a Public Spending Code compliance review concerned with value for money, costs, scheduling, and governance. It was not an environmental assessment. CRU forwarding or endorsing a business case under the Public Spending Code is not endorsement of environmental compliance. The Applicant's use of CRU/HR Wallingford to support its environmental case overstates what this review covers.	**NOTED**

24 Key Observations: What the MPAG Review Note Establishes

24.1 The State's Own Oversight Body Found the Leakage Alternatives Analysis Deficient

The most significant finding for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's submission is at MPAG paragraph 2.3:

> *"Insufficient analysis has been carried out within the options analysis of longer term leakage reduction strategies. Longer term leakage reduction strategies were not included in the options analysis brought forward and the external reviewers were not assured that the company had followed best practice in this regard."* *MPAG Review Note, para 2.3, 25 January 2024*

This finding was made not by the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance, not by a campaign group, and not by an objector. It was made by the Irish Government's own project oversight body, reviewing the project's own business case, against the project's own documentation, in January 2024more than two years before the SID planning application was lodged.

The MPAG's finding that the external reviewers (HR Wallingford, acting for CRU) 'were not assured that the company had followed best practice' on leakage reduction alternatives is a direct independent corroboration of the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Article 4(7)(d) WFD ground: that leakage elimination as a significantly better environmental alternative was not adequately assessed.

The Applicant's response throughout the RtS Report is that leakage reduction is 'being addressed' through the National Leakage Plan and that a comparison with the WSP is 'not relevant to the SID planning application.' The MPAG's finding which is now on the public records that this approach did not follow best practice. ACP cannot ignore this conclusion.

The irrationality loop confirmed by MPAG

MPAG para 2.4 explicitly states that leakage must be 'prioritised in line with the WSP, as the new Shannon Source will be piped into the existing water supply pipeline.' This is the State's own project oversight body acknowledging that the new Shannon water will be piped into the same leaking infrastructure the factual basis for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's prima facie irrationality argument. You cannot claim a cost-benefit ratio of 12.25:1 for a project that by the State's own account will deliver its water into a system losing 36% through leakage, without first demonstrating why that leakage has not been eliminated.

24.2 The True Upper Cost Range Is €9.255–10.405 billion

The RtS Report consistently presents the project cost range as €4.58bn–€5.96bn. The MPAG Review Note reveals a fuller picture. The Reference Class Forecasting (RCF) methodology which uses comparable real-world mega-project outcomes rather than project-team 'inside view' estimates produces the following range (MPAG para 4.3):

Methodology	P50 (€m)	P80 (€m)	P90 (€m)	P95 (€m)
'Inside view' QRA (project team estimate)	4,306	4,446	4,520	4,579

Methodology	P50 (€m)	P80 (€m)	P90 (€m)	P95 (€m)
'Outside view' RCF (comparable mega-projects)	3,357	5,958	**9,255**	**10,405**

The RtS Report presents the €5.96bn figure (the P80 of the RCF) as the upper range. But the MPAG itself recommended (para 4.4) that the project should use the RCF P90/95 as the upper range, noting this 'would be consistent with other projects who have used these methodologies.' At P90 and P95 of the RCF, the project cost range is €9.255–10.405 billion.

This has direct legal consequences:

- The Article 4(7)(iii) WFD 'overriding public interest' test requires the benefits of the project to outweigh its costs. A cost-benefit ratio calculated against a management base of €4.58bn looks very different against an RCF P90/95 cost of €9–10bn. The CBA methodology should have been applied against the full RCF range, as MPAG recommended, before being relied upon in an Article 4(7) analysis. It was not.
- At a potential cost of €9–10bn, the comparative economics of alternatives such as desalination, Poulaphouca optimisation, or aggressive demand management look materially different from the comparison conducted in 2018 against a €800m–€1.4bn project estimate. The alternative-options analysis has never been updated against the RCF P90/95 cost range.
- The MPAG also notes (para 4.7) that if the project delivery date is not met, 'the impact on the options analysis versus desalination in particular' should be assessed. This is the State's own advisory body independently identifying desalination as a comparison point that the project's own analysis does not adequately examine.

24.3 Habitats Directive Compliance Was an Unresolved Issue at the Time of Application

MPAG paragraph 5.1 records that at January 2024, 'requirements within the Habitat Directive at Parteen Basin' were listed as outstanding issues not yet addressed. MPAG paragraph 5.2 states that 'clarity is needed as to whether there are other Natura 2000 sites along the project route and if the EIA is complete.'

The planning application was subsequently lodged in 2025. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that these findings from January 2024 create a material question: have the Habitats Directive concerns at Parteen Basin identified by MPAG as outstanding been fully resolved in the EIAR and NIS, or have they been carried forward and addressed only at the level of assertion in those documents? The NIS's conclusion of 'no adverse effect on integrity' while conceding residual effects (RtS Report para 49) suggests the latter.

An Taisce's related finding

An Taisce's submission noted that the State has tendered a project (Ref 7328234) to develop environmental flow recommendations for the Shannon scheme the foundational ecological data needed to assess Habitats Directive compliance and that this data 'does not yet exist.' Taken together with MPAG's January 2024 finding that Habitats Directive compliance was unresolved, this creates a consistent picture: the NIS's integrity conclusion was reached without the foundational ecological data that the State itself has acknowledged is needed.

24.4 The EPA Had Not Set Acceptable Abstraction Levels Before the Application Was Lodged

MPAG paragraph 5.5 states:

> *"EPA has not provided Uisce Éireann with indicative acceptable abstraction levels in advance of the coming into force of this crucially relevant legislation."* *MPAG Review Note, para 5.5, 25 January 2024*

This is the State's own project advisory body confirming, in January 2024, that the single most important regulatory question for this project what volume of water can lawfully be abstracted from the Shannon under the Water Environment (Abstractions and Associated Impoundments) Act 2022, on the basis of environmental standards set by the EPA had not been resolved. The SID planning application was subsequently lodged without this determination having been made.

This directly reinforces the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's abstraction licence sequencing ground (Consolidated Submission 7). ACP is being asked to determine an application for infrastructure whose core operational activity the abstraction has not been cleared at the level of: (a) what volume the EPA considers environmentally acceptable; (b) what conditions the EPA would attach to the abstraction licence; or (c) what the ESB's parallel licence application will show. All three are preconditions for a complete cumulative environmental assessment.

24.5 Judicial Review Risk Was Formally Acknowledged by MPAG

MPAG paragraph 4.8 states: 'There is significant risk of judicial review and delays arising from legal challenges in Ireland, and potentially at EU level, which could result in the project being set back a number of years.'

MPAG paragraph 5.7 states: 'The project schedule does not include allowance for a potential judicial review of any grant of planning permission, nor of a reference to the European courts.'

These findings are significant not as advocacy for the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's position, but as objective acknowledgement by the State's own infrastructure oversight body that: (a) the legal challenges raised by the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance and others are sufficiently credible and material to constitute a project risk; and (b) the project has not adequately planned for them. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance does not cite these findings to suggest that legal risk should deter determination it cites them to emphasise that the grounds for judicial review are substantial, well-founded, and acknowledged even by those within the State's own governance process.

The appropriate response to acknowledged judicial review risk is to ensure the planning decision is legally unimpeachable not to rush determination. The grounds set out in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Consolidated Formal Submission are precisely the grounds that, if not adequately addressed, would expose any grant of permission to successful challenge.

24.6 CRU/HR Wallingford: Governance Review, Not Environmental Assessment

The MPAG Review Note records (para 10) that 'the External Assurance Process undertaken by HR Wallingford, on behalf of CRU, has found that the Preliminary Business Case meets the requirements of the Public Spending Code / Infrastructure Guidelines and should progress to Approval Gate 2.'

This is a compliance finding under the Public Spending Code concerned with value for money, cost estimation methodology, schedule robustness, and governance. It explicitly recommends that 'the affordability and financing of the project should be further examined' and that 'any updates to key data should be reported to the CRU.'

The Applicant relies on CRU/HR Wallingford as an 'independent' body that endorsed the project's alternatives assessment and economic case (RtS Report paras 88, 128–130, 370). The MPAG Review Note makes clear what the HR Wallingford review actually was. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that ACP should not treat a Public Spending Code compliance review by an infrastructure economics consultancy as independent corroboration of the Applicant's EIA Directive alternatives assessment or WFD compliance conclusions. These are entirely different legal and technical domains. The HR Wallingford review was not, and did not purport to be, an ecological assessment, a hydrological peer review, or an EU environmental law compliance analysis.

What HR Wallingford did and did not review

HR Wallingford reviewed: cost estimation methodology, schedule robustness, procurement strategy, demand projections, and governance compliance with the Public Spending Code. HR Wallingford did NOT review: the ecological adequacy of the NIS; WFD quality-element deterioration findings; Habitats Directive integrity conclusions; the hydrological model's treatment of drought scenarios; or the legal compliance of the EIAR alternatives chapter under Article 5(1)(d) of the EIA Directive.

25 Specific Submissions to An Coimisiún Pleanála Arising from This Document

Having regard to the MPAG Review Note and the analysis above, the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance makes the following specific additional submissions and requests:

25.1 4.1 Full RCF Cost Range Must Be Before ACP

ACP should require the Applicant to present the full Reference Class Forecasting cost range including the P90 (€9.255bn) and P95 (€10.405bn) figures in its assessment materials before ACP. The Article 4(7)(iii) WFD 'overriding public interest' analysis, the cost-benefit ratio relied upon to justify the project, and the alternatives comparison should all be re-assessed against the RCF P90/95 range that the MPAG itself recommended should be presented to decision-makers.

25.2 4.2 Leakage Alternatives Analysis: Best Practice Gap Acknowledged

ACP should note that the State's own project oversight body and its commissioned external reviewer (HR Wallingford/CRU) both found that longer-term leakage reduction strategies were not included in the options analysis and that 'best practice' was not followed. This finding by MPAG, made in January 2024, substantially strengthens the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Article 4(7)(d) ground and its irrationality argument. It is not open to the Applicant to simply assert that leakage is being addressed under the National Leakage Plan when the State's own oversight process found the leakage options analysis to be deficient.

25.3 4.3 EPA Abstraction Levels Must Be Confirmed

ACP should require confirmation from the EPA, before determining this application, of what volume of abstraction from the Shannon system at Parteen Basin the EPA considers environmentally acceptable under the Water Environment (Abstractions and Associated Impoundments) Act 2022. The MPAG found in January 2024 that no such indication had been provided. The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance is not aware that this situation has changed. Without this information, ACP cannot assess whether the proposed 154–300 Mld abstraction is within or outside the EPA's environmental assessment framework.

25.4 4.4 Habitats Directive Outstanding Issues Must Be Demonstrably Resolved

MPAG identified Habitats Directive compliance at Parteen Basin as an outstanding unresolved concern in January 2024. ACP should require the Applicant to specifically address how and when each of the Habitats Directive concerns identified by MPAG at paragraph 5.1 was resolved, with reference to specific sections of the NIS and/or supplementary environmental information. A general assertion that the NIS demonstrates compliance is not sufficient given the MPAG's pre-application finding.

25.5 4.5 Desalination as a Schedule-Delay Comparator

The MPAG itself identified (para 4.7) that if the project fails to meet its delivery date, 'the impact on the options analysis versus desalination in particular' should be considered. The project schedule is described by MPAG as 'ambitious' and the MPAG explicitly flags a high risk of delays from judicial review and European court proceedings. ACP should require the Applicant to provide the schedule-delay scenario analysis recommended by MPAG, including a comparison with desalination under extended timeline assumptions, as part of a complete alternatives assessment. This directly supports the River Shannon Environmental

Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's EIA Directive alternatives ground.

25.6 Conclusion

The MPAG Review Note of 25 January 2024 is not a document produced by objectors or campaign groups. It is a document produced by the Irish Government's own major infrastructure oversight body, reviewing the project's own business case against the project's own documentation. Its findings, summarised in this analysis, independently corroborate five of the most important grounds in the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Consolidated Formal Submission:

- The leakage reduction alternatives analysis was deficient and did not follow best practice the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's Article 4(7)(d) and irrationality grounds (Consolidated Submission 8)
- The true project cost range, on the RCF 'outside view' methodology, is €9.255–10.405bn at P90/95the CBA relied upon for the overriding public interest test was assessed against materially understated costs (Consolidated Submission 18)
- Habitats Directive compliance at Parteen Basin was an unresolved outstanding concern as of January 2024, when the planning application was being prepared (Consolidated Submission 5, 20)
- The EPA had not set indicative acceptable abstraction levels before the application was lodged confirming the abstraction licence sequencing problem (Consolidated Submission 7)
- The risk of judicial review and EU-level legal challenge was formally identified as 'significant' by MPAG confirming the legal credibility of the grounds the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance advances (Consolidated Submission, all grounds)

The River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance submits that ACP's Inspector should treat the MPAG Review Note as a primary source document in the assessment of this application. Its findings are not the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's characterisation of the project's weaknesses they are the Irish State's own contemporaneous assessment of those weaknesses, made in January 2024, before the application was lodged.

26 .ESB Flow Data and the 2018 Drought

The River Shannon Environment Protection River Shannon Environmental Protection Alliance obtained ESB flow data for Parteen Basin under the Freedom of Information Act (Appendix E to the River Shannon Environment Protection River Shannon Environmental Protection Alliance's Comprehensive Objection). This data reveals the most concrete operational test of the project's feasibility.

The 2018 drought arithmetic an impossible equation

ESB FOI data shows that in 2018 there were 74 consecutive days during which Ardnacrusha took zero water turbines completely idle. During this period, the only flow at Parteen Basin was 10.5 m^3/s just sufficient to meet the statutory minimum compensation flow. If the proposed pipeline had been operating: • Total Shannon flow at Parteen: 10.5 m^3/s (at statutory minimum) • Limerick City abstraction (Clareville WTP): 0.6 m^3/s • Remaining: 9.9 m^3/s • Pipeline abstraction: 3.47 m^3/s • Pipeline as proportion of TOTAL Shannon flow: 3.47/10.5 = 33% Conclusion: for those 74 days in 2018, the pipeline COULD NOT have operated without either (a) reducing the statutory compensation flow below 10 m^3/s unlawful; or (b) drawing down Lough Derg lake storage, with no capacity to control drought duration.

Ireland experiences significant droughts approximately every two years. The EIAR has not been back-tested against the 2018 scenario. The Applicant's hydrological model acknowledges effects during 2018 but does not present a full operational simulation showing how the pipeline would have been managed during those 74 days and what Lough Derg lake levels would have been at the end of that period.

There are three outlets from Parteen Basin: Ardnacrusha, the Old River Shannon (minimum 10m^3/s), and Clareville WTP (0.6m^3/s for Limerick). The proposed pipeline adds a fourth. During drought, when Ardnacrusha already cannot operate, it is mathematically impossible to simultaneously satisfy all four demands. The EIAR's response that abstraction will come from 'lake storage' is accurate in a hydrological modelling sense but does not address the ecological question: what does the resulting Lough Derg drawdown do to littoral habitats, spawning beds, tern nesting islands, and dissolved oxygen conditions during precisely the period of maximum ecological stress?

The River Shannon Environment Protection River Shannon Environmental Protection Alliance also documents (Comprehensive Objection, 7.1) that a 28cm decline in Lough Derg water levels in September 2025 was a primary contributor to an algal bloom on the lake. The documented September 2025 algal bloom event should be specifically addressed in the EIAR's water quality assessment, including whether the model predicts additional algal bloom frequency and severity under the proposed abstraction regime during drought years.

27. Core Propositions from Allied Submissions

27.1 Friends of the Irish Environment

FIE, submitting with Dr William O'Connor's ecological review and FP Logue Solicitors' legal analysis, identifies four structural deficiencies:

- The project is assessed primarily as supply infrastructure rather than as part of the full water cycle. Assessment must take place at catchment scale across the full cycle of abstraction, use, and return flows. Approximately 300 Mld of new supply will generate approximately 300 Mld of additional wastewater loading within connected catchments yet no regional water balance assessment demonstrating that receiving waters can accommodate this loading without Article 4(1) WFD deterioration has been provided.
- HMWB designation does not reduce assessment obligations. Where the environmental baseline is already subject to hydromorphological pressure and restoration obligations, additional abstraction must be assessed against potential future environmental flow requirements, not historic operating conditions alone.
- Cumulative effects on migratory salmon and lamprey under low-flow migration periods have not been clearly demonstrated, and uncertainty regarding potential effects should be resolved before a compliance conclusion is reached.
- Any conclusion that no significantly better environmental alternative exists must be supported by clear and transparent analysis capable of independent verification demonstrating system-wide optimisation including sequencing of infrastructure delivery, storage resilience, and demand-side measures.

FIE conclusion

On the information provided, it is not clear how the competent authority could be satisfied that the environmental objectives of Article 4 of the Water Framework Directive would be met. In the absence of such information, where compliance with environmental obligations cannot be established, the competent authority cannot reach a reasoned scientific conclusion that the objectives of the WFD will not be compromised.

27.3 An Taisce

An Taisce (statutory prescribed body) identifies:

- The proposed abstraction is not being introduced into an ecologically neutral baseline. Approximately 90–95% of the long-term average flow of the Lower River Shannon SAC at Parteen Regulating Weir is already diverted to Ardnacrusha, leaving a predominantly uniform 10 cumecs for 15 km of the Old Shannon for the majority of the year. The NIS assesses the proposed abstraction relative to this managed regime without recognising that the baseline itself is both heavily hydrologically impacted and ecologically constrained.
- The $10m^3/s$ compensation flow has never been assessed against WFD objectives or the conservation requirements of the SAC. Any project depending on the hydrological status quo is, in effect, relying on continuation of existing ecological degradation.
- The State has tendered a project (Ref 7328234) to develop environmental flow recommendations for the Shannon scheme the exact information needed to assess this application and it does not yet exist.

ACP is being asked to consent to a major new abstraction while the State simultaneously acknowledges that the foundational ecological baseline data does not exist.

27.4 Salmon Watch Ireland

Salmon Watch Ireland (12 May 2026, addressing the ESB retrospective EIA scoping) identifies issues directly relevant to the cumulative assessment of this application:

- The 1988 baseline proposed for the ESB retrospective EIA may institutionalise an already ecologically degraded condition. The Shannon Scheme commenced operation in 1929; substantial impacts predate 1988 and must be incorporated in any baseline.
- The ESB's salmon hatchery at Parteen is presented as mitigation without supporting evidence of effectiveness. Under People Over Wind, unvalidated mitigation cannot be relied upon to exclude likely significant effects.
- No quantitative fish passage assessment has been provided: adult upstream passage efficiency, smolt downstream survival, turbine mortality, delay times and fallback rates, and seasonal migration success should all be based on telemetry, tagging, or counter data.
- Species-specific minimum flow thresholds, seasonal migration cue flows, spawning and juvenile habitat requirements, and redd dewatering risk assessments are absent.

27.5 Waterways of Clare

> *"Here is where the fatal flaw in the proposed Water Supply Project lies. The new abstraction is embedded within, and dependent upon, this same regulated system. The planning application acknowledges that water management will need to change in the future but it does not define what that change will look like, nor assess the abstraction against the environmentally compliant regime that will be required. The proposed abstraction is not trivial. It represents roughly 35% of the flow currently left in the Old River Shannon for an average of 93% of the year."* *Waterways of Clare, statement recorded at Parteen Regulating Weir*

28 Priority New Grounds

Case C-164/17 Grace and Sweetman v An Bord Pleanála (CJEU, 2018): a project cannot rely on assumed or undefined future management measures to exclude adverse effects under Article 6(3) of the Habitats Directive. The proposed abstraction is embedded within the ESB dam management regime and cannot function independently of it. The NIS concludes the project will not impede future 'flow-sharing decisions' — but no defined future ecological operating scenario is presented against which this can be tested. The hydrological regime necessary to achieve compliance with the Habitats Directive and the WFD has not been defined, quantified or assessed. Under C-164/17, reliance on undefined future management flexibility cannot remove reasonable scientific doubt. This case was confirmed and applied in Ireland in Connelly v ABP [2018] IESC 31. Source: Dr W. O'Connor (Ecofact), FIE submission, 25 February 2026.

The most recent IFI fish counter data (2024) records only 124 salmon passing through the Ardnacrusha fish pass in the whole year. At Parteen Regulating Weir, 966 were recorded — but these were predominantly hatchery fish returning to the hatchery. The River Shannon is at the bottom of all Irish rivers for meeting its conservation limit (CL) escapement target. The CL for the Shannon is approximately 50,000 salmon per year. Actual numbers are in the hundreds. Additionally, two Irish Red Data Book species — Smelt (Osmerous eperlanus) and Pollan (Coregonus autumnalis) — which IFI specifically requested be surveyed, are absent from the NIS. European eel (critically endangered) has no structured assessment despite readily available ESB eel trap data. DAHG formally requested an Impingement Mortality and Entrainment Characterisation Study — this was not conducted. These are not minor omissions. They are specific, documented, formal requests from statutory and government bodies that were not met. Source: Dr W. O'Connor (Ecofact), FIE submission; IFI 2024 Counter Report.

UKTAG Q95 calculation (Dr O'Connor): The Applicant's own Appendix A9.1 states the Q95 net inflow to the Lough Derg/Parteen system is 25.6 m^3/s. The proposed peak abstraction is 3.47 m^3/s. This represents 13.6% of Q95 — exceeding the UKTAG 10% EQS benchmark for most river types, and even more stringent thresholds apply to sensitive salmonid watercourses. The assessment does not present a naturalised Q95; the regulated Q95 is likely higher than the natural Q95, meaning the true percentage of natural low flow abstracted is even higher.

Inter-basin transfer (Dr O'Connor): The project is a mandatory Annex I EIAR scheme because it constitutes a water transfer exceeding 100 million m^3/year. Despite this being the legal trigger for the EIAR, the EIAR does not assess the environmental implications in the receiving basin. Chapter 9 states this is addressed in Appendix A9.1 — but that Appendix does not contain this assessment. The EPA explicitly required it in scoping. This is a stated-but-absent assessment that is legally required for Annex I EIAR compliance.

Source: Dr W. O'Connor (Ecofact), FIE submission, 25 February 2026.

PRIORITY

An Taisce (statutory prescribed body) identifies a specific and additional dimension to the 1929 baseline circularity argument that has not been captured in the consolidated submission: not only has the 10m^3/s compensation flow never been assessed against WFD objectives, it has also never been 'climate-proofed.' The abstraction assessment models climate change by reducing inflows but retains the 10m^3/s as a fixed structural baseline. Under projected summer temperature increases and drought frequency increases, compliance with EU environmental law may require increased environmental baseflows. The climate modelling demonstrates compatibility with the historic 1935 regime under projected Q95 reductions — but does not demonstrate compatibility with the environmentally compliant regime that may be required under future climate conditions. Source: An Taisce submission, 25 February 2026.

Article 10 Habitats Directive / HDD bentonite risk

An Taisce identifies a legal ground not cited in the consolidated submission: Article 10 of the Habitats Directive requires Member States to manage landscape features of importance for species migration, dispersal and genetic exchange — including rivers and their banks and stepping stones such as ponds and small woods. A 172km linear pipeline corridor crossing 639 watercourses and numerous woodland fragments, wetlands, and peatlands has the potential to fragment ecological connectivity at landscape scale. ACP must assess compliance with Article 10 for the full pipeline route, not only European sites. Additionally, Horizontal Directional Drilling (HDD) using bentonite drilling fluid creates risk of 'inadvertent returns' — subsurface blowouts of drilling fluid into groundwater, watercourses, and sensitive ecological receptors. Source: An Taisce submission, 25 February 2026.

Section 10 — Murray-Darling Basin / Colorado River precedents

The Murray-Darling Basin (Australia) is the closest international analogue for the Shannon situation: a temperate, developed country with regulated rivers and 'sustainable' abstraction rules in which ecological collapse was triggered during drought years — mass fish kills (2018–19), collapse of native fish populations, salinity increases, algal blooms. Multiple government reviews found over-allocation and weak enforcement caused collapse even though abstraction limits existed on paper. The critical point: abstraction impacts are non-linear and emerge most strongly during low-flow years — precisely the condition the EIAR models least reliably.

The Colorado River (USA/Mexico) no longer reaches the sea. Every individual abstraction was 'within legal limits.' Environmental flows were ignored until collapse. Climate change made the system far more fragile than projected. This is the 'within legal limits' argument applied to the 2% framing — legally permissible average abstraction that is operationally impossible during drought.

Source: River Shannon Environmental Protection River Shannon Environmental Protection Alliance Comprehensive Objection, Chapter 13, 20 February 2026.

Reid v ABP; Community Benefit Scheme fish pass condition

Reid v An Bord Pleanála [2021] IEHC 362 (Humphreys J., para 48): 'The board must have sufficient expertise to fully understand and properly evaluate the developer's fact-specific material and the science underlying it... The notion of relying on other people's judgements more generally is flawed and, if it were to be applied, would be an abdication of the board's independent statutory role.' This is directly applicable to this application, which requires expertise in hydrology, EU environmental law, ecology, fisheries science, groundwater, climate modelling, and water regulation. ACP should confirm it has commissioned or retained this range of expertise before determining the application.

Community Benefit Scheme — fish pass conditions: An Taisce specifically requests that ACP condition the Community Benefit Scheme (CBS) to fund CDM Smith (2021) Concept U1 and U2 fish pass improvements at Parteen Weir and Ardnacrusha. Without this condition, the CBS 'Environment Objective' is unenforceable. Source: An Taisce submission; FP Logue Solicitors submission.

1988 ESB baseline / hatchery genetic impacts / Exceptionality Test

Salmon Watch Ireland (12 May 2026) makes three points not fully captured in the consolidated submission: (1) The proposed 1988 ESB retrospective EIA baseline institutionalises an already degraded condition — substantial impacts from the 1929 scheme predate 1988 and must be included. (2) Hatchery mitigation genetic risks: straying rates, domestication effects, disease transfer, and reproductive fitness of hatchery fish have not been assessed. Under People Over Wind, unvalidated mitigation cannot be relied upon to exclude likely significant effects. (3) The Exceptionality Test Report for the ESB retrospective EIA must publicly address why environmental assessment was not undertaken from 1929; whether retrospective authorisation undermines the EIA Directive; and whether exceptional circumstances genuinely exist. Failure to make this analysis publicly available undermines Aarhus public participation rights.

Source: Salmon Watch Ireland submission to EPA, 12 May 2026 (also relevant to ACP via piecemeal consenting ground).

29. Biodiversity: Specific Gaps in the Assessment

29.1 Atlantic Salmon at Approximately 5% of Conservation Limits

Critical quantified finding Tipperary County Council (statutory body)

Atlantic salmon populations in the Lower Shannon are at roughly 5% of their conservation limits (RtS para 1346). At this level, the Habitats Directive does not merely require 'no further deterioration' it requires positive restoration to Favourable Conservation Status. Any further pressure on a species at 5% of conservation limits is ecologically and legally unacceptable, regardless of how 'small' or 'marginal' the incremental impact is described as being.

The Castleconnell River Association monitors approximately 200 wild salmon spawning beds (redds) in the Old River Shannon the only, and last, wild salmon still spawning in the Shannon. The Shannon historically hosted the biggest wild salmon runs of all rivers in Europe, estimated at over 400,000 fish per year. Once these spawning populations are gone, they cannot be re-established.

29.2 Groundwater Dependent Terrestrial Ecosystems

Tipperary County Council (RtS para 1351) identifies that the GWDTE assessment uses the 2% drawdown figure as its basis. The Applicant's response addresses only GWDTEs immediately adjacent to Parteen Basin. It does not assess whether GWDTEs in hydrologically connected areas along the Old River Shannon corridor including wetlands dependent on groundwater connectivity to the river may be affected by altered flow variability and reduced flood pulses during drought periods.

29.3 Invasive Non-Native Species Inter-Catchment Transfer

Offaly County Council (RtS para 1338) identifies that the EIAR does not assess how the project may influence the spread of INNS. The pipeline physically connects the Shannon and Eastern catchments for the first time in Irish history, creating permanent vectors for inter-catchment species transfer. Zebra mussel (*Dreissena polymorpha*) already established in the Shannon, devastating where introduced is of particular concern. An INNS-specific inter-basin risk assessment has not been provided. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require this as a condition of any grant.

30. Sludge Production from the Proposed Water Treatment Plant

A significant environmental impact not adequately assessed in the EIAR or Chapter 22 (Resource and Waste Management): sludge production from the proposed Birdhill Water Treatment Plant at peak operational capacity.

At peak abstraction of 4 m³/s (approximately 345,600 m³/day), using standard municipal water treatment parameters of 0.08–0.12 kg dry solids per m³ treated:

- Dry sludge produced: approximately 28–42 tonnes of dry solids per day
- Dewatered sludge volume (at 20% solids): approximately 140–210 m³ per day
- Annual dewatered sludge: approximately 51,100–76,650 m³ per year
- 60-year operational life total: approximately 3–4.6 million m³ of dewatered sludge requiring management and disposal

For context, Ringsend Wastewater Treatment Plant treating 40% of national wastewater produces approximately 40,000–50,000 tonnes of wet sludge per year. No sludge management plan, disposal pathway, or lifecycle GHG assessment for sludge is on the public file. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require a full sludge management plan as a condition of any grant, including volume quantification at 154, 300, and 330 Mld; disposal routes and receiving environments; GHG emissions from sludge management over the 60-year operational life; and phosphorus and aluminium loading to agricultural soils if land-spreading is the disposal route.

31. Wastewater Return Flows: An Unassessed Full Water Cycle Impact

Friends of the Irish Environment (1) identifies that the project is assessed primarily as supply infrastructure, not as part of the full water cycle. Approximately 300 Mld of new potable supply will generate approximately 300 Mld of additional wastewater loading in connected Eastern catchments. No regional water balance assessment has been presented demonstrating that receiving waters can accommodate this additional loading without risk of WFD deterioration. Material submitted during the process indicates wastewater treatment infrastructure in parts of the receiving region is already operating at or near capacity, with upgrades dependent on future delivery programmes. Outcome-based obligations under Article 4 WFD require assessment on the basis of demonstrated environmental performance, not anticipated future infrastructure upgrades.

32. Poulaphouca Reservoir

Poulaphouca has total storage of approximately 166 billion litres (active: 148 billion litres), a surface area of 22.26 km², and existing integration with Ballymore Eustace WTP and Greater Dublin Area infrastructure. It is approximately 115km closer to Dublin than Parteen Basin. The River Shannon Environment Protection River Shannon Environmental Protection Alliance's Comprehensive Objection demonstrates:

- Sustainable yield optimisation from existing Poulaphouca storage has not been comparatively assessed at project level
- Operational flexibility as a drought buffer or seasonal supplement has not been evaluated against the Shannon alternative using equivalent methodology
- The cost of Poulaphouca optimisation versus the current €4.58–5.96bn for the Shannon pipeline has not been comparatively presented

The Applicant's acknowledgment (RtS para 374) that any Poulaphouca increase 'would need to be carefully planned' is an implicit admission that increases are at least conceivable yet this was never properly examined at project EIA stage.

18. The 10:1 CBA Ratio and Preliminary Business Case

The Applicant asserts a 10:1 benefit-cost ratio from a 2024 Preliminary Business Case whose methodology, discount rate, time horizon, and treatment of non-market environmental costs are not on the public file. A CBA of this scale is highly sensitive to: (a) the discount rate a 3.5% vs 7% rate changes 60-year present values by a factor of 3–5; (b) whether ecological costs (salmon population collapse, SAC degradation, tern extinction) are assigned any monetary value; (c) the time horizon beyond 2050. A CBA with unpublished inputs cannot sustain the Article 4(7)(iii) 'overriding public interest' analysis. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP place the Preliminary Business Case and all model inputs on the public file before determination.

19. CEMP Mitigation Enforceability

The Applicant's claim that CEMP measures are 'binding commitments' is conditional on ACP imposing specific enforceable conditions which it has not yet done. The CEMP is described as an evolving document 'further amended by the Contractor.' A document subject to contractor amendment is not equivalent to a precise, judicially enforceable planning condition. 'Captured in a register and tracked' describes internal corporate governance, not statutory enforcement. No statutory enforcement body for CEMP compliance during construction across a 170km, 500-landholding linear corridor has been identified. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require: the final CEMP on the public file before determination; a schedule of objective, measurable conditions; and identification of the enforcement body and mechanism.

20. Atlantic Salmon and the Ecological Collapse of the Shannon

The combination of evidence from Tipperary County Council (5% of conservation limits), Salmon Watch Ireland (hatchery mitigation remains unvalidated), the National Parks and Wildlife Service's *Conservation Objectives: Lough Derg (Shannon) SPA 004058* (Version 1, 2024 and Waterways of Clare (collapse of breeding population of common tern, with no breeding pairs recorded in 2024 survey), and the River Shannon Environment Protection River Shannon Environmental Protection Alliance's own submission (74 Castleconnell spawning reeds the last Shannon salmon) presents a consistent picture of a river system already under severe ecological pressure. The Habitats Directive's precautionary standard under Article 6(3) 'no reasonable scientific doubt' cannot be satisfied merely by demonstrating that the proposed abstraction will not accelerate an existing decline. The Applicant must demonstrate that it will not impede the restoration and achievement of the conservation objectives required by the Habitats Directive.

21. Population, Human Health and Public Safety

21.1 2022 Census Data

The Applicant (RtS paras 91–94) asserts forecasts use 'trusted national sources' but does not confirm whether 2022 census results have been incorporated. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP specifically require the Applicant to confirm the vintage of population data in the current demand model and provide a revised supply-demand balance using 2022 census data and current CSO projections if they have not been incorporated. The entire project justification rests on these demand figures.

21.2 Long-Distance Pipeline Bacterial Regrowth and Drinking Water Directive

No scientific assessment of water quality risks specifically associated with 172km pressurised water transfer has been presented. WHO and EFSA guidance identifies long-distance transfer as requiring dedicated management protocols. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests: a microbiological risk assessment (Legionella, total coliforms, trihalomethane formation); a chemical migration risk assessment for steel pipeline material over 60 years; and in-transit water quality monitoring at intermediate inspection points along the 172km route.

21.3 Lead Pipes Drinking Water Directive 2036 Deadline

Directive (EU) 2020/2184 requires lead pipe elimination from distribution networks by 2036. The Dublin network contains a significant but unquantified number of lead service connections. The RtS Report (Ch 27.3) dismisses the lead pipe submission as 'not relevant' the River Shannon Environment Protection River Shannon Environmental Protection Alliance contests this. The 2036 deadline creates a known capital expenditure requirement not costed in the CBA. The interaction between Birdhill WTP treatment chemistry and lead leaching in legacy pipes has not been assessed. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require this assessment and costing as a condition of any grant.

22. Carbon Cost of Treating Water Lost to Leakage

The RtS Report (Ch 27.6) dismisses the carbon cost comparison between leakage reduction and WSP as 'not relevant to the SID planning application' (para 3104). The River Shannon Environment Protection River Shannon Environmental Protection Alliance rebuts this directly. Article 4(7)(d) WFD requires assessment of 'significantly better environmental options’ a leakage reduction programme avoiding or reducing new abstraction is precisely such an option. Section 15 of the Climate Action Act requires ACP to have regard to carbon budgets. The carbon cost of treating and pumping 36% of the project's yield into the ground is a material omission from EIAR Chapter 13. The Applicant's reference to the NWRP SEA as the locus of the relevant climate assessment does not satisfy the project-level EIA obligation the NWRP SEA was not conducted under EIAR conditions and did not use current lifecycle carbon methodology.

23. Chapter-Specific Gaps from the Full RtS Report Audit

23.1 Chapter 3 Constitutionality of Compulsory Acquisition Powers

RSPA's non-statutory submission raises the constitutionality of CPO powers used to acquire land across approximately 500 holdings in 6 counties for a project whose primary beneficiary population is 170km away. The River Shannon Environment Protection River Shannon Environmental Protection Alliance draws ACP's attention to: the report (RtS para 2522) that some landowners did not receive written notification of their inclusion in the CPO schedule; the Article 43 Irish Constitution (property rights) and ECHR First Protocol Article 1 proportionality questions that the planning process does not resolve; and the reality that constitutional challenges to the CPO itself are foreseeable, adding to the overall legal vulnerability of the project.

23.2 Chapter 25 Shannon Callows SPA: Hydrological Function Assessment Absent

RSPA (6.10) identifies a NIS lacuna under Holohan (C-461/17): the Shannon Callows SPA supports golden plover, lapwing, curlew, and Bewick's swan species dependent on predictable seasonal floodplain inundation, invertebrate productivity linked to hydroperiod, and shallow water margins. The NIS addresses this SPA primarily in terms of construction disturbance. It does not contain an explicit hydro-ecological analysis demonstrating that the proposed abstraction will not alter floodplain hydroperiod in a manner capable of affecting Special Conservation Interests. Holohan requires the NIS to address all aspects of the project likely to affect each qualifying interest. This is a lacuna on the face of the NIS.

23.3 Chapter 10 INNS Inter-Catchment Transfer Risk

Addressed fully at Section 14.3. Offaly County Council's ground is a specific, consequential biodiversity risk arising from the novel inter-basin physical connection created by this project not addressed by reference to standard INNS mitigation protocols applicable to a single catchment.

24. Chapter 26 WFD: Three New Grounds

24.1 Derg TN Is Not an HMWB The Applicant's Own Concession at Para 2967

> *"It is not correct to state that both water bodies are designated as HMWBs in the 3rd Cycle River Basin Management Plan (2022–2027), as Lough Derg does not have HMWB status. The water body name for Lough Derg is Derg TN and for Parteen it is Lough Derg HMWB."* *Applicant, RtS Report para 2967*

This is a material admission. Derg TN directly affected by lake level changes from the proposed abstraction is a natural water body subject to Good Ecological Status (GES) objectives, not the less demanding Good Ecological Potential (GEP) standard applicable to HMWBs. The WSIAR must demonstrate no deterioration relative to GES for Derg TN. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require the Applicant to confirm the WFD classification and applicable objective for each affected water body and to confirm WSIAR conclusions hold against the correct standard for Derg TN.

24.2 UKTAG Q95 Threshold Exceeded on Applicant's Own Data

FIE (RtS para 2983) states the proposed abstraction exceeds UKTAG low-flow percentage benchmarks when measured against the Q95 value in the Applicant's own modelling. The River Shannon Environment Protection River Shannon Environmental Protection Alliance requests ACP require: (a) the Q95 flow for the Old River Shannon from the EIAR model; (b) the abstraction as a percentage of Q95; and (c) the applicable UKTAG river low-flow threshold for a river of equivalent sensitivity. If the abstraction exceeds the UKTAG threshold at Q95, the claim of having 'passed the UKTAG test' (para 2992) cannot stand.

24.3 Shannon (Lower)_0S0 at Poor Status Heightened WFD Burden

Tipperary County Council (para 1346) identifies that Shannon (Lower)_0S0 was at Poor Status in the last EPA Q value monitoring cycle (2021). Weser (C-461/13) requires that a project must not 'jeopardise the attainment of good surface water status.' A project adding abstraction pressure to a water body at Poor Status furthest from Good Status faces the most demanding evidential standard for demonstrating it will not impede recovery. The WSIAR does not specifically address this heightened burden. The 'legacy pressures' argument that historic hydromorphological degradation is simply the baseline does not discharge the Article 4(1) obligation: the competent authority must refuse authorisation where the project jeopardises attainment of WFD objectives, regardless of the source of prior degradation.

25. Chapter 27 Rebutting Four 'Not Relevant' Dismissals

Chapter 27 of the RtS Report dismisses four substantive grounds with the same blanket response: 'The Applicant does not consider this matter to be relevant to the SID planning application.' Each dismissal is legally inadequate.

25.1 Geotechnical Sinkhole Risk (RtS 27.2)

The geotechnical costs and risks of continued leakage are directly relevant to the Article 4(7)(d) alternatives assessment an assessment that excludes the negative externalities of the status quo is biased toward the new supply option. Article 3(1) EIA Directive requires assessment of indirect effects adding 300 Mld of new supply to a 36%-leaking network increases the volume of treated water entering Dublin's subsurface. RSPA grounds this in Article 191(2) TFEU and the precautionary principle the Applicant's response does not engage with this legal basis at all.

25.2 Environmental Liability Directive 2004/35/EC (RtS 27.4)

Article 5 of Directive 2004/35/EC requires preventive measures where there is an imminent threat of environmental damage. The Lower River Shannon SAC at degraded ecological status with salmon at 5% of conservation limits is precisely the environment the Directive protects. The ELD is part of the EU environmental law framework within which ACP must operate and reinforces the precautionary principle arguments throughout this submission. The dismissal as 'not relevant' does not engage with this legal dimension.

25.3 Carbon Cost Comparison (RtS 27.6)

Addressed fully at Section 22. The dismissal as 'not relevant' fails to engage with Article 4(7)(d) WFD and Section 15 of the Climate Action Act. The Applicant's reference to the NWRP SEA does not satisfy the project-level obligation.

25.4 Lead Pipes (RtS 27.3)

Addressed at Section 21.3. The dismissal fails to engage with the Drinking Water Directive 2036 obligation, the lead-chemistry interaction risk, and the CBA costing gap.

26. Legal Reference Table

Reference	Case / Instrument	Area	Key principle
C-127/02	Waddenzee (CJEU, 2004)	Habitats	No reasonable scientific doubt standard for Art 6(3); precautionary principle means uncertainty defeats authorisation
C-258/11	Sweetman v ABP (CJEU, 2013)	Habitats	Project undermining conservation objectives must be refused; 'prior certainty' standard; no balancing at Art 6(3) stage
C-461/17	Holohan v ABP (CJEU, 2018)	EIA+HD	NIS must address all qualifying interests and all scientific evidence; no lacunae permitted; complete precise definitive findings required
C-293/17 & C-294/17	Coöperatie Mobilisation (CJEU, 2018)	Habitats	In-combination effects must include all plans/projects including already-permitted ones affecting the same SAC
C-399/14	Grüne Liga Sachsen (CJEU, 2016)	Habitats	Defective AA cannot be cured retrospectively unless original authorisation would still have issued
C-323/17	People Over Wind (CJEU, 2018)	Habitats	Mitigation cannot be relied on at screening stage; at AA stage mitigation must be precisely defined, secured, scientifically certain
C-72/95	Kraaijeveld (CJEU, 1996)	EIA	Member States cannot define project scope to circumvent EIA; salami-slicing/piecemeal consenting prohibited
C-50/09	Commission v Ireland (CJEU, 2011)	EIA	EIA obligations apply at project level regardless of prior strategic assessments
C-87/02	Commission v Italy (CJEU, 2004)	EIA	Alternatives must be genuine comparative analysis, not post-hoc justification of pre-selected option
C-461/13	Weser/Bund für Umwelt (CJEU, 2015)	WFD	Art 4(1) is individually binding at project consent; deterioration of even one quality element triggers prohibition
C-525/12	Commission v Germany (CJEU, 2014)	WFD	Art 4 non-deterioration is an objective individually binding obligation, not a programmatic RBMP duty
[2018] IEHC 463	Callaghan v ABP (High Court)	HD+WFD	AA quashed where failure to consider all hydrological impact pathways on a water-dependent Natura site
[2021] IEHC 50	FIE v ABP (High Court)	Climate	Planning bodies must meaningfully engage with climate obligations under Climate Action Acts; mere noting is insufficient
[2019] IEHC 84	Kelly v ABP (High Court)	EIA	EIA alternatives chapter quashed where developer pre-selected preferred option before comparative assessment
[2017] IECA 67	An Taisce v ABP (CoA)	EIA	Courts will scrutinise whether EIA screening and alternatives meet the substance, not just form, of EU requirements
[2022] IEHC 595	Concerned Residents v ABP (High Court)	HD	Conceded residual effects irreconcilable with 'no adverse effect on integrity' absent detailed scientific explanation
Directive 2011/92/EU (amend. 2014/52/EU)	EIA Directive	EIA	Art 5(1)(d): alternatives; Art 8a: conditions must reflect EIAR commitments; Art 11: access to justice
Directive 92/43/EEC	Habitats Directive	Natura	Art 6(2): ongoing protection; Art 6(3): AA standard; Art 6(4): IROPI derogation only if 6(3) fails
Directive 2000/60/EC	Water Framework Directive	Water	Art 4(1) no deterioration / good status; Art 4(7) derogation; Art 4(8) basin integrity; Art 14 public participation
Directive 2001/42/EC	SEA Directive	Plans	Art 5/7: strategic alternatives; cannot substitute for project-level EIA alternatives assessment

Reference	Case / Instrument	Area	Key principle
Directive 2004/35/EC	Environmental Liability Directive	ELD	Art 5 preventive obligation where imminent threat of environmental damage; polluter pays principle
Directive 2020/2184/EU	Drinking Water Directive	DWD	Lead pipe elimination by 2036; resource efficiency; microbiological and chemical standards for distribution
Aarhus Convention Art 6(7) & 9(2)	Aarhus Convention	Access	Fair, equitable, timely public participation; access to justice in environmental matters
Reg. 2021/1119	European Climate Law	Climate	55% GHG reduction by 2030; climate neutrality by 2050 binding on Member States
Climate Action Acts 2015–2021	Irish Climate Act	Climate	S.15: ACP must have regard to national climate objective, carbon budgets, and sectoral emissions ceilings
Art 191(2) TFEU	Treaty on the Functioning of the EU	Principles	Precautionary principle and preventive action principle apply in EU environmental policy

27. Complete Coverage Audit All 28 RtS Report Chapters

RtS Report Chapter	Ground / Issue	Coverage	Location in this doc
Ch 1 Introduction	RtS para 49: residual effects vs 'no adverse integrity' core AA	✓ Addressed	5.2
Ch 2 Overarching Matters	Abstraction licence sequencing; piecemeal consent	✓ Addressed	7
Ch 2 Overarching Matters	10:1 CBA ratio opacity; Preliminary Business Case not on file	✓ Addressed	18
Ch 3 Planning	CPO constitutionality / landowner notification issues	✓ Addressed	23.1
Ch 4 Consultation	Aarhus effective participation; corrected deadline prejudice	✓ Addressed	3.2
Ch 5 Alternatives	Wallingford Report 2024s; NWRP screening; Poulaphouca	✓ Addressed	4, 17
Ch 5 Alternatives	SEA/EIA structural gap effet utile	✓ Addressed	4.3
Ch 7 Construction	CEMP 'binding' claims; enforceability; final form not on file	✓ Addressed	19
Ch 8 Noise/Vibration	Standard construction impacts	✗ Not pursued	
Ch 9 Traffic	Agricultural access disruption	✗ Not pursued	
Ch 10 Biodiversity	Atlantic salmon; lamprey; pearl mussel; otter; bats	✓ Addressed	5.4, 14, 20
Ch 10 Biodiversity	Salmon at ~5% conservation limits quantified by Tipperary CC	✓ Addressed	14.1
Ch 10 Biodiversity	GWDTEs 2% drawdown basis challenged	✓ Addressed	14.2
Ch 10 Biodiversity	INNS inter-catchment transfer risk	✓ Addressed	14.3, 23.3
Ch 11 Water (Hydrology)	2% vs 29% Q95; 2018 drought; no gauges Old River Shannon	✓ Addressed	12
Ch 11/26 UKTAG	UKTAG thresholds not validated against Irish EPA biological metrics	✓ Addressed	9, 24.2
Ch 12 Water (General)	Wastewater return flows; assimilative capacity in Eastern catchment	✓ Addressed	16
Ch 13 Soils/Geology	Pipeline corridor geology	✗ Not pursued	
Ch 14 Agriculture	Construction disruption; farm access	✗ Not pursued	
Ch 15 Air Quality	Construction dust; standard mitigation	✗ Not pursued	
Ch 16 Climate	11,628 tCO2eq 'immaterial'; cumulative sectoral emissions; RCP8.5 compound drought gap	✓ Addressed	10
Ch 16 Climate	Ardnacrusha 1.2% renewable concession	✓ Addressed	10.4
Ch 16 Climate	Carbon cost of leaked water Ch 27 dismissal rebutted	✓ Addressed	22
Ch 17 Population	2016 census base; 2022 data confirmation not provided	✓ Addressed	21.1
Ch 18 Human Health	Long-pipeline bacterial/chemical risk; DWD compliance	✓ Addressed	21.2
Ch 18 Human Health	Lead pipes Ch 27.3 dismissal contested	✓ Addressed	21.3
Ch 19 Landscape/Visual	Standard rural corridor impacts	✗ Not pursued	
Ch 20 Cultural Heritage	Standard archaeological mitigation	✗ Not pursued	
Ch 21 Material Assets	Navigation; angling; water recreation; economic value unmonetised	✓ Addressed	17
Ch 22 Resource/Waste	Sludge 28–42 t/day; no sludge management plan	✓ Addressed	15
Ch 23 Major Accidents	Pipeline failure scenarios	✗ Not pursued	

RtS Report Chapter	Ground / Issue	Coverage	Location in this doc
Ch 24 Cumulative Effects	In-combination under drought; climate trajectory; third-party abstractions	✓ Addressed	5.3, 12, 13
Ch 25 NIS (Natura)	Art 6(3) Sweetman/Holohan/Waddenzee; People Over Wind; Power v ABP	✓ Addressed	5.1–5.5
Ch 25 NIS	Common tern SPA functionally extinct	✓ Addressed	5.4, 20
Ch 25 NIS	Shannon Callows SPA hydrological function assessment absent	✓ Addressed	23.2
Ch 26 WFD	Art 4(1) element-level; Weser; CIS vs UK guidance; Art 4(7) absent	✓ Addressed	6, 9
Ch 26 WFD	Derg TN is NOT an HMWB Applicant's own concession para 2967	✓ Addressed	24.1
Ch 26 WFD	UKTAG Q95 exceeded on Applicant's own data (FIE)	✓ Addressed	24.2
Ch 26 WFD	Shannon (Lower)_0S0 at POOR status heightened WFD burden	✓ Addressed	24.3
Ch 27 Additional Topics	Geotechnical sinkhole risk 'not relevant' dismissal rebutted	✓ Addressed	25.1
Ch 27 Additional Topics	Environmental Liability Directive 'not relevant' rebutted	✓ Addressed	25.2
Ch 27 Additional Topics	Carbon cost comparison 'not relevant' rebutted	✓ Addressed	22
Ch 27 Additional Topics	Lead pipes/DWD 'not relevant' rebutted	✓ Addressed	21.3

27. Consolidated Priority Summary of All Grounds

Ground	Nature of vulnerability	Strength	Section
Alternatives assessment EIA Dir Art 5(1)(d)	Strategic 1994–2022 NWRP screening substituted for project EIA level. Wallingford Report 2024s never published. SEA/EIA structural gap (effet utile). Cost quadrupled since last comparison.	Critical	4, 17
Habitats Directive Art 6(3) AA integrity standard	Conceded residual effects irreconcilable with 'no adverse integrity' finding. Salmon at 5% conservation limits. Shannon Callows SPA hydroperiod unassessed. People Over Wind / ESB management reliance.	Critical	5, 14, 23.2
Abstraction licence sequencing piecemeal consent	SID consent precedes two EPA licences (UÉ + ESB). ESB retrospective EIA not yet conducted. Cumulative assessment never done across both.	Critical	7, 14.3
Leakage elimination WFD Art 4(7)(d)	36% treated water lost. No quantified leakage elimination strategy. Carbon cost of leaked water unassessed. Prima facie irrationality argument.	Critical	8, 22
WFD Art 4(1) 1929 baseline circularity	10m³/s compensation flow set 1929; never assessed against WFD. UK/UKTAG guidance used instead of CIS. Derg TN is natural water body (not HMWB) Applicant's own concession.	High	6, 9, 24.1
2018 drought 74-day operational impossibility	ESB FOI data: 74 days zero Ardnacrusha flow. Pipeline CANNOT simultaneously satisfy statutory flow, Limerick supply AND Dublin abstraction. Model not back-tested.	High	12
WFD Art 4(8) Shannon basin integrity	Inter-basin transfer not assessed at full Shannon River Basin District level against Water Action Plan 2024 Programme of Measures.	High	6.3
No flow gauges Old River Shannon Parteen–Limerick	'No deterioration' conclusion for most affected stretch based on unvalidated model outputs no independent observational data exists.	High	6.2
Aarhus Convention effective participation	4-week window for 585-page technical report while Commission takes 1 year. Corrected deadline with 25 days remaining.	High	3.3
UKTAG Q95 exceeded on Applicant's own data	FIE: abstraction exceeds UKTAG low-flow benchmarks at Q95. Applicant invokes UKTAG when it shows pass, dismisses it when FIE shows fail.	High	6.2, 24.2
Shannon (Lower)_0S0 at POOR status	Heightened WFD burden: must demonstrate project will not impede recovery. Applicant's 'baseline' argument does not address this.	High	24.3
Climate compound drought not modelled	52-yr historical basis + RCP8.5 adjustment; no first-principles compound/consecutive drought. ICARUS evidence on Shannon Midlands drought frequency not incorporated.	Medium-High	10
Sludge unassessed WTP output	28–42 t dry sludge/day at peak. No sludge management plan. No disposal pathway. No GHG lifecycle assessment for sludge.	Medium-High	15
Wallingford Report 2024s not on public file	Two foundational hydrological assessments (1994, 2007) underlying original alternatives screening never placed in public domain. AIE requests lodged.	Medium-High	4.4

Ground	Nature of vulnerability	Strength	Section
Wastewater return flows unassessed	300 MLD new supply → 300 MLD additional wastewater. Assimilative capacity in Eastern catchment not demonstrated. Infrastructure already at/near capacity.	Medium	16.1
Atlantic salmon / ecological receptors	Last Shannon spawning population at Castleconnell. 5% conservation limit. Common tern functionally extinct on Lough Derg (no birds 2024 survey).	Medium	14, 20
INNS inter-catchment transfer risk	Pipeline physically connects Shannon + Eastern catchments for first time. Zebra mussel, Asian clam vectors not specifically assessed.	Medium	23.3
CRU cited as independent misleading	CRU reviewed under Public Spending Code (value for money only). **Under the Public Spending Code and Water Services Sector Specific Guidelines (WSSSG) the CRU has an external assurance role in performing external review of major projects relating to the water services sector.**	Medium	11.1
CBA/Preliminary Business Case opacity	10:1 ratio underpinned by unpublished methodology, discount rate, ecological cost treatment. Cannot support Art 4(7)(iii) overriding public interest test.	Medium	18
Subsurface leakage impacts Dublin	GWDTEs along Old River Shannon corridor; sinkhole risk; geotechnical cumulative impact. Ch 27.2 dismissal as 'not relevant' legally inadequate.	Medium	8, 25.1
CEMP mitigation unenforced	'Binding' claims conditional on ACP conditions not yet imposed. No final CEMP on file. No statutory enforcement body identified.	Low-Medium	19
Lead pipes / Drinking Water Directive	DWD 2036 deadline; interaction with Birdhill WTP chemistry; not costed in CBA. Ch 27.3 dismissal as 'not relevant' contested.	Low-Medium	21.3

28. Consolidated Requests to An Coimisiún Pleanála

The River Shannon Environment Protection River Shannon Environmental Protection Alliance makes the following specific requests, in order of urgency:

28.1 Procedural before Ardany determination

1. CONVENE an Oral Hearing under section 134 of the Planning and Development Act 2000 (as amended) before any determination.
2. REQUIRE Uisce Éireann to place the Wallingford Hydrological Reports (1994 and 2007) and review of the report and the full NWRP alternatives-screening matrices on the public file.
3. REQUIRE the Preliminary Business Case and all CBA model inputs (discount rate, time horizon, ecological cost monetisation) to be placed on the public file.
4. CONFIRM on the record that all 61 RtS Report references to the River Shannon Environment Protection River Shannon Environmental Protection Alliance (under both naming variants) are attributed to WSP_SUB_26 and form part of the public file.

28.2 Alternatives and EIA

5. REQUIRE a project-level alternatives assessment using 2026 costs, current climate projections, and current demand data specifically including Poulaphouca optimisation, Kildare groundwater, demand management, aggressive leakage reduction to EU-standard levels (≤15%), and desalination by an independent expert not contracted to Uisce Éireann.
6. REQUIRE quantification and independent verification of treated water currently lost to Dublin network leakage and a demonstration that leakage reduction to below 20% is not a significantly better environmental alternative under WFD Article 4(7)(d).
7. REQUIRE confirmation that the 2022 census data and current CSO population projections have been incorporated into the supply-demand balance, with a revised model provided if they have not.

28.3 Habitats Directive and Biodiversity

8. REQUIRE the NIS to be supplemented with species- and habitat-specific ecological threshold assessments for all qualifying interests of the affected European sites, including the Lower River Shannon SAC, the Lough Derg SPA and the Shannon Callows SPA. This should include, inter alia, Atlantic salmon, lamprey, freshwater pearl mussel, otter, common tern, and alluvial forest habitats.
9. REQUIRE the Applicant to confirm whether all Natura 2000 sites within the hydrological zone of influence have legally compliant, adopted conservation objectives, and to address this in light of Power v An Bord Pleanála.
10. REQUIRE an INNS inter-catchment transfer risk assessment, specifically addressing the potential transfer of zebra mussel, Asian clam, and New Zealand mudsnail via the inter-basin connection.

28.4 Water Framework Directive

11. REQUIRE a strict element-level WFD deterioration assessment consistent with CIS Guidance No. 36 not a significance-based EIA assessment for every quality element of every affected water body.

12. REQUIRE the Applicant to confirm the WFD classification and applicable objective (GES or GEP) for Derg TN as a natural water body and to confirm WSIAR conclusions hold against the GES standard.
13. REQUIRE the Applicant to produce a table showing the abstraction volume as a percentage of Q95 flow against the applicable UKTAG river low-flow threshold, confirming whether the project passes or fails on its own data.
14. REQUIRE the Applicant to address the heightened WFD evidential burden for Shannon (Lower)_0S0 at Poor Status and to demonstrate the project will not impede recovery to Good Status.

28.5 Consenting and Licensing

15. NOT GRANT consent until both the ESB Parteen Basin impoundment licence and Uisce Éireann's water abstraction licence have been granted by the EPA following completed EIAR processes. Alternatively, condition any grant so that construction cannot commence until both licences are in place.
16. REQUIRE a schedule of enforceable planning conditions with precise, objectively measurable criteria, identifying the statutory enforcement body and enforcement pathway for CEMP compliance.
17. REQUIRE the final CEMP and REAC in complete forms to be publicly available before any grant of permission.

28.6 Additional requirements

18. REQUIRE a full sludge management plan for the Birdhill WTP at 154, 300, and 330 Mld abstraction rates, including disposal pathway, GHG lifecycle assessment, and agricultural loading assessment.
19. REQUIRE a regional water balance assessment demonstrating that receiving waters in the Eastern catchment can accommodate 300 Mld of additional wastewater loading without WFD deterioration.
20. REQUIRE a 172km long-distance water transfer risk assessment addressing bacterial regrowth, chemical migration, and trihalomethane formation potential during transit, consistent with Directive (EU) 2020/2184.
21. REQUIRE the Inspector to audit all cross-references in the RtS Report to confirm every substantive ground is resolved with complete, precise, and definitive findings not merely relocated to another chapter.

30. Conclusion

This summary is intended to give An Coimisiún Pleanála's Inspector an immediate overview of the principal grounds, the key facts, and the specific requests made.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance's central submission in one paragraph

Every independent legal, technical, scientific, and governmental review of this application has arrived at the same conclusion: the proposed Water Supply Project, as assessed and presented, does not demonstrate compliance with binding EU environmental law, and planning consent cannot lawfully be granted on the information currently before the Commission. This conclusion has been reached by the River Shannon Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance, by Sabrina Joyce-Kemper (Planning and Environmental Consultant, King's Inns), by Friends of the Irish Environment with independent ecological analysis and legal advice from FP Logue Solicitors, by An Taisce, by Salmon Watch Ireland, by Waterways of Clare, and critically by the Irish State's own infrastructure oversight body, the Major Projects Advisory Group, which found in January 2024 that the leakage alternatives analysis did not follow best practice, that the EPA had not set acceptable abstraction levels, and that Habitats Directive compliance at Parteen Basin was unresolved. They are the findings of the Irish State's own governance process.

29 1. The Ecological System Is Already in Crisis

Before any assessment of whether the proposed pipeline's impacts are acceptable, ACP must confront what the evidence shows about the current state of the River Shannon system:

- Atlantic salmon in the Lower Shannon are at approximately 5% of their conservation limits (Tipperary County Council, statutory body). The Shannon historically hosted the largest wild salmon runs in Europe — an estimated 400,000 fish per year. Catches collapsed from 414,000 pounds to 42,000 pounds in the decade after Ardnacrusha was built (CDM Smith/DHLGH Roadmap, 2021). The Castleconnell redds — a few hundred metres of river near Limerick city — are the last place wild salmon spawn in the River Shannon. Once gone, they cannot be restored.
- Common tern — a qualifying interest of the Lough Derg Shannon SPA — breeding population collapse on Lough Derg. No breeding pairs were recorded during the 2024 survey (National Parks and Wildlife Service (NPWS), Conservation Objectives: Lough Derg (Shannon) SPA 004058, Version 1, Department of Housing, Local Government and Heritage, 2024 , although the Conservation Objectives note that further survey work is required to confirm the species' current breeding status. Against this backdrop, any additional pressure on the SPA requires particularly careful assessment under the Habitats Directive.
- The Old River Shannon below Parteen Weir runs at the statutory minimum of 10 m^3/s for approximately 11 months of the year. This flow was set in 1929 as an engineering compromise for the Ardnacrusha hydroelectric scheme. It was never assessed against any ecological standard. The Irish State's own expert consultants — commissioned by the Department of Housing in 2021 to produce a fish passage roadmap, with Uisce Éireann on the Steering Group — concluded plainly that this flow 'does not present current international best practice' and recommended flows of 17–65 m^3/s to restore ecological function.
- Ireland is currently — as this submission is written in July 2026 — experiencing an extreme hydrological drought. The Shannon at Parteen Basin during the 2018 drought provided zero

operational flow for Ardnacrusha for 74 consecutive days. The ESB's own data, obtained under FOI, confirms that Ardnacrusha already idles for an average of 20 days per year under current conditions — without any pipeline abstraction. Every one of those days is a day on which the pipeline, if operational, would draw from Lough Derg Lake storage.

Against this baseline, the Applicant is asking ACP to authorise a new abstraction of up to 300 million litres per day from the same water system. The Habitats Directive's precautionary standard 'no reasonable scientific doubt' about the absence of adverse effects cannot be met for a system in this condition.

30 2. The Demand Case Is Built on Data the Regulator Has Contradicted

The entire project justification rests on a supply-demand deficit in the Greater Dublin Area. Every one of the key figures underpinning that deficit has been challenged or contradicted by the Applicant's own Regulator, the Commission for Regulation of Utilities (CRU):

What the CRU's own data shows

The correct national leakage rate in 2024, applying the CRU's revised definition, is 43% — not the 36–37% Uisce Éireann has been reporting publicly.

Leakage nationally went UP in 2022, 2023 and 2024 — the opposite of the falling trajectory assumed in the demand model.

The CRU fined Uisce Éireann €20 million for missing its 2020–2024 leakage reduction targets: 176 Mld of reduction was required; only 90 Mld was achieved — a 49% shortfall.

The network mains replacement rate is less than 0.3% per year — not the 0.4% Uisce Éireann has published.

Uisce Éireann's claim that GDA leakage is down to 29% is unverifiable. CRU Commissioner has confirmed to Emma Kennedy (RSEPA Consultant) confirmed the CRU does not collect leakage data for specific Water Resource Zones. There is no data to support this figure.

The Irish Government's Major Projects Advisory Group (MPAG), reviewing the Preliminary Business Case in January 2024, independently found that the leakage options analysis 'did not follow best practice' and that new Shannon water 'will be piped into the existing water supply pipeline' — confirming that the project adds new supply to a network losing 43% to leakage without first demonstrating that leakage reduction is not a significantly better environmental alternative.

The 86 Mld of leakage reduction that was legally required between 2020 and 2024 and was not delivered represents 56% of the pipeline's initial operational capacity. Ireland is being asked to spend up to €10.4 billion on a 172km pipeline partly to fill a supply gap that exists only because Uisce Éireann missed a statutory target and was fined €20 million for doing so.

31 3. Poulaphouca: The Publicly Owned Solution Being Used as a Temporary Fix

Poulaphouca Reservoir — the Blessington Lakes — has 148 billion litres of active storage capacity. It was built between 1937 and 1940 specifically to serve Dublin's water supply. It is publicly owned. It is 45km from Dublin — 115km closer than Parteen Basin. Ballymore Eustace Water Treatment Plant is already on the reservoir and connected to the Greater Dublin Area supply network.

Thames Water in England is currently seeking planning permission to build a new reservoir of approximately 150 billion litres — virtually identical to Poulaphouca — at an estimated cost of £3.6–5 billion, to secure supply for 15 million Londoners.

Uisce Éireann now confirms it will use Poulaphouca to secure Dublin's supply during the construction period of the Shannon Pipeline — because it can. If it can secure Dublin's supply for five to seven years at zero new capital cost using Poulaphouca, the question of why Poulaphouca cannot secure Dublin's supply for twenty or thirty years — with demand management and incremental eastern river development — has never been answered at project EIA level. It has been assumed away.

The project need case, the cost-benefit ratio, and the alternatives assessment are all undermined by this single fact: Ireland already owns a reservoir of the scale Thames Water is spending €5bn to build, purpose-built for Dublin's water supply, and Uisce Éireann is proposing to spend up to €10.4bn on a pipeline instead.

32 4. The Wallingford Reports: Foundations That Have Never Been Tested

The alternatives assessment underpinning this application rests on two hydrological assessments of the River Shannon system — understood to have been prepared by Wallingford Hydrosolutions in approximately 1994 and 2007 — which formed the foundation of the NWRP alternatives screening. These reports have never been placed in the public domain. They have never been independently reviewed. They cannot be examined by ACP, by the Inspector, or by any party to these proceedings.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance has made formal AIE requests for both reports. Without them, the alternatives assessment cannot be evaluated for legal compliance with Article 5(1)(d) of the EIA Directive. ACP should require Uisce Éireann to place both reports on the public file before determining this application. A permission granted without these documents being publicly available and independently reviewed would be built on foundations that no one outside Uisce Éireann has ever seen.

33 5. What the Irish State's Own Bodies Have Found

The River Shannon Environment Protection River Shannon Environmental Protection Alliance is not alone in identifying these deficiencies. The following findings come from Irish State bodies and Government-commissioned reports — not from campaign groups:

- MPAG Review Note (January 2024, Department of Public Expenditure): Leakage alternatives analysis 'did not follow best practice.' EPA had not set acceptable abstraction levels. Habitats Directive compliance at Parteen Basin was an outstanding unresolved concern. True RCF P90/95 project cost range is €9.255–10.405bn — never presented to ACP. Desalination identified as relevant comparator if project schedule slips.
- Lower Shannon Roadmap (CDM Smith for DHLGH, 2021, with Uisce Éireann on the Steering Group): The 10m³/s compensation flow 'does not present current international best practice.' Recommended ecological flows of 17–65 m³/s. The existing Parteen fish pass and Ardnacrusha fish lock 'cannot be brought up to present best practice' and should be completely replaced. The pipeline abstraction was specifically flagged as a competing demand on the flow budget.
- UCD Dooge Centre (O'Loughlin and Mozafari, 2023): Uisce Éireann's NWRP uses IPCC AR4 data — two generations old. Multi-year droughts projected to be 11–48% more frequent by mid-century. Q95 flows projected to reduce by 21% by the 2080s. Shannon Basin PET to increase 13.5% by 2080. The project's hydrological modelling methodology is not fit for purpose.
- An Taisce (statutory prescribed body): The State itself has tendered a project (Ref 7328234) to develop environmental flow recommendations for the Shannon scheme — the foundational ecological data needed to assess this application — and it does not yet exist. ACP is being asked to consent to a major new abstraction while acknowledging, through its own tendering process, that the baseline ecological knowledge is not available.
- Tipperary County Council (statutory body): Atlantic salmon in the Lower Shannon are at approximately 5% of their conservation limits. Even small flow reductions may have harmful effects on spawning, nursery habitat and migration.

- Clare County Council (statutory body): The EIA process may be legally deficient in several respects that have previously resulted in successful judicial review challenges in Ireland.

34 6. Summary of Grounds

#	Ground	Legal basis	Strength	Section	Key facts
1	**EIA Directive — Alternatives Assessment**	Art 5(1)(d)	**Critical**	4, 17, 35	Wallingford Reports (1994/2007) unpublished. NWRP strategic screening (1994–2022) substituted for project EIA assessment. SEA/EIA effet utile gap. Costs quadrupled. MPAG: leakage analysis deficient. Poulaphouca: 148bn litre publicly owned reservoir, 115km closer to Dublin, being used as interim measure — never assessed as long-term alternative. 594 feasible options never project-level assessed.
2	**Habitats Directive — Appropriate Assessment**	Art 6(3)	**Critical**	5, 14, 20	RtS para 49 concedes 'minor residual effects' then asserts 'no adverse effect on integrity' — legally incoherent under Sweetman and Holohan. Salmon at 5% of conservation limits. Common tern breeding population collapse on Lough Derg (zero breeding pairs, 2024). Shannon Callows SPA hydrological function unassessed. ESB operational management inadmissible as mitigation under People Over Wind. Ardnacrusha already idles 20 days/year — drawdown is annual, not exceptional. No legal mechanism prevents emergency derogation from Normal Operating Band.
3	**Abstraction Licence Sequencing — Piecemeal Consent**	EIA Dir / CJEU	**Critical**	7	SID planning consent precedes two interdependent EPA licences (UÉ and ESB). ESB retrospective EIA not yet conducted. Cumulative assessment never done across both. MPAG (Jan 2024): EPA had not set acceptable abstraction levels when this was written. Kraaijeveld prohibition on salami-slicing directly engaged.
4	**Leakage — CRU Enforcement and Collapsed Demand Case**	WFD Art 4(7)(d)	**Critical**	8, 22	National leakage is 43% (correct CRU definition) — not 36% as published. Leakage ROSE in 2022, 2023 and 2024. CRU fined UÉ €20m for missing 2020–2024 targets: 176 Mld reduction required; only

#	Ground	Legal basis	Strength	Section	Key facts
					90 Mld achieved (49% shortfall). Network renewal rate <0.3%/year not 0.4% as stated. GDA 29% figure unverifiable — CRU Commissioner Kennedy confirmed no WRZ-level data exists. MPAG: leakage alternatives analysis did not follow best practice.
5	**Water Framework Directive — Baseline Circularity**	Art 4(1), Art 4(7)	**High**	6, 24	10m³/s compensation flow set 1929 as engineering compromise. Never assessed against WFD. Lower Shannon Roadmap (2021, commissioned by DHLGH, UÉ on Steering Group): 'the low and unvaried compensation flow practice does not present current best practice.' Recommended EFlow: 17–65 m³/s. Derg TN is NOT an HMWB — Applicant's own concession at RtS para 2967 — so GES not GEP applies. UKTAG Q95 exceeded on Applicant's own data (FIE). Shannon (Lower)_0S0 at Poor Status — heightened burden.
6	**THM Contamination — Drinking Water Directive**	Dir 2020/2184	**Critical**	27, 31	Clareville WTP (Limerick) draws from Ardnacrusha Headrace and Old River Shannon — fed solely from Parteen Basin. Same source water as proposed Birdhill WTP. Clareville currently supplies Limerick with water containing THM levels far exceeding 100µg/l maximum permitted. Applicant's response at RtS para 2272 misleadingly implies these are different source waters. No upgrade plan for Clareville provided.
7	**Climate — Compound Drought Not Modelled**	Climate Acts / CJEU	**High**	10, 34	EIAR uses 52-year historical baseline with RCP8.5 adjustment. O'Loughlin & Mozafari (UCD Dooge Centre, 2023): UÉ's NWRP uses IPCC AR4 data — two generations behind current assessment reports. Multi-year droughts projected 11–48% more frequent by mid-century (Leahy et al. 2021). Q95 flows projected to reduce 21% by 2080s (Meresa et al. 2022). Shannon Basin PET to increase 13.5% by 2080 (Gharbia et al. 2018). Recent events, including Cape Town 2015–2018: multi-reservoir city nearly failed in 3-year

#	Ground	Legal basis	Strength	Section	Key facts
					drought. Loire Basin July 2026: river-dependent nuclear stations closed.
8	**Lough Derg Evaporation — Insufficiently assessed System Demand**	EIA Dir Art 5(1) / WFD	**High**	39	On a hot drought day, Lough Derg (118 km²) loses 354–708 million litres to evaporation — equivalent to 4.09–8.19 m³/s. At 6mm/day, evaporation exceeds the pipeline abstraction by a factor of 2.4 and equals 82% of the statutory compensation flow.
9	**Data Centres — Omitted from 585-Page RtS Report**	EIA Dir / Public Interest	**High**	30	The words 'data centre' do not appear in the 585-page RtS Report. Ireland has 80+ operational data centres and 40+ in planning. Peak cooling demand coincides with peak drought — hot summer conditions — when Shannon flow is lowest. True allocation of pipeline output to data centre cooling has never been disclosed. Water is a Common Good.
10	**Aarhus Convention — Effective Participation**	Aarhus Art 6(7)	**High**	3.2	Corrected 21 July deadline gave <4 weeks to respond to 585-page document. Commission takes 1 year (to July 2027) to reach its own determination. Extension request made. Proportionality of this disparity is inconsistent with Aarhus Article 6(7).

35 7. What the River Shannon Environment Protection River Shannon Environmental Protection Alliance Requests of An Coimisiún Pleanála

The River Shannon Environment Protection River Shannon Environmental Protection Alliance makes the following essential requests, in priority order:

36 Before any determination

- CONVENE an Oral Hearing. The disputed scientific, hydrological, ecological, and legal questions in this application cannot be resolved on paper. Cross-examination of the Applicant's experts is required.
- EXTEND the response deadline to no earlier than 29 August 2026, consistent with Aarhus Convention Article 6(7). The corrected 21 July deadline gave the River Shannon Environment Protection River Shannon Environmental Protection Alliance fewer than four weeks to respond to a 585-page document while the Commission itself takes one full year to determine the application.
- REQUIRE Uisce Éireann to place the two Wallingford Hydrological Reports (approximately 1994 and 2007) and the full NWRP alternatives-screening matrices on the public file.

- REQUIRE the Preliminary Business Case and all CBA model inputs — including the discount rate, time horizon, and ecological cost methodology — on the public file. The 10:1 ratio claimed cannot support the Article 4(7)(iii) overriding public interest test without disclosure of its foundations.
- REQUIRE confirmation from the EPA of what volume of abstraction from Parteen Basin it considers environmentally acceptable under the Water Environment (Abstractions and Associated Impoundments) Act 2022.

37 On alternatives

- REQUIRE a project-level alternatives assessment using 2026 costs, current climate projections, and current demand data — including Poulaphouca as a long-term option, Kildare groundwater, demand management, leakage reduction to EU-standard levels, and the eastern rivers (Liffey, Boyne, Barrow, Slaney) in combination.
- REQUIRE quantification and independent verification of treated water lost to Dublin network leakage, and a demonstration that leakage reduction to below 20% is not a significantly better environmental alternative under WFD Article 4(7)(d).

38 On Habitats Directive

- REQUIRE the NIS to be supplemented with species-specific ecological threshold assessments for all qualifying interests of the affected European sites, including the Lower River Shannon SAC the Lough Derg (Shannon) SPA and the Shannon Callows SPA, with each qualifying habitat and species assessed—addressed individually as required by Holohan (C-461/17).
- REQUIRE the Applicant to demonstrate that the conceded 'measurable effects during extreme drought periods' (RtS para 2626) do not constitute adverse effects on the integrity of the affected European sites over the 60-year operational life of the project, for each qualifying interest individually.
- REQUIRE the Applicant to identify the legally binding mechanism that would prevent emergency derogation from the Normal Operating Band during a prolonged drought. In the absence of such a mechanism, the Article 6(3) integrity conclusion depends upon an operational assumption that is not legally secured and may not hold in the very circumstances in which the project is intended to operate.

39 On Water Framework Directive and THM

- REQUIRE a strict element-level WFD deterioration assessment using CIS guidance, not post-Brexit UK guidance, for every quality element of every affected water body — including Derg TN as a natural water body subject to GES, not GEP.
- REQUIRE documentary confirmation of current THM levels in Limerick City's drinking water from Clareville WTP, and a specific plan for bringing Clareville to the same standard as the proposed Birdhill WTP before the abstraction commences.

40 On consenting

- NOT GRANT consent until both the ESB Parteen Basin impoundment licence and Uisce Éireann's water abstraction licence have been granted by the EPA following completed EIAR processes.

41 8. Conclusion

This is one of the most consequential planning decisions in the history of the Irish State. It will determine whether a 172km pipeline is built from the River Shannon to Dublin at a true project cost of potentially €10.4bn abstracting water from one of Ireland's most ecologically significant river system. The proposal is advanced against an ecological baseline that has deteriorated significantly, a compensation flow regime established in 1929, climate assumptions that have been criticised as relying on outdated projections, and an alternatives assessment founded on unpublished hydrological reports that have never been subjected to independent public scrutiny.

The River Shannon Environment Protection River Shannon Environmental Protection Alliance is not opposed to securing Dublin's water supply. It is opposed to doing so through this project, in this form, with this level of evidence, against this ecological baseline, in these climate conditions. The Shannon ecosystem cannot absorb another pressure of this magnitude. The evidence from the River Shannon Environment Protection River Shannon Environmental Protection Alliance, from allied objectors, from statutory bodies, from Government-commissioned reports, and from the Applicant's own Regulator does not support the conclusion that it can.

Planning permission for this application cannot **lawfully** be granted on the information currently before the Commission. The River Shannon Environment Protection River Shannon Environmental Protection Alliance urges ACP to convene an Oral Hearing, require the outstanding information identified in this submission, and refuse to determine this application until it can be satisfied — to the standard the Habitats Directive and the EIA Directive require — that the grounds for objection have been answered.

ELAINE DOYLE

Director and Secretary

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This submission is made without prejudice to the River Shannon Environmental Protection River Shannon Environment Protection River Shannon Environmental Protection Alliance's right to advance additional or supplementary grounds, to engage independent expert witnesses, and to challenge any grant of permission by way of judicial review. The River Shannon Environment Protection River Shannon Environmental Protection Alliance expressly reserves all rights under the Aarhus Convention and under EU and Irish environmental law.

An Coimisiún Pleanála SID 323980 Submission

Uisce Éireann Water Supply project

Photo by Michael Starkie on Unsplash

Objection submission submitted by:

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Portmarnock
Co. Dublin.

Date of Submission: 25th February 2026

Submission

Introduction

I.1 Sabrina Joyce-Kemper, Planning and Environmental Consultant, makes this objection in her peronal capacity, I holds an Advanced Diploma in Planning and Environmental Law from the Honorable Society of King's Inns.

1. Introduction and Scope of Submission

1.1 This submission is made as an initial response to the proposed abstraction of up to 300 megalitres per day (Mld) from the Lower River Shannon at Parteen Basin for transfer to the Greater Dublin Area and associated Water Resource Zones. It is expressly framed as a preliminary submission identifying significant legal non-compliance, methodological defects and substantive lacunae in the documentation lodged, particularly in respect of Directive 2000/60/EC establishing a framework for Community action in the field of water policy ("Water Framework Directive" or "WFD"), Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("Habitats Directive"), Directive 2004/35/EC on environmental liability, Directive (EU) 2020/2184 on the quality of water intended for human consumption ("Drinking Water Directive"), and associated Irish transposition measures.

1.2 It is concerning to me that this project proceeds on the basis of a large-scale inter-basin abstraction while Dublin's existing water infrastructure continues to leak approximately 36% of treated water[1]. The failure to prioritise leakage reduction and infrastructure renewal represents a fundamental policy and legal omission, which in my opinion materially affects compliance with EU environmental law.

2. Water Framework Directive: Article 4 Non-Deterioration and Objectives.

2.1.1 The Legal Standard:Article 4(1)(a)(i) of Directive 2000/60/EC requires Member States to "implement the necessary measures to prevent deterioration of the status of all bodies of surface water". Article 4(1)(a)(ii) further requires protection, enhancement and restoration to achieve good status or, in the case of heavily modified water bodies, good ecological potential.

2.1.2 The Court of Justice of the European Union (CJEU), in Case C-461/13 Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik Deutschland ("Weser"), confirmed that deterioration occurs where the status of at least one quality element falls by one class, even if that does not result in a change in overall classification. The prohibition is strict.

2.1.3 Article 4(7) permits derogation only where four cumulative conditions are satisfied, including that the reasons are of overriding public interest and that the objectives cannot be achieved by significantly better environmental options.

[1] https://www.rte.ie/news/business/2025/1125/1545760-uisce-eireann-fined-20m-for-not-hitting-leak-targets/

2.1.4 Article 4(8) requires that implementation of measures shall not permanently exclude or compromise the achievement of the Directive's objectives in other bodies of water within the same river basin district.

2.2 Failure to apply a atrict element-level deterioration test.

2.2.1 The Water Status Impact Assessment relies upon UK Environment Agency guidance rather than the Common Implementation Strategy (CIS) guidance adopted by the European Commission and Member States. Ireland remains bound by Directive 2000/60/EC and the jurisprudence of the CJEU. UK guidance, post-Brexit, is not interpretatively authoritative.

2.2.2 Under CIS Guidance Document No. 36 (2017) (Appendix 1), deterioration must be assessed at the level of individual biological, hydromorphological and physico-chemical quality elements, supported by complete, precise and definitive findings. Any reliance on risk-based or "not significant" reasoning is legally insufficient.

2.2.3 The documentation does not clearly demonstrate that abstraction of up to 3.47 m^3/s during drought periods will not affect hydromorphological conditions, nutrient dynamics, temperature stratification, residence time, or downstream ecological supporting conditions in Derg TN or Derg HMWB. Given that Derg TN is classified as Moderate and "At Risk" under the River Basin Management Plan, the evidential threshold is heightened.

2.2.4 Absent a strict element-level assessment consistent with Weser, compliance with Article 4(1) is not established.

2.3 Absence of a Structured Article 4(7) Derogation Assessment

2.3.1 If deterioration cannot be excluded with certainty, Article 4(7) must be expressly engaged. The project documentation proceeds on the basis that deterioration will not occur and does not present a structured, sequential Article 4(7) analysis.

2.3.2 CIS Guidance No. 20 (Appendix 2) and No. 36 require:

I) Identification of the specific quality elements at risk;
II) Demonstration that all practicable mitigation measures are taken;
III) A reasoned analysis of overriding public interest;
IV) A structured alternatives assessment showing no significantly better environmental option;
V) Compliance with Article 4(8) basin-wide integrity.

No such comprehensive Article 4(7) justification is presented. This omission is legally material.

2.4 Inter-Basin Transfer and Article 4(8) Basin Integrity

2.4.1 The project involves abstraction from the Shannon River Basin District to supply the Eastern and Midlands Region. The WFD is founded on river basin management principles. Article 4(8) requires that measures implemented do not compromise achievement of objectives elsewhere in the river basin district.

2.4.2 The documentation does not clearly demonstrate that abstraction during critical flow periods will not compromise the Shannon basin's Programme of Measures under the Water Action Plan 2024. Nor does it address whether cumulative abstraction, climate change variability and extreme drought modelling have been stress-tested against basin-level objectives.

3. Failure to Prioritise Leakage Reduction – Breach of Article 4(7)(d)

3.1 A central legal deficiency concerns the failure to prioritise repair and renewal of Dublin's existing water infrastructure, which reportedly loses approximately 36% of treated water through leakage.

3.2 Article 4(7)(d) of the WFD requires that the objectives pursued cannot be achieved by significantly better environmental options that are technically feasible and not disproportionately costly. The project documentation does not present:

3.2.1 A quantified leakage elimination strategy;
3.2.2 A cost-benefit comparison between large-scale abstraction and network renewal;
3.2.3 A business case addressing the cost of treating water (coagulation, flocculation, chemical dosing, UV disinfection, pumping energy, infrastructure maintenance, all associated overheads and OPEX) which is subsequently lost to leakage;

3.2.4 An assessment of the carbon emissions associated with treating and pumping water that is never delivered to end users and how that impacts on Ireland's statutory obligations to reduce emissions. The application is substantial and any life cycle embodied carbon assessment report may have been missed, that contains this information but it could not be located.

3.3 This omission undermines compliance with Article 4(7)(d). It is prima facie irrational to abstract and treat additional raw water while continuing to permit a substantial proportion of treated water to leak into the subsurface environment. Any any grant of such a project without reasons and considerations that could possibly support same could be considered irrational in itself.

4. Environmental and Subsurface Impacts of Leakage in Dublin.

4.1 The decision to prioritise new abstraction rather than infrastructure renewal raises additional environmental concerns not addressed in the Environmental Impact Assessment Report or the NIS (if potential to impact on a NATURA2000) site or Annex species. Continuous leakage of treated water into urban subsurface environments may:

4.1.1 Alter groundwater regimes;
4.1.2 Cause soil saturation and frost heave in winter;
4.1.3 Contribute to subsidence beneath roads and buildings;
4.1.4 Increase risk of structural damage or sinkhole formation;
4.1.5 Modify chemical balances in urban soils due to residual disinfectants and treatment chemicals e.g. chlorine.

4.2 No assessment has been presented of cumulative subsurface impacts of chronic leakage, nor of long-term urban hydrogeological consequences. Under Article 191(2) of the Treaty on the Functioning of the European Union (TFEU), EU environmental policy is based on the precautionary principle and the principle that preventive action should be taken. Continuing systemic leakage while expanding abstraction conflicts with both principles.

5. Climate and Carbon Implications

5.1 Directive (EU) 2020/2184 (Drinking Water Directive) emphasises resource efficiency and sustainable water management. Treating and pumping water that is subsequently lost through leakage has embedded carbon costs from:

5.1.1 Chemical production and transport;
5.1.2 Electricity consumption for pumping and UV treatment and operation;
5.1.3 Maintenance of treatment works;
5.1.4 Replacement and disposal of treatment media.

5.2 The above are just example and are not exhaustive. The documentation does not quantify lifecycle greenhouse gas emissions associated with the production of water that is never beneficially used. Under the Climate Action and Low Carbon Development Acts (2015–2021) and EU climate objectives, such omissions are material.

6. Habitats Directive and Cumulative Impacts

6.1 Article 6(3) of Directive 92/43/EEC requires that any plan or project likely to have a significant effect on a Natura 2000 site be subject to appropriate assessment.

6.2 Where hydrological modification may influence downstream SACs or SPAs, cumulative impacts must be considered. The CJEU in Case C-258/11 Sweetman and Case C-323/17 People Over Wind emphasised strict evidential standards and prohibition of mitigation assumptions at screening stage.

6.3 This section addresses the adequacy of the Natura Impact Statement ("NIS") prepared in support of the proposed abstraction from Parteen Basin on the Lower River Shannon and associated transfer infrastructure. It focuses on compliance with Article 6(3) of Council Directive 92/43/EEC ("Habitats Directive"), Directive 2009/147/EC ("Birds Directive"), and the interaction of those obligations with Directive 2000/60/EC ("Water Framework Directive" or "WFD").

6.4 While the NIS concludes that the Proposed Project will not adversely affect the integrity of any European site, that conclusion is not supported by complete, precise and definitive findings capable of removing all reasonable scientific doubt, as required by settled jurisprudence of the Court of Justice of the European Union ("CJEU"), including Case C-127/02 Waddenvereniging and Case C-258/11 Sweetman.

6.5 Failure to Properly Apply the Article 6(3) Integrity Test.

6.5.1 Article 6(3) requires that the competent authority may agree to a plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned, in light of its conservation objectives.

6.5.2 The integrity test is not satisfied by demonstrating that:

- i) Water levels remain within historic operational bands;
- ii) Physical hydraulic controls prevent large-scale drawdown;
- iii) No “visible” change occurs in day-to-day water level management.

The legal test concerns the ability of the site to *maintain the ecological structure and functions necessary to sustain its qualifying interests at favourable conservation status.*

6.5.3 The NIS relies heavily on modelling of lake levels and flow pass-forward regimes, but does not clearly demonstrate how those physical metrics translate into ecological thresholds tied to conservation objectives for Annex I habitats and Annex II species.

6.5.4 There is no explicit demonstration of:

- i) The flow regime thresholds necessary to sustain migratory fish populations (e.g., salmon, lamprey);
- ii) Hydroperiod duration required to maintain alluvial forests, wet meadows, or floodplain habitats;
- iii) Sediment transport dynamics necessary to maintain spawning substrates;
- iv) Temperature and dissolved oxygen conditions under altered abstraction regimes during low-flow scenarios.

The absence of a clear linkage between model outputs and ecological tipping points creates residual scientific doubt. Under *Sweetman,* such doubt precludes a lawful finding of no adverse effect.

6.6 Reliance on Operational Management Measures as a Substitute for Ecological Assessment.

6.6.1 The NIS repeatedly references ESB operational management of Lough Derg and Parteen Basin within a “Normal Operating Band”. The conclusion that hydrological effects will be negligible appears to depend materially on continued adaptive management of flows and generation regimes. Where the avoidance of adverse effect depends on ongoing operational adjustments, those measures constitute mitigation.

6.6.2 Under Case C-323/17 People Over Wind, mitigation measures cannot be relied upon to exclude likely significant effects at screening stage. At Appropriate Assessment stage, mitigation may be considered, but only where it is, Precisely defined, Scientifically certain, Fully secured, And demonstrably capable of eliminating adverse effects beyond reasonable scientific doubt.

6.6.3 The NIS does not demonstrate that maintenance within the Normal Operating Band ensures that conservation objectives for water-dependent SACs and SPAs will be achieved. Hydraulic containment does not equate to ecological protection. (it should be noted that the applicant should identify any Natura2000 sites that do not yet have conservation objectives as there is a live case 'Power v. An Bord Pleanála)[2] awaiting a ruling as to whether the Commission is precluded from carrying out an Appropreiate Assessment without compliant conservation objectives in place.

6.6.4 Without a scientifically robust demonstration that operational flow management protects ecological function under all hydrological scenarios, the integrity conclusion is premature.

6.7 Inadequate Integration of Water Framework Directive Obligations.

6.7.1 Article 4(1)(c) of the Water Framework Directive requires Member States to achieve compliance with objectives for protected areas, including areas designated under the Habitats and Birds Directives where maintenance or improvement of water status is an important factor in their protection.

6.7.2 Water-dependent SACs and SPAs within the Lower River Shannon catchment are therefore WFD "protected areas" under Annex IV.The NIS does not clearly demonstrate that, these European sites were treated as WFD protected areas in the hydrological assessment or that the abstraction regime was tested against the requirement to maintain water status necessary for conservation objectives.

6.7.3 Was Deterioration of relevant quality elements was assessed at the level required by the CJEU in Case C-461/13 (Weser)? The assessment of water level change alone does not satisfy the obligation to prevent deterioration of relevant ecological or hydromorphological quality elements that underpin Natura conservation objectives.

6.7.4 The directives must be read coherently and holistically by the Commission. A failure to integrate WFD protected area obligations into the Appropriate Assessment undermines the lawfulness of the conclusion.

6.8 Hydrological Zone of Influence Artificially Constrained.

6.8.1 The NIS defines the abstraction Zone of Influence (ZoI) between Meelick Weir and Limerick Dock, based on hydraulic control points. However, hydrological influence in ecological terms is *not* confined to visible water level changes within a controlled envelope. Ecological effects may arise from:
- Altered flow variability;
-Modified seasonal drawdown patterns;
-Reduced magnitude or duration of natural flood pulses;
-Cumulative interaction with climate-induced low-flow periods.
-Significant changes in assimilate capacity of waterbodies due to pollution inputs (slurry spreading, wastewater) in wet or dry extreme weather periods and events.

6.8.2 The integrity of riverine and floodplain habitats, including SPAs dependent on seasonal

[2] https://www.mccannfitzgerald.com/knowledge/environmental-and-planning/cjeu-asked-if-stage-two-assessment-can-proceed-without-site-specific-conservation-objectives

inundation (e.g., River Shannon Callows SPA), is intrinsically linked to timing, duration and variability of flow.

6.8.3 The NIS does not clearly demonstrate that floodplain hydroperiod and ecological productivity remain unaffected under the abstraction regime, particularly under high-end climate change scenarios. A hydraulically defined ZoI is insufficient unless translated into ecological functional analysis. Further information and modelling is required.

6.9 In-Combination Effects and Climate Change.

6.9.1 Article 6(3) requires assessment of effects “individually or in combination with other plans or projects”.The River Shannon system is already subject to, hydropower regulation; Agricultural nutrient pressures; Climate change-driven hydrological variability; Existing abstractions and wastewater and industrial discharges.

6.9.2 The NIS does not clearly demonstrate that cumulative pressures under future drought frequency scenarios will not interact with the proposed abstraction to produce adverse effects on qualifying interests. For instance where are the figures from monitored discharges points for primary sewer discharges and agglomeration sewage overflows triggers by adverse weather? How many Waste Water Treatments plants discharge into the Catchment system hydro logically linked to the development abstraction? How many licenses allow industrial discharges to the relevant catchment and what is the constitute contaminants and quantification of those discharges? Have they been fed into the model for worst case scenario weather events in the EIAR and NIS? In both regimes there is a requirement to assess ‘worst case’ not merely the average senario.

6.9.3 Where future climate conditions increase the frequency of low-flow events, abstraction impacts may become more ecologically significant than current baseline modelling suggests. Absent a robust cumulative ecological stress test, reasonable scientific doubt remains.

6.10 SPA Assessment Insufficiently Focused on Hydrological Function.

6.10.1 For SPAs dependent on riverine and floodplain habitats, the assessment appears focused primarily on disturbance buffers rather than on hydrological drivers of habitat condition. Bird species using callows and floodplain wetlands depend upon factors such as predictable seasonal inundation, invertebrate productivity linked to hydroperiod, shallow water margins.

6.10.2 The NIS does not clearly demonstrate that the abstraction will not alter the duration or timing of floodplain inundation in a manner capable of affecting Special Conservation Interests. Without explicit hydro-ecological analysis of SPA habitat function, the AA integrity conclusion lacks evidential foundation and retains scientific doubt. Where there is scientif doubt the burden is on the developer to remove it, the burden does not ship to the observer to prove an impact just to identify where scientific doubt exists, due to now evidence before the Comission to displace that doubt.

7. Environmental Liability and Risk Allocation

7.1 Directive 2004/35/EC on environmental liability establishes the "polluter pays" principle and imposes preventative obligations where environmental damage is threatened.

7.2 Expanding abstraction while tolerating known infrastructure leakage shifts environmental risk rather than preventing it. Preventive action under Article 5 of Directive 2004/35/EC requires operators to take necessary measures where there is an imminent threat of environmental damage. Failure to systematically address leakage may engage future liability considerations.

8. Precautionary Principle and Principle of Effectiveness

8.1 Article 191(2) TFEU enshrines the precautionary principle. Where scientific uncertainty exists regarding hydromorphological deterioration, chemical concentration shifts, or subsurface impacts, precaution requires that environmental protection take precedence.

8.2 The principle of effectiveness (effet utile) in EU law requires that directives achieve their intended practical effect. Approving large-scale abstraction while failing to require infrastructure renewal undermines the practical effectiveness of the WFD's resource protection objectives.

9. Conclusion.

The proposed project presents a significant risk of non-compliance with:

- Article 4(1), 4(7) and 4(8) of Directive 2000/60/EC;
- Article 6(3) of Directive 92/43/EEC;
- Directive 2004/35/EC;
- Directive (EU) 2020/2184;
-Article 191(2) TFEU.

The failure to prioritise leakage reduction, quantify treatment losses, assess carbon costs, and evaluate subsurface damage constitutes a material lacuna in the environmental assessments and in the Article 4(7) alternatives analysis.

Water is a finite strategic resource. Its conservation is fundamental not only to ecological integrity but to economic resilience and public health. The sustainable path forward requires investment in infrastructure efficiency, preventive action and basin integrity not expansion of abstraction while systemic waste persists.

Accordingly, it is submitted that the competent authority cannot lawfully grant consent absent:

I) A strict element-level WFD deterioration analysis;
II) A structured and transparent Article 4(7) assessment;
III) A quantified leakage elimination and infrastructure renewal strategy, which may in fact displace the need for the project.
IV) A lifecycle embedded carbon and treatment cost analysis;
V) A cumulative and basin-level compatibility review.

VI) Updated Hydrological modelling of relevant waterbodies and catchments.
VII) Precise data on wastewater and industrial discharges.
VII) updates to the EIAR, NIS and Water Framework Directive assessments.
VII) Submission of relevant, most up to date RBMP cycle catchment reports for all affected catchments.

This submission is made without prejudice to further detailed observations.

Yours Sincerely

Sabrina Joyce-Kemper

COMMON IMPLEMENTATION STRATEGY
FOR THE WATER FRAMEWORK DIRECTIVE
(2000/60/EC)

Guidance Document No. 37
Steps for defining and assessing ecological potential for improving comparability of Heavily Modified Water Bodies

Document endorsed by EU Water Directors at their meeting in Helsinki on 26 November 2019

Foreword

This document is a deliverable of the CIS working group ECOSTAT. It was developed and drafted by a core-group of experts listed below, with the support of Eleftheria Kampa (Ecologic Institute) as consultant (Contract 07.0201/2018/779441/SER/ENV.C.l). It contains synthesis of the output of discussions that have taken place in the context of the working group ECOSTAT and of the Ad-hoc Task Group on Hydromorphology. It builds on the input and feedback from a wide range of experts and stakeholders that have been involved throughout the procedure of Guidance development through meetings, workshops, and written consultation, without binding them in any way to this content. It has been endorsed by the EU Water Directors at their meeting in Helsinki on 26 November 2019.

List of members of the core-group:

- Martina Bussettini (Italian Institute for Environmental Protection and Research, Italy)
- Sebastian Döbbelt-Grüne (German Working Group on water issues of the Federal States and the Federal Government - LAWA, Planungsbüro Koenzen, Germany)
- Wouter Van de Bund (Joint Research Center of the European Commission)
- Veronika Koller-Kreimer (Federal Ministry for Sustainability and Tourism, Austria)
- Katarina Vartia (Swedish Agency for Marine and Water Management, Sweden)
- Jan Brooke (Navigation Task Group ; Jan Brooke Environmental Consultant Ltd.)
- Jo Halvard Halleraker (Norwegian Environment Agency, Norway)
- Michael Wann (Scottish Environment Protection Agency, UK)
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EXECUTIVE SUMMARY

1. Review of designation and objectives needed in appropriate intervals (see section 1 and section 4)

- This CIS Guidance Document No. 37 proposes a common practical framework for defining Good Ecological Potential (GEP), as a main mechanism for assisting comparability of approaches between Member States. The focus is on updating and further refining approaches already being used (reference approach and mitigation measures approach), based on practical experience of their application by the Member States.
- The recommendations are based on a common understanding of the requirements of the WFD and good practice for implementation developed within the Common Implementation Strategy (CIS).
- The principles agreed under CIS Guidance No. 4 on the Identification and Designation of Heavily Modified and Artificial Water Bodies (HMWB and AWB) are still valid. Key aspects that should be considered in the designation of HMWBs are summarised in the present document to provide a clear context for defining Maximum and Good Ecological Potential (MEP and GEP).
- A proper review of all the designated HMWBs and their objectives is expected when preparing the River Basin Management Plan (RBMP) and Programme of Measures (PoM) for a new planning cycle. This review should be efficiently designed and performed to provide a proper HMWB designation according to the requirements of the WFD; it should also take into account monitoring outcomes, new modifications (e.g. new flood protection structures, hydropower plants, etc.), effects of implemented measures, emerging good practice on hydromorphological assessment methods and relevant mitigation measures as well as reconsidering the criteria for assessing significant adverse effects, where appropriate.
- GEP should be rechecked occasionally, as knowledge/expertise can increase and also economic aspects may change over time.

2. A more detailed step-wise framework for GEP (see section 5)

- A logical series of steps should be followed to determine GEP. In this document, a new flow-chart presents a step-wise framework for defining GEP and shows the two routes or approaches (reference approach and mitigation measures approach) to follow the framework. By following the steps included in the new flow chart (step-wise approach), a comparable outcome in ecological terms is expected.
- The steps included in the step-wise approach follow the requirements of the WFD. If, in following the routes through the framework, it is not possible to take all steps, relevant justification is therefore needed in the RBMP. Member States should make sure they can complete the remaining steps by improving data availability and knowledge on the links between hydromorphology and biology. In particular, improved monitoring data is crucial.
- To ensure comparability, a national, regional or basin-specific method for GEP definition has to be developed, although its application will be at water body level taking into account site-specific conditions.

3. Consideration of all relevant mitigation measures (see section 5)

- To identify **relevant mitigation measures** in a HMWB or series of heavily modified water bodies, the following issues are important:
  - the nature and extent of the physical modification(s) and their implications for the hydromorphological supporting elements,
  - if appropriate, physico-chemical supporting elements in the impacted water bodies need to be understood,
  - the consequent effects on the biological quality elements, and hence the measures that are needed to meet GEP.
- To define MEP, a wide range of potential mitigation measures should always be considered, and several measures are normally expected to mitigate modifications. To select best combinations of measures, the following needs to be evaluated:
  - i) the relevance of measures in terms of the hydromorphological alteration(s) and physicochemical characteristics of the water body as well as in terms of other water body characteristics relevant to the biota (e.g. whether modification is within the fish zone/outside the fish zone, fish community types etc.),
  - ii) the measures' ecological effectiveness and benefits in the specific context of the water body or water bodies (i.e. is measure appropriate for addressing the existing ecological impacts and can it deliver a proven ecological benefit),
  - iii) whether or not the measures will have a significant adverse effect on use or the wider environment,
  - iv) ensuring best approximation to ecological continuum, and
  - v) the requirements of Article 4(8) for the achievement of objectives in other water bodies within the same river basin district.
- The criteria for **judgements on the significance** of any effects of measures on use or the wider environment should be clear, transparent, justified and set in a consistent way at the national, regional or local level. Decisions on when such adverse effects are significant are important, because they may affect the level of ambition of ecological improvements and intensity of measures.
- When assessing mitigation measures regarding their potential for a significant effect on use, differing intensities of a measure or combinations also have to be considered, as a lower intensity of a measure (e.g. a reduced amount of additional flow, or a smaller area of habitat enhanced) might still deliver a substantive benefit without having a significant adverse effect on the use in question.
- For defining GEP, measures are then excluded that, even in combination, are predicted to deliver only a slight ecological improvement. GEP is ultimately defined as the biological values that are expected to be achieved after successfully implementing the selected mitigation measures.
- In general, when defining GEP, the first option should be to optimise the conditions for the original natural water body type (if appropriate). If this is not possible, the alternative should be to optimise the conditions for the existing closest comparable natural water body type, or combinations of water body types.
- Combinations and site-specific adaptations of measures are necessary in many cases within a set of measures to ensure the best possible ecological improvement and approximation of ecological continuum.

4. Best approximation of ecological continuum (see section 5)

- Best approximation to ecological continuum (WFD Annex V 1.2.5) is a key aspect of ecological potential. Ecological continuum refers to movements of energy, material, and organisms within the aquatic ecosystem. Achieving ecological continuum ensures that the habitats for type-specific aquatic species are interconnected in space and time so that the species can fulfil their life cycles in self-sustaining populations.
- Measures implemented in this regard should be relevant for the closest comparable water body type and related quality elements. For example, if the modifications to a river make it more closely resemble a lake, the set of measures shall take this into account.
- The best approximation to ecological continuum requires consideration of all hydromorphological measures that could mitigate any obstacles to migration (of biota, sediment and water) and improve the quality, quantity and range of habitats affected by the physical modifications. This can include connectivity to groundwater and/or to riparian, shore and intertidal zones, as well as a sustainable supply of an appropriate sediment type. WFD emphasises both migration of biota and sediment transport. Priority should therefore be given to appropriate and effective measures reducing any obstacles that significantly inhibit longitudinal (both upstream and downstream) and lateral migration of aquatic biota and ensure appropriate sediment conditions. For achieving ecological continuum, it should also be considered whether there is an ecological benefit or a need to restore continuity in order to support upstream and downstream water bodies in achieving their environmental objectives (especially for migratory fish).
- “Best approximation” is interpreted as being as close as possible to undisturbed ecological continuum. MEP requires that best approximation to ecological continuum is ensured. A water body can only be at GEP if a condition close to best approximation is achieved. This is a prerequisite for the functioning of the ecosystem.

5. European mitigation measures library (see section 5)

- A consistent understanding of when the available measures are relevant is crucial, by linking drivers, pressures, impacts and ecological effects. To support this, a European ‘library’ of emerging good practice mitigation measures for HMWB has been set up for this CIS Guidance No. 37 (https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm).
- This European library represents the emerging good practice especially for rivers and transitional and coastal (TraC) waters, while the library content on measures for lakes will need to be improved and updated based on further discussions in the future.
- The library describes the typical implications of different types of physical modification and suggests potentially relevant mitigation measures to address typical effects in each water category (rivers, lakes/reservoirs, transitional/coastal waters). The library includes key groups of mitigation measures, which are expected to be considered for ecological improvements in order to address certain modifications. Due to the Europe-wide nature of this library, it was not possible to produce fully comprehensive lists and some of the physical modifications or measures which are considered in the Member States may not be included. The library of mitigation measures is a living document and updates will be provided in regular intervals.
- When there is a lack of suitable biological assessment methods and/or data sensitive to modifications, the approach to the selection of mitigation measures should be more

precautionary and more measures may need to be considered until there is sufficient evidence to exclude measures from MEP and GEP.

- The assessment of hydromorphological conditions after having implemented all mitigation measures defined for GEP can be used as an intermediate tool until monitoring results of hydromorphology-sensitive biological assessment methods are available. Increased efforts are needed in many countries to establish appropriate biological monitoring and develop and apply hydromorphology-sensitive biological assessment methods.

6. Definition of GEP in quality elements terms and slight change (see section 5)

- Good ecological potential is defined in the WFD as an ecological state in which “there are slight changes in the values of the relevant biological quality elements as compared to the values found at maximum ecological potential” (WFD Annex V 1.2.5). With respect to “slight changes from MEP”, HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP.
- According to WFD Annex V 1.2.5, the values for the biological quality elements at MEP should reflect, “as far as possible, those associated with the closest comparable surface water body type, given the physical conditions which result from the artificial or heavily modified characteristics of the water body”. Slight change cannot be equivalent to a complete/temporary absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone).
- Slight changes to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, “slight change” means that a condition close to best approximation to ecological continuum should be ensured (instead of best approximation).
- Physico-chemical quality elements should also be defined in the GEP definition process. For physico-chemical parameters, the closest comparable water body type is in general the original natural water body type (before physical modification). For those physico-chemical parameters that are significantly modified by the hydromorphological alterations causing the heavily modified character, and that cannot be mitigated, other types should be considered (the closest comparable natural water body type, or combinations of water body types).

7. Implementation of measures to achieve GEP (see section 6)

- A clear distinction between the selection of measures needed to define and achieve GEP and the implementation of measures (objective setting in the RBMP) is crucial for more transparency and common understanding.
- To assess the effects of any mitigation measures already in place and the need for further mitigation measures, the ecological condition of the HMWB should be monitored. The main decisive elements are (apart from specific pollutants) the biological quality elements that determine the class of ecological potential. These are supported by hydromorphological and physico-chemical quality elements. If a proper assessment based on biological quality elements is not yet possible (e.g. due to a lack of hydromorphology-sensitive methods), monitoring of hydromorphological (and physico-chemical) quality elements can be used as proxy to estimate the effectiveness of the mitigation measures already in place and thereby the ecological potential class. If the classification of the ecological potential is not based on hydromorphology-

sensitive biological assessment methods, the classification result should include the information that the confidence level is low.

- If one or more of the selected GEP measures cannot be implemented due to disproportionate costs or infeasibility, it has to be checked whether the remaining measures are still sufficient to achieve the biological conditions at GEP. If this is not the case, a review and possibly re-design of the measures will be needed to avoid the need to use exemptions: for example, selecting another combination/intensity of measures may deliver the desired ecological improvement.
- If it is not possible to implement all the measures needed to achieve GEP, it will not be possible to reach GEP conditions and the water body will have to be classified as being at moderate potential or lower and would therefore need an exemption. Nevertheless, all the remaining measures would still have to be applied to improve/avoid deterioration of the conditions of the water body as far as possible.
- If monitoring shows that expected GEP conditions are not achieved after the implementation of all measures, it should be checked whether the reasons for not achieving GEP are linked to delayed biological responses to restoration, overestimation of the biological response or to other significant impacts (e.g. multiple pressures) and the measures may need to be refined accordingly, if appropriate. This requires that well-defined goals are set up as well as suitable methods for monitoring.
- Implementation of measures to achieve GEP should be seen as an iterative process.

8. Intercomparison of ecological potential (see section 7)

- As for natural water bodies, the requirement for intercalibration of HMWB (WFD Annex V 1.4.1) implies that there is a need to ensure GEP classification methods are set in compliance with the WFD, and that classification results are comparable between EU Member States.
- The step-wise approach and the mitigation measures library set out in this document should ensure a better common understanding and support the intercomparison of ecological potential.
- Comparability of classification results can be evaluated by analysing how Member States have addressed key steps of the procedure, especially:
    - Identification and assessment of hydromorphological impacts and alterations causing the failure to meet good status (from the designation phase) , distinguishing those related to the use
    - Identification and consideration of the full range of potentially relevant mitigation measures, then excluding measures with a significant adverse effect on use or the wider environment, in a transparent and consistent way
    - Definition of ‘slight’ changes for biological conditions and removal of measures only leading to “slight” changes as well as consideration of approximation to ecological continuum.

Abbreviations:

ATG	Ad-hoc Task Group
AWB	Artificial water body
BQE	Biological quality element
CIRCABC	Communication and Information Resource Centre for Administrations, Businesses and Citizens
CIS	Common Implementation Strategy
DPSIR	Driving forces, Pressures, State, Impacts, Responses
ECOSTAT	WFD CIS working group dedicated to the ecological status of surface water bodies
EQR	Ecological Quality Ratio
GEP	Good ecological potential
GES	Good ecological status
HMWB	Heavily modified water body
HPP	Hydropower plant
Hymo	Hydromorphology/Hydromorphological
MEP	Maximum ecological potential
MS	Member States
NWB	Natural water body
RBD	River Basin District
RBMP	River basin management plan
TraC	Transitional and coastal waters
PoM	Programme of Measures
QE	Quality element
SQE	Supporting quality element
WFD	Water Framework Directive
WISE	Water Information System for Europe
WG	Working Group

1 INTRODUCTION

Key messages for this section:

- The water directors have recognised the need for complementary guidance to CIS Guidance Document No. 4 and for further clarification of the procedure for defining GEP of HMWB. This is needed to ensure more comparability and consistent implementation of WFD principles relevant to hydromorphology, HMWB and class boundaries for good ecological potential.
- This CIS Guidance Document No.37 proposes a common practical framework for defining GEP, as a main mechanism for assisting comparability of approaches between Member States. The focus is on updating and further refining approaches already being used (reference approach and mitigation measures approach) based on practical experience of their application by the Member States.

1.1 A new Guidance Document No.37 on the ecological potential of heavily modified water bodies: What for?

This document aims at guiding experts and stakeholders in the implementation of Directive 2000/60/EC establishing a framework for Community action in the field of water policy, commonly referred to as the Water Framework Directive (WFD). The document focuses on the definition of good ecological potential (GEP) which is the environmental objective of heavily modified water bodies (HMWB). Member States can designate HMWB when the physical structure of water bodies has been heavily modified to serve various uses, e.g. navigation, flood protection, hydropower, and agriculture. In many cases, as acknowledged by the Directive, it is not viable nor desirable from a socio-economic perspective to abandon such uses and to remove the physical modifications which affect the water bodies, but still possibly further mitigate ecological effect thereof by measures.

The document further elaborates on the issues already outlined in CIS Guidance Document No.4 on the designation of HMWB and artificial water bodies (AWB) and on GEP setting, which was published in 2003. This new Guidance Document No.37, developed under the auspices of the WFD Common Implementation Strategy (CIS) process since 2016, is based on a more mature common understanding and emerging good practice on the designation of HMWB and GEP setting. This has further evolved since the publication of CIS Guidance No. 4 in 2003, as outlined in several CIS workshops and technical reports (see list of relevant CIS activities in section 1.2).

The definition of ecological potential has been a subject of long discussions between Member States and the Commission in the context of the CIS. Defining ecological potential is a challenging and complex subject in WFD implementation, and this new Guidance Document No.37 aims to provide complementary guidance and further clarification by taking into account the experience of Member States in designating HMWB and defining GEP during the 1st and 2nd river basin management planning cycles.

This additional guidance is intended to address:

- The need to provide clarifications to previously issued CIS guidance, namely CIS Guidance Document No.4.

- The need to review the designation of HMWB in every WFD planning cycle (for further information on this issue, please refer to section 4.2).
- The need to improve methods for GEP definition and to have a transparent and clear process for this aspect of the WFD.
- The need to take into account Member State experience gained so far on HMWB designation, definition of GEP and the use of hydromorphological assessment methods, which has been documented in numerous CIS technical documents and workshop agreements since 2003.
- The need to achieve intercomparison of HMWB, which is being supported by the principles put forward in this CIS Guidance Document No. 37. For further information on the intercomparison of HMWB, please refer to section 7 of this document.

This Guidance Document No.37 proposes a common practical framework for defining GEP, as a main mechanism for assisting comparability of approaches between Member States. The guidance focusses on updating and refining the existing CIS methods based on practical experience of their application by the Member States.

A comparable assessment of natural water bodies and HMWB is fundamental as a technical and legal basis for consistent, efficient and transparent river basin management. Both natural water bodies and HMWB have ambitious environmental objectives. Good ecological status in natural water bodies is based on deviation from reference conditions. HMWB are a specific water body category[1] with their own classification scheme and objective, GEP. GEP is based on deviation from maximum ecological potential (MEP) and requires the identification and consideration of measures to mitigate the effects of the physical modifications associated with the use so as to improve the overall environmental condition of the water bodies to ensure the best approximation of ecological continuum. GEP also takes account of judgements on the adverse effects of mitigation measures on use and site-specific characteristics of the local conditions, as described in this document. Therefore, the application of a common framework for defining GEP does not mean that all water bodies classified as at GEP will have an equivalent quality of aquatic ecosystem structure and function.

This CIS Guidance Document No. 37 sets out a transparent process for defining GEP in which the roles of technical and policy considerations are made clear, and which results in comparable levels of ambition for these water bodies. It is also important to keep in mind that HMWB are not a type of exemption. Exemptions from GEP under WFD Articles 4.4, 4.5, 4.6 and 4.7 may apply to HMWB in the same way as they apply to natural water bodies.

The recommendations in this CIS Guidance Document No.37 are based on the common understanding of the requirements of the WFD and good practice for implementation developed within the CIS. Member States are not legally required to follow the recommendations contained in this guidance. Member States are, however, required to use methods and approaches compliant with the requirements of the WFD.

The guidance is specifically addressed towards:

[1] Please refer to CIS Guidance Document No.36 which states that “Artificial and HMWBs are considered as a specific water body category with its own classification scheme and objectives“ as well as CIS Guidance Document No.2 on the identification of water bodies with mention of four categories river, lake, transitional and coastal water. A HMWB can be one of these four water categories. It should be taken into account that when delineating water bodies, a water body is not allowed to consist of different categories and a HMWB cannot be mixed with natural categories.

- Water managers and river basin authorities developing river basin management plans.
- Authorities responsible for taking decisions on the review or the issuing of permits for activities or projects that might impact the hydromorphology of a water body/water bodies.
- Interested stakeholders and representatives from civil society organisations.

The main contents of this Guidance Document No. 37 are as follows:

- Section 2 discusses fundamental principles on the role of hydromorphology in WFD implementation.
- Section 3 explains the scope of the wider environment and human development activities which is one of the terms for designating water bodies as heavily modified.
- Section 4 reflects on key aspects of CIS Guidance Document No.4 for the process of designating HMWB and discusses key principles and issues to consider when reviewing the designation of HMWB in upcoming cycles.
- Section 5 proposes a step-by-step approach for defining MEP and GEP, building on previous approaches and methods discussed within the CIS process. It also introduces and describes how to use the European library of mitigation measures, which is included in a separate document supporting this guidance[2].
- Section 6 addresses the process for the implementation of measures to achieve good ecological potential for HMWB.
- Section 7 provides information on the intercomparison of HMWB.

The Annexes to this document include the following:

- Annex I: Illustrative case studies on the steps for defining ecological potential.
- Annex II: Example of Ditches as Artificial Water Bodies (on the use of mitigation measures to improve the ecological situation).
- Annex III: Glossary of key terms used in this CIS Guidance No.37.

Disclaimer on Good Ecological Potential for Artificial Water Bodies:
Good ecological potential is also the Directive's default objective for artificial water bodies (AWB). However, with the notable exception of the Netherlands, AWB tend to be far less numerous than heavily modified water bodies. The present document concentrates on the definition of GEP for HMWB. Generally, the procedure for setting GEP is comparable between AWB and HMWB, including the consideration of mitigation measures and adverse effects on use. Because AWB are developed with a specific function in mind, the criteria for adverse effects on use as a consequence of proposed mitigation measures are in many cases easily met.

However, there are also some clear differences between HMWB and AWB. AWB are created at a place where no water existed before, while HMWB are related to a formerly natural water body. Restoration measures required to achieve GES cannot be considered for AWB, because the concept of reference conditions does not apply. An AWB is created by human activity and this creation has (or has had) a clear purpose to serve a specified use, and this use usually is related to the ones referred in Article 4(3). An example is provided in Annex II on the use of mitigation measures to improve the ecological situation of ditches, which are designated as AWB in the Netherlands.

[2] Available at: https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm

1.2 Overview of CIS activities relevant to HMWB and GEP

The implementation of the WFD raises a number of shared technical challenges for the Member States, the Commission, the Candidate and European Economic Area (EEA) Countries as well as stakeholders and Non Governmental Organisations (NGOs). In addition, many of the European river basins are international, crossing administrative and territorial borders and therefore a common understanding and approach is crucial to the successful and effective implementation of the Directive.

In order to address the challenges in a co-operative and coordinated way, the Member States, Norway and the Commission agreed on a Common Implementation Strategy (CIS). Since 2001, the activities delivered under the CIS have aimed towards a coherent and harmonious implementation of the WFD. The focus is on methodological questions related to a common understanding of the technical and scientific implications.

In this context a series of working groups and joint activities have been undertaken since 2001. One of the first working groups established within the CIS focussed on issues related to the provisional identification and designation of HMWB and AWB, including the definition of good ecological potential.

Since the development of the resulting CIS Guidance Document No. 4 "Identification and Designation of Heavily Modified and Artificial Water Bodies", a number of CIS workshops have led to key conclusions and recommendations for good practice related to hydromorphology issues, HMWB and ecological potential (workshop results available at CIRCABC).

In 2015, the Water Directors identified work on best practice and guidance on dealing with hydromorphology as one of three priority issues to be addressed through an ad- hoc task group (ATG) on hydromorphology. This ATG aims to ensure coordination of strategic hydromorphology issues aimed at a common understanding and harmonising environmental requirements in hydromorphologically-impacted water bodies.

Table 1 provides an overview on the main CIS activities and key CIS supportive documents relevant for HMWB and GEP since the adoption of the Directive. More detailed information can be obtained from the related documents.

Table 1: Overview CIS activities and key documents relevant to ensure common implementation of HMWB, hydromorphology and GEP according to WFD

When	Who	Output
2003	Water Directors	Guidance Document No. 4 "Identification and Designation of Heavily Modified and Artificial Water Bodies"
2005	CIS process	Summary report of workshop on WFD and hydromorphology. As a result, an alternative approach to defining good ecological potential based on mitigation measures was put forward (known also as the "Prague" approach)
2006	CIS process	Technical report on WFD and hydromorphological pressures
2007	Water Directors	Policy paper on WFD and hydromorphological pressures
2007	CIS process	Summary report of workshop on WFD and hydropower
2009	CIS process	Summary report of workshop on Heavily Modified Water Bodies
2011	Water Directors	Recommendations on assessing and improving comparability of Good Ecological Potential (GEP)
2011	CIS process	Issues Paper and Summary report of workshop on water management, WFD and hydropower

When	Who	Output
2014	CIS process	Proposal to establish a CIS Ad-hoc Task Group (ATG) on hydromorphology
2015	Water Directors	Guidance Document No. 31 “Ecological flows in the implementation of the Water Framework Directive”
2015	CIS process	Summary report of workshop hydromorphology and WFD classification
2016	Water Directors	WFD reporting guidance 2016
2016	CIS process	JRC report on common understanding of using mitigation measures for reaching Good Ecological Potential for HMWB – Part 1: Impacted by water storage
2017	CIS process	Summary report of workshop on GEP inter-comparison case studies on water storage
2017	CIS process	Summary report of workshop on mitigation measures and GEP for inland navigation water use
2018	CIS process	CIS reports on methods for river hydromorphological assessment and monitoring
2018	Water Directors	Guidance Document No. 36 “Exemptions to the environmental objectives according to Article 4(7)”
2018	CIS process	JRC report on common understanding of using mitigation measures for reaching Good Ecological Potential for HMWB – Part 2: Impacted by flood protection structures – Part 3: Impacted by drainage
2018	CIS process	Summary report of workshop on significant adverse effect on water use & wider environment
2018	CIS process	Summary report on hydromorphology of ECOSTAT classification workshop

Source: All documents are available on CIRCABC.

2 ROLE OF HYDROMORPHOLOGY IN WFD

Key messages for this section

- Supporting elements (hydromorphological and physico-chemical) provide the boundary conditions for the biological quality elements and any alteration in those can translate into a corresponding change of biological conditions at various time scales.
- The WFD defines ecological status as "an expression of quality of the structure and functioning of aquatic ecosystems associated with surface waters” (Art. 2. 21, WFD). Change in land use and other human activities have profound effects on hydromorphological processes, causing fragmentation and loss of habitats, with direct and indirect consequences for the structure and functioning of the aquatic ecosystem.
- Ecological status is defined in terms of all quality elements. Hydromorphological conditions are only explicitly described for the high status in WFD Annex V, corresponding totally or nearly totally to undisturbed conditions. For good and moderate status, hydromorphological conditions are defined as to be “consistent with the achievement of values specified for the biological elements”. This implies there is a need for 5-class biological assessment methods sensitive to hydromorphological alterations. The development of such methods requires hydromorphological assessment methods that are able to reliably assess hydromorphological conditions along the full degradation gradient, from good to bad hydromorphological status.

Given the relevance of hydromorphological assessment in all the steps regarding HMWB designation and GEP definition, this introductory section deals with the role of hydromorphology in the WFD. This section also aims to improve the understanding of the differences between dealing with GES and GEP.

2.1 Overview

Hydromorphology is a term that is used to describe the hydrological and geomorphological characteristics (including continuity) of rivers, lakes, coastal, and transitional waters including the underlying processes from which they result. Water and sediments interact at different scales and shape the physical environment, determining physico-chemical processes and providing physical habitat for the biota.

Therefore, hydromorphological conditions are a key aspect of aquatic ecosystems and the WFD considers hydromorphological quality elements as "supporting" biology, together with the physico-chemical quality elements. The supporting elements provide the boundary conditions for the biological quality elements, and any alteration in those can translate into a corresponding change of biological conditions at various time scales.

The WFD defines ecological status as "an expression of quality of the structure and functioning of aquatic ecosystems associated with surface waters" (Art. 2. 21, WFD), classified in accordance with Annex V. Hydromorphological alterations are one of the most dominant reasons for failure to reach good ecological status in water bodies. Change in land use and other human activities have profound effects on hydromorphological processes, causing fragmentation and loss of habitats, with direct and indirect consequences for the structure and functioning of the aquatic ecosystem.

The hydromorphological quality elements for each water category are listed in Annex V, together with the relevant aspects to be considered (e.g. for rivers: conditions of flow regime, sediment transport, river morphology, lateral channel mobility and more in general continuity - i.e. longitudinal, vertical, lateral, which are expressed in terms of some aspects listed in Annex V).

WFD recognizes the fundamental role of hydromorphology in different steps and aspects of WFD implementation, as highlighted in Table 2 and summarised in the following paragraphs.

Table 2: Role of hydromorphology in different steps and aspects of WFD implementation

WFD stage	Consideration of hydromorphology	Articles	CIS Guidance
Water body delineation	Ensure uniform hydromorphological conditions within water bodies to allow sound delineation of water bodies.	Art. 5 Annex II	2
Risk analysis	Consider hydromorphological conditions in the analysis of pressures and their impacts	Art. 5 Annex II.1.4; 1.5	3
Monitoring strategies	Requirements to monitor the hydromorphological quality elements, focus on hydromorphological alterations and their effects on the BQEs in operational monitoring in water bodies at risk of failing the objectives because of	Art. 8; Annex V 1.3	7

WFD stage	Consideration of hydromorphology	Articles	CIS Guidance
	hydromorphology; design investigative monitoring of some specific hydromorphological aspect in more complex situations.		
Typology and Reference Conditions	Consider hydromorphological conditions in the definition of water body types. Consideration of unaltered hydromorphology in reference conditions	Annex II 1.1-3	5,10
Status assessment	Hydromorphological conditions and related biological response	Art. 4 Annex V	13
Design and implementation of measures	Measures to improve hydromorphological conditions	Art. 11.3 Annex VI	31
HMWB designation	Hydromorphological pressures and alteration	Art. 4.3.c	4
Ecological Potential assessment	Hydromorphological conditions, status and mitigation measures	Art. 4 Annex V	4,13
Exemptions	Deterioration of hydromorphological condition also to less than good should be predictable to fulfil Article 4.7 principles	Art. 4.4, 4.5, 4.6, 4.7	20,36

2.1.1 Characterization

Look out!

In the characterization phase, major catchment controls are considered (topography, geology, hydrology) to delineate water bodies and to define water body types – groups of water bodies sharing the same behaviour and character. Hydromorphological functions and features (e.g. energy, channel morphology, sediments) are key factors that need to be taken into account. **WFD typologies should reflect the natural variability in hydromorphological characteristics and processes**, which in turn will result in different reference values in those BQE methods that are sensitive to hydromorphological alterations (WFD CIS Guidance Documents No.2&10; Oslo, 2015).

It is important to ensure that hydromorphological conditions are sufficiently homogeneous within each water body when they are delineated. This can only be confirmed by applying a hydromorphological assessment method which can assess hydromorphological conditions along the full degradation gradient. The initial delineation of spatial units and their characterization are crucial, because they are the basis for all further steps and in particular for decisions on appropriate and effective measures. These measures are likely to turn out far more costly in the long term or even infeasible if delineation and characterisation are not taken into account thoroughly at the outset.

If the delineation of water bodies is based on a proper initial segmentation and categorization into hydromorphological types, the assessment of hydromorphological conditions will be much easier and significant. Defining water body types on a rigorous basis and also taking hydromorphological conditions into account allows like-with-like comparison and identification of the type-specific indicators that are meaningful for monitoring, assessment and for the design of measures.

2.1.2 Pressure and impacts and risk analysis

Hydromorphological pressures (e.g. abstractions, damming, etc.) and their impacts on the type-specific hydromorphological conditions and biological quality elements in water bodies need to be evaluated in the context of water body type. A preliminary classification is undertaken on the basis of the pressures on the different water bodies and the expectation with regard to the risk for BQEs to fail the environmental objectives. This risk assessment requires hydromorphological assessment methods that are able to predict the risk of not achieving good ecological status due to hydromorphological pressures (CIS Guidance Document No. 36).

2.1.3 Monitoring

WFD Annex V 1.3.1 requires the monitoring of parameters indicative of all hydromorphological quality elements for the surveillance monitoring.[3]

For water bodies at risk from significant hydromorphological pressures, Member States need to monitor parameters indicative of the hydromorphological quality elements most sensitive to the pressure identified.[4] Sufficient monitoring points are needed within a selection of the water bodies in order to assess the magnitude and impact of the hydromorphological pressures. The selection of water bodies must be indicative of the overall impact of the hydromorphological pressure to which all the water bodies are subject (Annex V 1.3.2).

Monitoring frequencies must be selected which take account of the variability in parameters resulting from both natural and anthropogenic condition. For hydrology, the WFD recommends a continuous monitoring. For morphology and continuity, recommended minimum frequencies are provided (Table 3). No recommendations are given for tidal regime in coastal and transitional waters.

Table 3: Assessment and minimum requirements for monitoring frequencies of hydromorphology for surface water bodies

Hydromorphological QE	River	Lake	Transitional	Coastal
Continuity	6 years	n.a.	n.a.	n.a.
Hydrology (rivers, lakes)	Continuous (daily)	1 month	n.a.	
Tidal regime (transitional, coastal)	n.a.	n.a.	No minimum requirement	No minimum requirement
Morphology	6 years	6 years	6 years	6 years

Notes: Derived from Annex V, 1.3.4. Guidelines for frequencies for monitoring surface waters for hydromorphological quality elements (for operational monitoring). As indicated in the table, the WFD requires

[3] Surveillance monitoring provides a general description and a representative picture of the water status in each water district or basin. The surveillance monitoring should also be used to assess long-term changes in natural conditions and of large-scale human impact.
[4] Operational monitoring is carried out in order to determine the status of the surface water bodies that are deemed to be at risk of failing to meet the environmental quality objectives set for the bodies under Article 4 and to follow up if the programs of measures put in place in order to achieve the desired effect and goals.

minimum monitoring frequencies for certain aspects but not for others ("n.a." stands for "not applicable"). In cases where no minimum monitoring frequency is required, there is still a need for determining the monitoring frequency based on natural variability. Considering these frequencies, it is possible to update monitoring data (e.g. morphology) for water bodies where changes are expected. If it can be assumed that no changes occurred since the last monitoring cycle, a new assessment is not obligatory.

2.1.4 Ecological status

The WFD considers hydromorphological quality elements as supporting elements for biota and aquatic ecosystems. Ecological status is defined in terms of all quality elements. Hydromorphological conditions are only explicitly described for high status in WFD Annex V, corresponding totally or nearly totally to undisturbed conditions (Table 4). For good and moderate status, hydromorphological conditions are defined as being "consistent with the achievement of values specified for the biological elements". This implies there is a need for 5-class biological assessment methods sensitive to hydromorphological alterations. The development of such methods **requires hydromorphological assessment methods that are able to reliably assess hydromorphological conditions along the full degradation gradient, from good to bad hydromorphological status**.

Table 4: Definition of high, good and moderate status for hydromorphological quality elements (WFD Annex V)

Element	High Status	Good Status	Moderate Status
General	There are no, or only very minor, anthropogenic alterations to the values of the physico-chemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion. These are the type-specific conditions and communities.	The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.	The values of the biological quality elements for the surface water body type deviate moderately from those normally associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status.
Hydrological regime (Rivers)	The quantity and dynamics of flow, and the resultant connection to groundwaters, reflect totally, or nearly totally, undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
Hydrological regime (Lakes)	The quantity and dynamics of flow, level, residence time, and the resultant to groundwaters, reflect totally of nearly totally undisturbed conditions	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
River continuity	The continuity of the river is not disturbed by anthropogenic	Conditions consistent with the achievement of the values specified above for the biological quality elements.	

Element	High Status	Good Status	Moderate Status
	activities and allows undisturbed migration of aquatic organisms and sediment transport.		
Morphological conditions (Rivers)	Channel patterns, width and depth variations, flow velocities, substrate conditions and both the structure and condition of the riparian zones correspond totally or nearly totally to undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
Morphological conditions (Lakes)	Lake depth variation, quantity, and structure of the substrate, and both the structure and condition of the lake shore zone correspond totally or nearly totally to undisturbed conditions	Conditions consistent with the achievement of the values specified above for the biological quality elements	
Morphological conditions (Transitional)	Depth variations, substrate conditions, and both the structure and condition of the intertidal zones correspond totally or nearly totally to undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
Morphological conditions (Coastal)	The depth variation, structure and substrate of the coastal bed, and both the structure and condition of the inter-tidal zones correspond totally or nearly totally to the undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
Tidal regime (Transitional)	The freshwater flow regime corresponds totally or nearly totally to undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	
Tidal regime (Coastal)	The freshwater flow regime and the direction and speed of dominant currents correspond totally or nearly totally to undisturbed conditions.	Conditions consistent with the achievement of the values specified above for the biological quality elements.	

Even if it may only be required for the classification of ecological status of water bodies in high status, the assessment of hydromorphological conditions is crucial for the management of all water bodies. Knowledge of hydromorphological conditions is required to develop and to predict effects of measures that aim to restore these conditions or to mitigate hydromorphological alterations. It is also required to forecast the risk and extent of deterioration in case of a new project leading to hydromorphological alterations (see also CIS Guidance Document No.36 on exemptions to the environmental objectives according to Article 4(7), which outlines practical considerations for the role of supporting elements). This also allows not only a better understanding of responses and the possibility to monitor the progress and efficiency of measures, but also the designation of HMWB, which requires the evaluation of the significance and permanence of modifications and the definition of ecological potential. This is not possible with a single qualitative 2-class method.

2.1.5 Reference conditions and typology

The ecological status of a water body is classified based on five classes (from high to bad) and is defined on the basis of the degree of deviation from the conditions that would occur if the water body had no or negligible pressures acting on it. Reference conditions describe this undisturbed or very slightly altered situation that is based on type-specific characteristics for all quality elements. This requires that hydromorphological conditions are properly considered in the definition of water body types, minimizing within-type variability at reference conditions.

2.1.6 Measures

According to WFD, in order to reach the environmental objectives, measures have to be designed and implemented. Article 11 lists the basic measures (minimum requirements) to be complied with and among them obligatory measures on water abstraction and impoundment (11.3.e) and measures to ensure that the hydromorphological conditions of the water bodies are consistent with the achievement of the required environmental objectives (11.3.i). In addition to the basic measures, other supplementary measures aimed to enhance hydromorphological conditions may be necessary (e.g. restoration, abstraction controls, rehabilitation projects – Annex VI part B). Such measures have to be listed in the RBMPs.

2.1.7 Exemptions

Hydromorphological conditions may be one of the reasons to delay reaching the environmental objective or to set a less stringent objective. Exemptions may then be agreed if the relevant conditions listed in Art. 4 are met. The justification for exemptions is based on the knowledge of nature and dynamic of the specific hydromorphological processes and, similarly to the stage of designing measures, it implies the prediction of hydromorphological conditions under certain management scenarios (e.g. Art. 4.7).

2.2 Hydromorphology in HMWB designation and assessment of ecological potential

By definition, a HMWB has undergone a substantial change in character as a result of physical modification due to sustainable human activity. Because of that, it cannot reach good ecological status and it is not possible to restore this without significant adverse effects on the use of the water body or the wider environment.

The change in character must be extensive enough to prevent the achievement of good ecological status. This requires assessment methods which are sensitive to hydromorphological alterations. Detection of such changes in character requires assessment through a full gradient hydromorphological method (CIS Guidance Document No.4, step 6), and proper consideration of the temporal dimension of processes.

The ecological conditions of a HMWB have to be monitored and assessed with respect to its environmental objective, namely good ecological potential (GEP). The whole procedure for defining GEP is outlined in section 5, including details on the selection of mitigation measures for GEP. Once a water body is designated as HMWB, there is a need to predict the effects of potential mitigation measures on BQEs sensitive to hydromorphological alterations; this requires hydromorphological assessment methods able to predict such effects.[5] These hydromorphological assessment methods need to cover the full degradation gradient with respect to hydromorphological, physico-chemical and biological conditions related to the pressures behind HMWB designation.

If monitoring results (of BQEs or of supporting quality elements as proxy) show that the ecological potential is moderate or lower, mitigation measures have to be put in place to reach GEP. In the design of measures, hydromorphological processes need to be identified and actions to mitigate the hydromorphological impacts and restore ecological processes have to be planned.

Mitigation measures should aim to improve the quality and connectivity of habitats and enhance transfer of energy, material (water, sediments, etc.), and organisms (for rivers, this includes flow releases, sediment management, in-channel habitat enhancement, connection to floodplain and side branches, etc.).

3 WATER USES, WIDER ENVIRONMENT AND OTHER SUSTAINABLE HUMAN DEVELOPMENT ACTIVITIES

Key messages for this section

- Member States may designate water bodies as heavily modified only if measures for restoring the water body to good ecological status would have a significant adverse effect on (a) the benefits provided by the water body's use or (b) the wider environment.
- In principle, any water use or human development activity serving significant benefits to society may lead to designation if it causes a permanent physical modification, a substantial change in character of the water body and impacts on ecology which lead to failure to achieve good ecological status.
- Human development activities in the context of HMWB designation should be important and still ongoing sustainable activities according to WFD Article 4(3)(a), thus serving significant societal benefits and including provisions to minimise negative effects on the environment.

According to WFD Article 4(3)(a), Member States may designate a body of surface water as artificial or heavily modified when the changes to the hydromorphological characteristics of that body which would be necessary for achieving good ecological status would have significant adverse effects on:

i. The wider environment.
ii. Navigation, including port facilities, or recreation.
iii. Activities for the purpose of which the water is stored, such as drinking water supply, power generation or irrigation.
iv. Water regulation, flood protection, land drainage.
v. Other equally important sustainable human development activities.

[5] Such methods can be either simulations with morphodynamic or hydraulic models and then application of a hydromorphological assessment method or directly applying hydromorphological assessment methods to the different scenarios of measures (e.g. Morphological Impact Assessment System (miMaS), Morphological Quality Index (MQI)).

In the 1st cycle RBMPs, several human development activities (water uses) related to the designation of HMWB, such as water storage, flood defence and navigation, were clearly specified by the Member States and in line with Article 4.3(a) of the WFD. However, several other human development activities related to the designation of HMWB were not as clearly specified or not explicitly mentioned in Article 4(3), e.g. it was not clear whether agriculture refers to land drainage or other activities.[6] In addition, detailed reporting into WISE on the specific human activities (water uses) and physical modifications linked to the designation of each HMWB was not required in the 1st cycle RBMPs.

Important!

WFD Article 4(3)(a) provides a list of human development activities (specified water uses) which can be related to the designation of HMWB. In principle, any **water use or human development activity** serving significant benefits to society may lead to designation if it causes a permanent physical modification, a substantial change in character of the water body and impacts on ecology which lead to failure of achieving good ecological status.

It should be noted that in the context of HMWB designation under the WFD, the term "**physical**" refers to the "shape" of a water body, defined by morphology, e.g. channel pattern, continuity, and hydrology (e.g. amount of water in river/lake water bodies) or tidal regime (e.g. wave exposure in coastal/transitional water bodies). As stated in CIS Guidance Document No.4, for the provisional identification of HMWB, the failure to achieve good status results from physical modifications to the hydromorphological characteristics of a water body. It must not be due to other impacts, such as physico-chemical impacts, except if the physico-chemical impacts are directly linked to the physical modifications.

Despite this, it is noted that not every human development activity can automatically be used as a reason for designating HMWB. Human development activities in the context of HMWB designation should be important and still ongoing sustainable activities according to WFD Article 4(3)(a), thus serving significant societal benefits and including provisions to minimise negative effects on the environment. Key benefits related to the main human development activities (water uses) and the wider environment in the context of designation of water bodies as heavily modified have been outlined in the Summary Report of the Workshop on Significant Adverse Effects on Use or the Wider Environment from Measures.[7]

It is acknowledged, however, that many water bodies are designated as heavily modified due to uses that would not be considered as sustainable according to current sustainability principles. In these cases (and assuming that the use is still present and/or the modification is still required), sustainability should be interpreted according to principles applicable, knowledge available and societal benefits considered at that time when the use leading to physical modifications in the water body was initiated. For any physical modifications that have taken place after 2003, and for future new modifications, sustainability of use should be interpreted as described in CIS Guidance Document No.36 on exemptions under WFD Article 4(7) (section 3.3).

The application of WFD Article 4(3)(b) also ensures sustainability by assessing whether the beneficial objectives served by the modifications of the HMWB can be achieved by other means, which are a significantly better environmental option. The issues which should be considered when assessing

[6] See Key Conclusions. Heavily Modified Water Bodies: "Information Exchange on Designation, Assessment of Ecological Potential, Objective Setting and Measures". Common Implementation Strategy Workshop, Brussels, 12-13 March 2009.

[7] Kampa et al. (2018). Summary Report. Workshop on Significant Adverse Effects on Use or the Wider Environment from Measures, 23-24 April 2018, Brussels.

other means as better environmental options are illustrated in CIS Guidance Document No.4 (section 6.5.3), while examples on the assessment of other means as better environmental options are provided in the Toolbox (2003) on the identification and designation of AWB and HMWB. Section 5.3 of CIS Guidance Document No.36 also discusses how “significantly better” can be demonstrated.

The following explains the scope of wider environment and of the physical modifications linked to sustainable human development activities (uses) under WFD Article 4(3)(a), which is one of the criteria for designating water bodies as heavily modified, as these have been addressed in the context of CIS activities on hydromorphology in recent years:

- **The wider environment** refers to the natural and human environment including archaeology, heritage, landscape and geomorphology[8] (CIS Guidance Document No.4). Specific aspects which should be considered may include cultural heritage sites or assets (e.g. a sluice which no longer serves a water management purpose but is protected under heritage legislation), Natura 2000 sites and protected species, other nationally and locally important sites and wider biodiversity. For the purpose of designating HMWB, relevant aspects of the wider environment should be related to substantial changes in the hydromorphological character of a water body. Other aspects that are not linked to substantial changes in the hydromorphological character, such as informal recreation not requiring infrastructure (e.g. canoes, angling), may however be relevant later in the process, when determining whether mitigation measures for defining GEP will significantly affect the wider environment (see section 5.4.4.2 on significant adverse effects on use or wider environment).
- Physical modifications linked to **navigation** refer to man-made structures, such as port infrastructure, locks and physical modifications to water bodies, such as dredging, for commercial, recreational (e.g. sailing) and military navigation purposes. Navigation infrastructure enables in particular the transport of goods or passengers.[9]
- Physical modifications linked to **water storage** refer to larger structures (reservoirs due to dams) for impounding water for useful purposes, such as water supply (industry, drinking), flood protection, power generation or irrigation. However, water storage can occur also to serve a range of other benefits and/or uses, including industrial water supply, aquaculture, recreational uses and navigation.[10] Such structures may include abstraction intakes and dams in rivers or lakes/reservoirs for permanent longer term (days – interannual) storage of surface water.[11]
- Physical modifications linked to **flood defences** refer to all the structures aimed at preventing or reducing the detrimental effects of floods, including actions on vegetation and sediments. Floods are defined as “the temporary covering by water of land not normally covered by water”. This includes floods from rivers, mountain torrents, Mediterranean ephemeral watercourses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems.[12]

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[8] Geomorphology in relation to wider environment can, for example, refer to special geomorphological protected areas.

[9] See Summary Report & Conclusions. Workshop on ‘Significant adverse effects on use or the wider environment’ of measures in the context of HMWB designation and GEP definition, 23-24 April 2018, Brussels.

[10] See Summary Report & Conclusions. Workshop on ‘Significant adverse effects on use or the wider environment’ of measures in the context of HMWB designation and GEP definition, 23-24 April 2018, Brussels.

[11] JRC Technical Report, Working Group ECOSTAT report on Common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies, Part 1: Impacted by water storage, 2016.

[12] Directive 2007/60/CE (Floods Directive), Article 2.

Flood defences represent hydromorphological pressures resulting from the use of flood protection. The focus of the CIS work was on pluvial and fluvial flood defences.[13] Flood defences may protect urban and agricultural areas, or important infrastructure leading to channelization, straightening of river plan form, bank and bed fixation, etc. As highlighted above, not every flood defence activity can automatically be used as reason for designating HMWB. It has to be proven that the flood defence activity is sustainable and the beneficial objectives cannot be achieved by other means, which are a significantly better environmental option. For example, flood defences for the protection of grazing land might not be automatically a valid reason for designation as HMWB.

- Physical modifications linked to **land drainage** refer to man-made structures or physical modifications (straightening, channelisation, using culverts) to water bodies to improve a specific land area for a certain purpose such as agriculture, forestry, urbanization, or tourism.[14] Drainage refers to a change in the drainage function, usually by removing excess water from the soil to lower groundwater level.
- Physical modifications linked to **water regulation** as used in Article 4(3)(a) of the WFD relate to all other uses described above, i.e. navigation, flood protection, water storage and land drainage.

WFD Article 4(3)(a) also refers to **other equally important sustainable human development activities**, which may include any other water use/sustainable human development activity which leads to a permanent physical modification, substantial change in character and such impact on ecology which leads to failure of achieving good ecological status. Examples of uses/activities which can be considered under “other equally important sustainable human development activities” are urbanization, commercial fishing, specific industries, mining or infrastructure such as highways and railways.[15]

Example: Due to the limited area for settlements in narrow valleys of the alpine area, railways or highways are often built directly along rivers. Flood protection measures (e.g. bank fixation, straightening) were implemented to safeguard from flooding. Those measures usually have led to a failure of good status. There is no option (no space) to improve habitat diversity and restore the type-specific hydromorphological conditions to achieve good ecological status by shifting the highway /railway away from the river.

Figure 1 presents the number of water bodies which have been designated as heavily modified in the 2nd RBMPs due to specific human development activities or the wider environment.

The most common uses for designating HMWBs in the second cycle RBMPs are hydropower (ca. 5800 water bodies) followed by flood protection (ca. 4500 water bodies), land drainage for agriculture (ca. 3500), urban/other (use other than drinking water supply) (ca. 2200), drinking water supply (ca. 1500) and irrigation for agriculture (ca. 1400). A large number of water bodies are designated as heavily

[13] JRC Technical Report, Working Group ECOSTAT report on Common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies, Part 2: Impacted by flood protection structures, 2018.

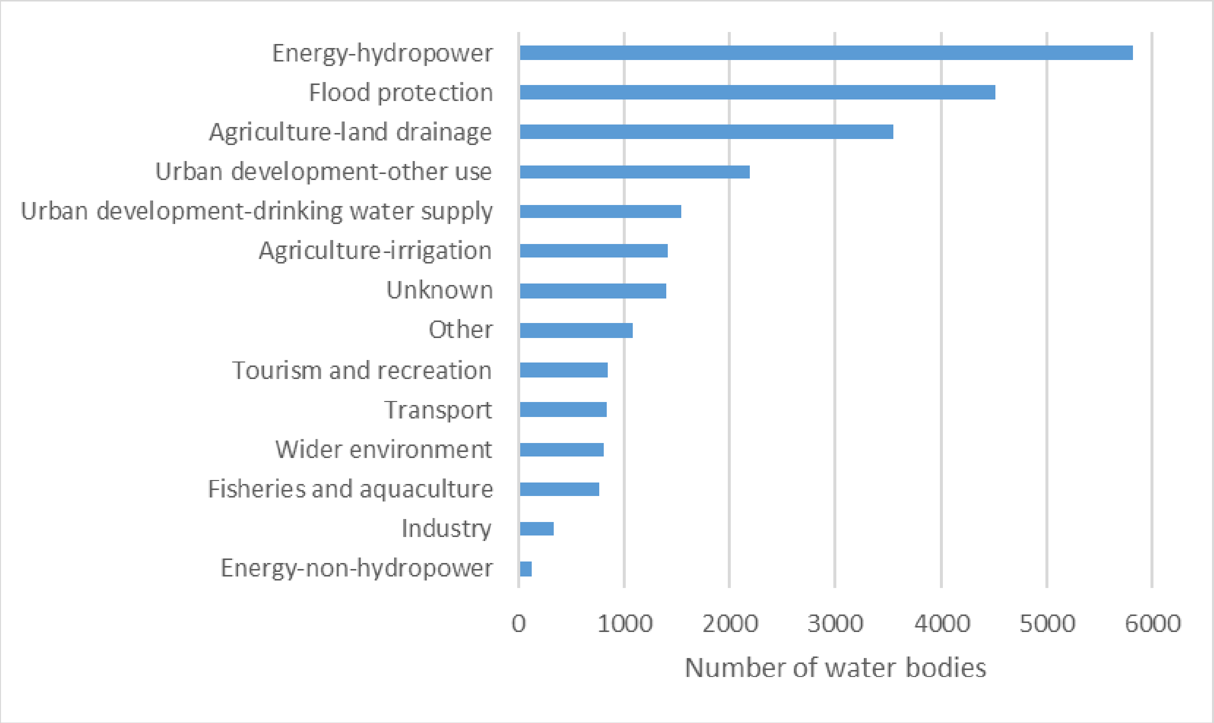
[14] JRC Technical Report, Working Group ECOSTAT report on Common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies, Part 3: Impacted by drainage, 2018.

[15] Kampa & Laaser (2009). Updated Discussion Paper. Heavily Modified Water Bodies: “Information Exchange on Designation, Assessment of Ecological Potential, Objective Setting and Measures". CIS Workshop, Brussels, 12-13 March 2009. Note: Information is based on the filled-in questionnaires of 24 European countries on HMWB designation in the first cycle RBMPs.

modified due to unknown activities (1400 water bodies) or other activities (1100) (i.e. activities which do not match any of the water use categories in the WISE reporting).

The percentage of HMWB in the second cycle RBMPs in Member States varies from 3% to approximately 50% of the total surface water bodies, with a European average of 13%.

Figure 1: Number of HMWB designated in the 2nd RBMPs due to specific human development activities or the wider environment



Source: WISE reporting 2016.

Notes: Data from https://www.eea.europa.eu/themes/water/european-waters/water-quality-and-water-assessment/water-assessments, 15 July 2019. Based on data reported for 26 Member States and Norway; no data are included for EL and LT .

It should be noted that a variety of different human activities (multiple uses) can depend on the same physical modification (e.g. a dam that serves energy production, flood protection and irrigation supply in a combined way). For this reason, many water bodies in the EU are designated as heavily modified due to more than one human activity. Section 5.4.4 in this document provides more information on the linkages between different types of physical modification, various human activities and relevant mitigation measures.

4 RE-CAPPING THE DESIGNATION OF HMWB

Key messages for this section

- HMWB designation should only be considered for water bodies that are substantially changed in character due to hydromorphological alterations linked to one or several specific sustainable uses (often due to specific European legislation - e.g. Floods Directive, Renewable Energy Directive etc.).
- Substantial changes in character must be extensive/widespread or profound. Typically this should involve substantial change to both the hydrology and morphology of the water body.
- If the morphology of a water body is substantially changed in character, then the changes are likely to be long-term. Such changes in morphology are very likely to result in changes in hydrology (not necessarily substantial).
- In cases of temporary, short-term and easily reversible substantial hydrological changes, the water body is not to be considered substantially changed in character. Substantial hydrological alterations may also result in long-term or permanent substantial changes in character when they have impacts on sediment dynamics and habitat conditions (morphology, turbidity etc.).
- Possible restoration measures to achieve good ecological status need to be identified and the reasons and criteria for judgements on significance of adverse effects of such measures on use or wider environment have to be made clear.
- HMWB are a specific water body category with their own classification scheme and objective, namely good ecological potential (GEP). Exemptions from GEP under WFD Articles 4.4, 4.5, 4.6 and 4.7 may apply to HMWB, as they apply to natural water bodies. Further, when setting the objectives for HMWB designated under Article 4(3), the requirements of Articles 4(8) and 4(9) must also be met.
- A proper review of all the designated HMWB and their objectives is expected in due time when preparing the RBMP and PoM for a new planning cycle. This review should be efficiently designed and performed to provide a proper HMWB designation according to the requirements of WFD Article 4.3 and Annex V, 1.2.5; it should also take account of monitoring outcomes, new modifications (e.g. new flood protection structures, hydropower plants, etc.) the effects of implemented measures, emerging good practice on hydromorphological assessment methods and relevant mitigation measures as well as reconsidering the criteria for assessing significant adverse effects, where appropriate.
- GEP should be rechecked occasionally, as knowledge/expertise can increase and also economic aspects may change over time.

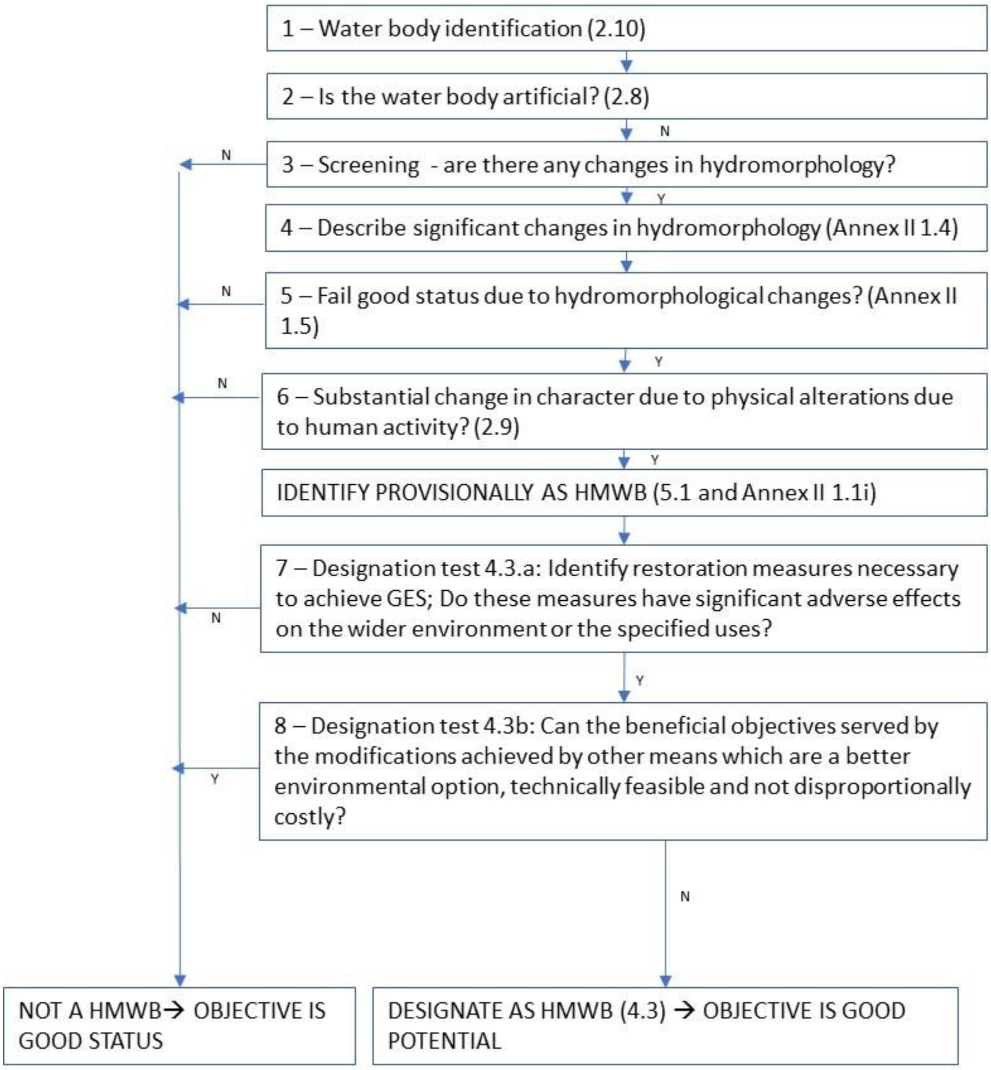
This section re-caps the key aspects which should be considered in the designation of HMWB (see CIS Guidance Document No.4 for details) to provide a clear context for defining MEP and GEP. It also provides a reminder of the importance of reviewing the designation of HMWB and the set GEP in each new planning cycle, outlining a check-list of issues and questions recommended as a basis for such a review.

4.1 Recap of key issues relevant to the designation of HMWB

CIS Guidance Document No.4 on the Identification and Designation of Heavily Modified and Artificial Water Bodies presents the EU-wide common understanding for the designation of HMWB and AWB. The principles agreed under CIS Guidance Document No.4 are still valid, and the Guidance is being used by Member States when preparing their river basin management plans. In both the first and the second RBMPs, heavily modified water bodies have been designated to a significant extent in Member States (on EU level, approximately 12-13% of total number of surface water bodies are HMWB and 4% are AWB)[16], reflecting the amount of modifications that have taken place historically in Europe.

CIS Guidance Document No.4 presented the key steps that should be followed to establish whether a water body may be designated as heavily modified or artificial (Figure 2). Steps 1 to 6 present the initial tests to provisionally identify a water body as heavily modified. Once potential HMWB have been identified, the key final designation tests under steps 7 and 8 should be carried out.

Figure 2: Key steps in HMWB designation (after characterisation and pressure analysis).



Note: Based on CIS Guidance Document No.4.

[16] European Commission (2019) Commission Staff Working Document, European Overview - River Basin Management Plans, Accompanying the document Report from the Commission to the European Parliament and the Council implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) Second River Basin Management Plans First Flood Risk Management Plans, SWD(2019) 30 final

Key aspects which should be considered in the designation of HMWB are recapped below to provide a clear setting for the next step of defining MEP and GEP for HMWB, which is now addressed in more detail in the present CIS Guidance Document No.37:

- **Water body identification:** It is crucial to ensure that hydromorphological conditions are sufficiently homogeneous within each water body.
- **Assessment of hydromorphological alterations:** The significant hydromorphological alterations causing the water body to fail good status need to be described. The "screening" of hydromorphological alterations as part of the provisional identification of HMWB is an important step (step 3 in Figure 2) for an efficient implementation of the WFD. It is possible to carry out broad-scale assessments of hydromorphological alterations, so that detailed assessment efforts are only concentrated on those water bodies where there is uncertainty or specific issues requiring further attention for possible designation as HMWB.
- **Substantial changes in character:** HMWB should be water bodies that have undergone significant hydromorphological alterations such that the water body is substantially changed in character (WFD Article 2(9)). The change in character must be extensive/widespread and profound. Typically, this should involve substantial change to both the hydrology and morphology of the water body (CIS Guidance Document No.4). Further guidance and examples on substantial changes to the morphology and hydrology are given in this section below. Suitable thresholds (e.g. percentage of river reach irreversibly affected) can be used to justify judgements on whether there are substantial changes in character and to ensure that significant modifications are not overlooked.
- **Proper assessment of ecological status:** The designation process needs to be based on a clear understanding of the expected failure of good status of biological quality elements due to hydromorphological alterations. Therefore, the proper assessment of ecological status is a prerequisite for HMWB designation. If GES is achievable, or if monitoring shows that GES has been reached since the previous review, designation as HMWB is not justified.
- **Assessment of significant adverse effects of restoration measures:** HMWB designation can only take place if the changes to the hydromorphological characteristics of that body which would be necessary for achieving GES would have significant adverse effects on use or the wider environment. Possible restoration measures to achieve GES need to be identified and Member States need to establish criteria and thresholds for deciding if these measures would have a significant (or not significant) effect on use. This is a key issue for achieving a clear and transparent process of designating HMWB.[17] Criteria need to reflect the effects on different benefits provided by the water use. Thus, not only one criterion may be considered but several criteria may need to be used.

  CIS Guidance Document No.4 gave different options for assessing significant adverse effects on different scales. Effects can be determined at the level of a water body, a group of water bodies, a region, a RBD or at national scale (CIS Guidance Document No.4). In the initial HMWB designation stage during the 1st RBMP cycle, the assessment of significant adverse effects normally took place at a regional or national scale. Detailed information on pressure-biological response relationships or administrative capacities for detailed feasibility studies were often missing at this stage. The assessment of significant adverse effects at a regional or national scale was a pragmatic approach, since there was generally no detailed project data available

[17] JRC technical report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies (2016).

in terms of restoration measures at the water body level in the 1st RBMP cycle. However, Member States should have collected such data in the subsequent RBMP cycle.
In this context, it has to be assessed whether the effect is important and to what extent it matters at a national or regional scale. For example, in case dam removal is needed to restore a water body to GES, or if a previously dredged channel is allowed to infill and behave naturally from a geomorphological perspective, the contribution of the modified water body to the regional or national economy could be lost or significantly reduced.
A significant adverse effect at local level may be insignificant in a regional or national context or vice versa. Overall, it is important to define at what level the main importance of the use lies (local, regional, national level or a combination). If the main importance of the use lies at national level, then local effects should be accumulated at national level to assess significance. In such a case, a single local effect will not necessarily be assessed as significant. In addition, the assessment at local scale should not be related to the private interest of one person/or company but to broader public interest.
The assessment of significant adverse effects of restoration measures is closely linked to the possible exclusion of mitigation measures with significant adverse effects when defining MEP/GEP. See section 5.4.4.2 of this document for further guidance on issues which should be addressed to achieve a transparent and clear process for assessing significant adverse effects of mitigation measures, including types of effects, consideration of socio-economic issues, scale of assessment and possible criteria.

- **Assessment of other means:** For HMWB designation, it must also be demonstrated and described that the beneficial objectives of the physical modifications cannot be achieved by other means, which are a significantly better environmental option, technically feasible and not disproportionately costly. For example, wind power can be taken as another means that can produce electricity instead of a hydropower plant. It has to be assessed whether this option would be technically feasible and not disproportionately costly. The better environmental option is assessed as being another renewable resource but might avoid damage leading to a failure of good ecological status.
- **Designation of HMWB is not a type of exemption**. HMWB are a specific water body category[18] with their own classification scheme and objective, namely good ecological potential (GEP). Exemptions from GEP under WFD Articles 4.4, 4.5, 4.6 and 4.7 may apply to HMWB, as they apply to natural water bodies. Further, when setting the objectives for HMWB designated under Article 4(3), the requirements of Articles 4(8) and 4(9) also should be met (see section 5 and section 6 for further information).
- The **methodology and specific criteria for HMWB designation** (application of all relevant steps according to CIS HMWB Guidance no. 4) **should be clearly explained in the RBMPs** or supplementary documents. It is recommended to include a reporting sheet for each water body in the RBMPs, which contains the information relevant for designation or non-designation as heavily modified, in order to increase transparency and to allow intercomparability.

Overall, the assessment of the first cycle RBMPs of Member States by the European Commission showed that the designation of HMWB has been based largely on expert judgement. The extent of designating water bodies as heavily modified and the transparency and/or availability of solid explanations for the implementation of the key steps of designation has been variable across Member

[18] See relevant explanatory footnote on ”specific water body category“ in section 1.1.

States.[19] Differences between Member States in the extent and manner of designation may be due to (among others):

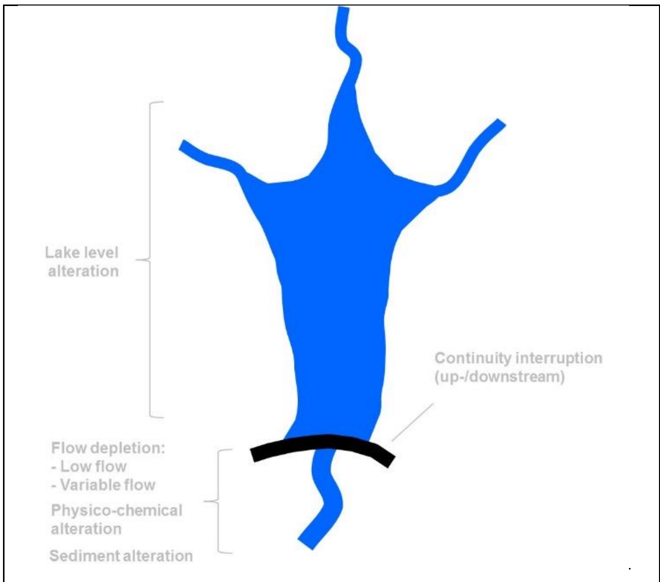
- Differences in population density, infrastructure density, intensity of use of water bodies,
- Differences in the thresholds used for identifying significant hydromorphological pressures (and thus interpreting substantial changes in character),
- Differences in the size of delineated water bodies,
- Differences in the spatial extent and type of impacts considered to be of sufficient magnitude to prevent achievement of good ecological status (and consideration of cumulative impacts or not),
- Differences in the designation methodologies applied (e.g. related to criteria on significant adverse effects of measures on use or wider environment),
- Availability of and experience with relevant mitigation and restoration measures (affecting ambition level for ecological improvements).

4.1.1 Substantial changes in character

According to CIS Guidance Document No.4, it is clear that a water body could be described as substantially changed in character if <u>both</u> its morphology and hydrology were subject to substantial changes (e.g. in the case of a water body downstream of a dammed river, whose morphology changes from braided to sinuous).

Example: Reservoirs with longer-term storage are usually clear cases of water bodies which are substantially changed in character both in their morphology and hydrology, even leading to a change in the closest comparable water category (from river to lake water bodies). Such water bodies are usually designated as HMWB (see **Box 1** below).

Box 1: Water body impacted by instream dam



The instream reservoir was built by damming a river. Below the dam, there is flow depletion (alterations to low flow, fish flow, variable flow). Such an instream reservoir is typical for storage purposes such as for drinking water. In case of hydropower use, the outlet of the turbines could cause additional impacts in the downstream reach, such as hydropeaking effects.
Such cases of instream reservoirs usually lead to a designation of the reservoir as heavily modified.

Graphical illustration based on ECOSTAT work on most common water storage situations for the GEP inter-comparison.

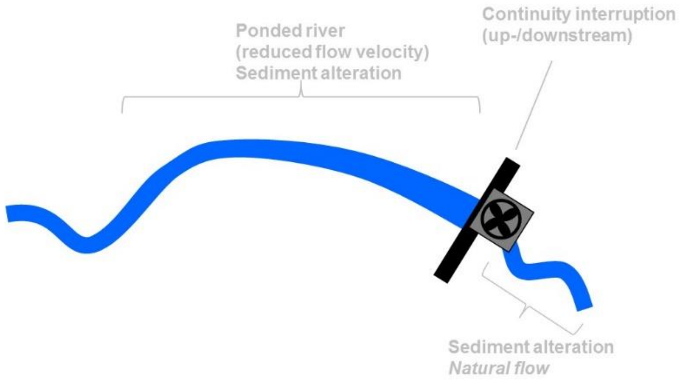
[19] Commission Staff Working Document 2012 WFD implementation (volume 2 of supporting material).

It is less clear-cut whether a water body should be considered as substantially changed in character if only morphology or only hydrology is substantially changed.

If the morphology of a water body is substantially changed in character, then the changes are likely to be long-term. Such changes in morphology are very likely to result in changes in hydrology (not necessarily substantial). A common sense approach would suggest that such water bodies should be considered as substantially changed in character (CIS Guidance Document No.4).

Example: Large impoundments definitely change morphological conditions of a river and therefore are also usually designated as HMWBs even without significantly changing the hydrological conditions (see Box 2 below).

Box 2: Water body impacted by significant ponding (impoundment)



In this case, the river is ponded by a dam, where hydropower turbines are situated in the dam (this type of run-of-river hydropower plant is usually called "in-stream plant type").
The dam leads to a significant ponding effect upstream (impoundment).
Downstream of the dam however there is the natural flow.
Such cases of impoundment usually lead to a designation of the water body upstream of the dam (ponded stretch) as heavily modified.

Graphical illustration based on ECOSTAT work on most common water storage situations for the GEP inter-comparison.

The situation is more diverse for water bodies subject to substantial changes in hydrology.

In cases of temporary, short-term and easily reversible substantial hydrological changes, the water body is not to be considered substantially changed in character. The water body should therefore be considered as natural, with good status as the environmental objective.

Substantial hydrological alterations may result in long-term or permanent substantial changes in character when they have impacts on sediment dynamics and habitat conditions (morphology, turbidity etc.). This happens when hydrological alterations affect the channel-forming discharges[20] and/or those discharges with higher return intervals. These are both relevant for sediment transport and the channel will undergo severe morphological alteration as a result. In other words, the interventions would cut the high flow peaks which promote sediment transport and the shaping of the channel. Such effects are typically associated with some dams for flood attenuation, water abstractions, spillways, retention basins, etc. Alteration of low flows does not generally promote morphological changes; nevertheless,

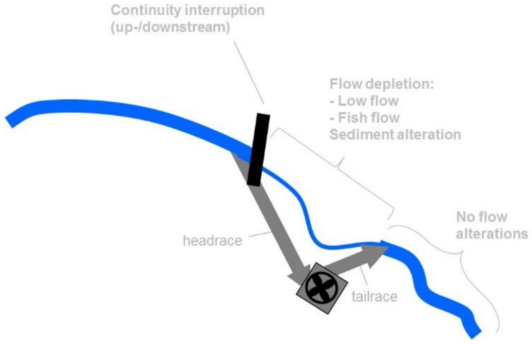
[20] Channel forming discharges are intended as those discharges having the most relevant effects on channel morphology. They correspond to those peak discharges, under natural conditions, with return period of few years (1,5 to 10 according to the specific hydrological regime and river type).

there are some exceptions, e.g. flow releases downstream of dams in rivers characterized by a typical Mediterranean hydrological regime (i.e. high flow variability and low or null water level during the summer). The release of constant flow (usually a minimum flow) during the summer, in such rivers which naturally would have little or no flow, raises the water table, promoting severe vegetation encroachment and consequent channel narrowing. In such specific cases, the application of the HMWB designation tests may be justified.

Water bodies affected by non-storage abstractions (e.g. small-capacity hydropower plants, small-scale irrigation abstractions) are in general not HMWB, because the change in hydromorphology is in most cases not large enough to cause a substantial change in character, e.g. the peak channel-forming discharge[21] is not totally eliminated by the abstraction. In small-capacity hydropower plants, there is often water abstraction to produce electricity but usually no or relatively small water storage with an impounding effect on the water body. The water abstraction will reduce the flow of the downstream stretch, but does not usually cause such a morphological change that causes a substantial change in the character of the water body; thus, the alteration is technically easily reversible by introducing more water into the depleted river reach.

Example: A small-capacity hydropower plant without water storage not causing a change in character and therefore not leading to HMWB designation is shown in Box 3 below.

Box 3: Water body impacted by abstraction without significant ponding/storage

	Water is abstracted from the river by a transversal structure (usually a weir). The abstracted water is transferred "via headrace" to a powerhouse. After passing through the turbine, the water is re-discharged "via a tailrace" into the river from which the water was abstracted. Downstream of the discharge point there is the normal quantity of flow, but between the abstraction and discharge points the river is characterised by flow depletion (alterations of low flow, fish flow, variable flow). The weir at the abstraction point does not lead to a significant ponding effect. There is thus no significant storage or water retention. The abstraction still allows channel-forming discharges in high-flow situations. This situation is typical for most of the small hydropower plants (e.g. Alps). This case does not lead to a designation of the water body as heavily modified, as the water abstraction alone does not lead to such a morphological change that causes a substantial change in character; the alteration from the water abstraction is technically easily reversible to restore GES by providing an eflow.

[21] See previous footnote on channel forming discharges.

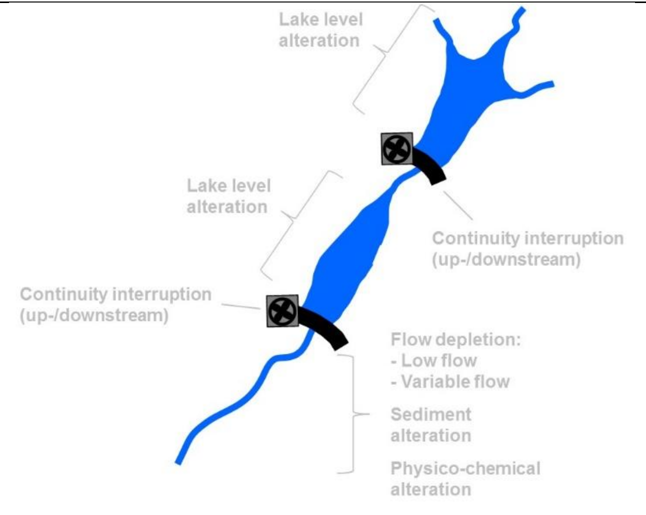
Graphical illustration based on ECOSTAT work on most common water storage situations for the GEP inter-comparison.

In general, the flow depleted reaches downstream of dams/reservoirs are sediment starved and undergo hydrological alteration. The severity of these alterations depends the way the reservoir is managed (according to its use). If the downstream reach is soon fed with water and sediments by close tributaries, it can regain its pseudo-natural character and therefore still reach the good status. Otherwise, the reach is likely to be changed in character, and the application of HMWB test is suggested.

In complex schemes (e.g. chains of reservoirs), the situation is such that the HMWB in the scheme affect the potential natural character and objectives of smaller water bodies, which may undergo the HMWB test as well.

Example: Box 4 shows an example where substantial hydrological alterations in a river stretch downstream of a chain of reservoirs can lead to changes in morphology and thus to designation as HMWB.

Box 4: Water bodies impacted by a chain of reservoirs



Several instream reservoirs were built by damming a river in different stretches. The reservoirs are clearly heavily modified and a change in category (from river to lake). Below the dams, there is a free-flowing river stretch with flow depletion (alterations of low flow, fish flow, variable flow) and sediment alteration. If such a chain of instream reservoirs severely alters conditions downstream leading to a severe change in character, the downstream water body should also be designated as heavily modified.

4.2 Review of HMWB designation in the river basin management planning cycles

The need to review the HMWB designation as well as the GEP setting for the designated water bodies every six years is stated in the WFD and CIS Guidance Document No.4. The identification and designation of HMWB is not a "one-off" process and the WFD provides for the flexibility to modify designations to take account of changes over time in environmental, social and economic circumstances. HMWB and GEP can also be modified as their environmental objective require adaptations as a result of new knowledge gained as well as a result of measures applied during a planning cycle. New or more detailed information (e.g. on economic aspects) or new projects which are exempted from the non-deterioration principle according to WFD Article 4.7 can also lead to new designations of HMWB in the forthcoming RBMP cycle.

The review of HMWB should include several steps as stated in CIS Guidance Document No.4 (Chapter 8). These are illustrated in Table 5, which presents an updated check-list and questions for clarification, which are recommended as a basis for the review of HMWB and GEP setting by Member States for the next planning cycles. More updated guidance for many of these steps is given in other sections of this new CIS Guidance Document No.37.

Table 5. Updated steps for the review of HMWB designation and GEP setting for the next planning cycles

Step			Explanation/questions to clarify	More guidance/examples
Step A.1	A. Review characterisation	Updated monitoring, hydromorphological assessment and BQE assessment	Does a more compliant hydromorphological assessment or monitoring program or implementation of new BQE assessment methods now have a better link to hydromorphological alterations and BQEs? Do updated assessments show that the water body is actually reaching good status?	CIS Workshop on river hydromorphological assessment methods, Nov 2017
Step A.2		Re-delineate water bodies	Do you need to re-delineate either by splitting or merging water bodies?	
Step B.1	B. Re-designation test	i. WBs mistakenly not designated previously	Are modifications more severely impacting aquatic ecology than previously expected?	
Step B.2		ii. New modifications	Have new activities that heavily impact the water body taken place (following the requirements of WFD Article 4.7)?	Art 4.7 CIS Guidance
Step B.3		iii. Reconsiderations of designation – updated screening for changes	*See the following substeps below*	CIS Workshop on significant adverse effect upon use/wider environment
Step B.3a		a) Technical circumstances or use itself	Have the operation, maintenance or need for the modification related to the sustainable water use or the wider environment been significantly changed during the previous planning cycle?	
Step B.3b		b) Available restoration measures	Have national criteria for adverse effects on relevant use, benefits or wider environment been established/changed, so that modification may be restored?	
Step B.3c		c) Methodological approach	Do methodological modifications (due to development of monitoring and better understanding) modify designation results?	
Step B.3d		d) Other means	Can the beneficial objectives of the use be delivered by other means?	
Step C.1	C. Review of MEP and GEP	Adopt BQEs sensitive to hydromorphological alterations	Taking on board emerging good practice on BQEs sensitive to the relevant hydromorphological alterations	
Step C.2		Reference value for MEP and GEP	Review if still only a slight deviation from MEP is valid?	
Step C.3		Identification of available mitigation measures	Could ambition level for GEP be increased, if more of the ecological impacts are possible to mitigate by "new" measures not previously considered/available?	See lists of common mitigation measures in the library provided as supporting tool to this document
Step C.4		Achievement of GEP or exemption	Is GEP being achieved, taking into account the need to ensure an approximation to ecological continuum, after implementation of available measures?	See section 5

5 STEPS FOR DEFINITION OF ECOLOGICAL POTENTIAL

Key messages for this section

Best approximation of ecological continuum

- Best approximation of ecological continuum is a key aspect of ecological potential. Ecological continuum refers to movements of energy, material, and organisms within the aquatic ecosystem. Achieving ecological continuum ensures that the habitats for type-specific aquatic species are interconnected in space and time so that the species can fulfil their life cycles in self-sustaining populations.
- Measures implemented in this regard should be relevant for the closest comparable water body type and related quality elements. For example, if the modifications to a river make it more closely resemble a lake, the set of measures shall take this into account.
- The best approximation of ecological continuum requires consideration of all hydromorphological measures that could mitigate any obstacles to movement of biota, sediment and water and improve the quality, quantity and range of habitats affected by the physical modifications. This can include connectivity to groundwater and/or to riparian, shore and intertidal zones, as well as a sustainable supply of an appropriate sediment type. WFD emphasises both migration of biota and sediment transport. Priority should therefore be given to appropriate and effective measures reducing any obstacles that significantly inhibit longitudinal (both upstream and downstream) and lateral migration of aquatic biota and ensure appropriate sediment conditions. For achieving ecological continuum, it should also be considered whether there is an ecological benefit or a need to restore continuity in order to support upstream and downstream water bodies in achieving their environmental objectives (especially for migratory fish).
- "Best approximation" is interpreted as being as close as possible to undisturbed ecological continuum. MEP requires that best approximation to ecological continuum is ensured. A water body can only be at GEP if a condition close to best approximation is achieved. This is a prerequisite for the functioning of the ecosystem.

A more detailed step-wise framework for GEP

- Determining GEP should follow a logical series of steps. In this document, a new flow-chart presents a step-wise framework for defining GEP and shows the two routes or approaches (reference and mitigation measures approach) to follow this framework.
- By following the steps included in the new flow chart (step-wise approach), a comparable outcome in ecological terms is expected. The steps included in the step-wise approach follow the requirements of the WFD. If, in following the routes through the framework, it is not possible to take all steps, relevant justification is therefore needed in the RBMP. Member States should make sure they can complete the remaining steps by improving data availability and knowledge on the links between hydromorphology and biology. In particular, improved monitoring data is crucial.
- To ensure comparability, a national, regional or basin-specific method for GEP definition has to be developed, although its application will be at water body level taking into account site-specific conditions.

Consideration of all relevant mitigation measures

- The following issues are important for identifying relevant mitigation measures in a HMWB or series of heavily modified water bodies:
    - the nature and extent of the physical modification(s) and their implications for the hydromorphological and, if appropriate, physico-chemical supporting elements in the impacted water bodies need to be understood.
    - the consequent effects on the biological quality elements, and hence the measures that are needed to meet GEP.
- A wide range of potential mitigation measures should always be considered when defining MEP, and several measures are normally expected to mitigate modifications. To select the best combination of measures, the following needs to be evaluated:
    - i) the relevance of measures in terms of the hydromorphological alteration(s) and physicochemical characteristics of the water body as well as other water body characteristics relevant to the biota (e.g. whether modification is within the fish zone/outside the fish zone, fish community types, etc.).
    - ii) the measures' ecological effectiveness and benefits in the specific context of the water body or water bodies (i.e. is measure appropriate for addressing the existing ecological impacts and can it deliver a proven ecological benefit).
    - iii) whether or not the measures will have a significant adverse effect on use or the wider environment.
    - iv) ensuring best approximation to ecological continuum.
    - v) the requirements of Article 4(8) for the achievement of objectives in other water bodies within the same river basin district.
- When assessing mitigation measures regarding their potential for a significant effect on use, differing intensities of a measure or combinations also have to be considered, as a lower intensity of a measure (e.g. a reduced amount of additional flow, or a smaller area of habitat enhanced) might still deliver a substantive benefit without having a significant adverse effect on the use in question.
- The mitigation measures selected for MEP exclude measures that have significant adverse effects on use or the wider environment. The criteria for judgements on the significance of any effects of measures on use or the wider environment should be clear, transparent, justified and set in a consistent way at the national, regional or local level. Decisions on when such adverse effects are significant are important, because they may affect the level of ambition of ecological improvements and intensity of measures.
- For defining GEP, measures are then excluded that, even in combination, are predicted to deliver only a slight ecological improvement. GEP is ultimately defined as the biological values that are expected from successfully implementing the selected mitigation measures.
- Combinations and site-specific adaptations of measures are necessary in many cases within a set of measures to ensure the best possible ecological improvement and approximation of ecological continuum.

European mitigation measures library

- A consistent understanding of when the available measures are relevant is crucial, by linking drivers, pressures, impacts and ecological effects. To support this, a European 'library' of emerging good practice mitigation measures for HMWBs has been set up for this CIS Guidance Document No.37.

- This European library represents the emerging good practice especially for rivers and TraC waters, while the library content on measures for lakes will need to be improved and updated based on further discussions in the future).[22]
- The library describes the typical implications of different types of physical modification and suggests potentially relevant mitigation measures to address typical effects in each water body category. The library includes key groups of mitigation measures, which are expected to be considered for ecological improvements in order to address certain modifications. The groups of measures are further elaborated with examples of specific practical measures included in these groups. Member States should consider a wide range of potentially available measures to deliver the needed ecological improvements.
- When there is a lack of suitable biological data assessment methods and/or data sensitive to modifications, the approach to the selection of mitigation measures should be more precautionary and more measures may need to be considered until there is sufficient evidence to exclude measures from MEP and GEP. The assessment of hydromorphological conditions after having implemented all mitigation measures defined for GEP can be used as an intermediate tool until monitoring results of hydromorphology-sensitive biological assessment methods are available. Increased efforts are needed in many countries to establish appropriate biological monitoring and develop and apply hydromorphology-sensitive biological assessment methods to increase the confidence level of monitoring results and classification.

Definition of GEP in biological terms

- Good ecological potential is defined as an ecological state in which "there are slight changes in the values of the relevant biological quality elements as compared to the values found at maximum ecological potential" (WFD Annex V 1.2.5). With respect to "slight changes", HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP.
- Slight change cannot be equivalent to a complete/temporary absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone).
- Slight changes to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, "slight change" means that a condition close to the best approximation of ecological continuum should be ensured (instead of best approximation) .
- Physico-chemical quality elements should also be defined in the GEP definition process. For physico-chemical parameters, the closest comparable water body type is in general the original natural water body type (before physical modification). For those physico-chemical parameters that are significantly modified by the hydromorphological alterations causing the heavily modified character, and that cannot be mitigated, other types should be considered (the closest comparable natural water body type, or combinations of water body types).

[22] The document "GEP_mitigation_measures_library.xlsx" presents a European library of mitigation measures for defining MEP and GEP, it can be accessed online (https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm) and is a supporting tool to this CIS Guidance No. 37.

Section 5.3 gives an overview, and section 5.4 describes the step-by-step process for defining MEP, GEP, and thereby also less than good potential in detail. Prior to this, it is crucial to have completed a proper review of the designation-tests (see section 4.2).

The environmental objective of HMWB, i.e. GEP, has to be defined by linking biological, hydromorphological and physico-chemical conditions. As described further below, ensuring approximation to ecological continuum is one of the key aspects; more details on this are provided in section 5.2 below.

The definition of MEP and GEP is also the starting point for classifying the ecological potential of a specific HMWB into a class, corresponding to its current condition.

5.1 Approaches for defining ecological potential in 1st & 2nd RBMPs

The "CIS reference approach" and the "mitigation measures approach" (so called "Prague method") are relevant options for defining ecological potential (Kampa and Kranz, 2005)[23] as GEP is established with reference to ecological targets and functionalities in both cases:

- **Reference approach (based on the CIS Guidance Document No.4):** This approach is based on biological quality elements as illustrated in CIS Guidance Document No.4. The MEP for HMWB relates to the values of biological quality elements which are expected to be achieved after implementation of all mitigation measures, which are relevant to the particular hydromorphological alterations, are ecologically effective in the physical context of the water body and do not have a significant adverse effect on use or wider environment. GEP is defined as only slight change from those biological values at MEP.

- **Mitigation measures approach (alternative or Prague approach):** The mitigation measures approach was agreed at the CIS workshop on Hydromorphology in 2005 as an alternative method for defining GEP (Kampa and Kranz, 2005). The mitigation measures approach[24] takes a different route compared to the reference approach and bases the definition of GEP on mitigation measures. Starting from assumed measures, which are relevant to the particular hydromorphological alterations and ecologically effective in the physical context of the water body and do not have a significant adverse effect on use or wider environment, it defines MEP in the same way as the reference approach. Based on this set of mitigation measures, those measures are excluded that, even in combination, are predicted to deliver only slight ecological improvement. GEP is then defined as the biological values that are expected from implementing the remaining identified mitigation measures.

Both approaches (reference approach and mitigation measures approach) require the definition of BQE conditions for GEP. Both approaches for GEP definition (reference approach, mitigation measures approach or combinations of the two approaches) should be drivers for best respectively as close as possible approximation of ecological continuum (see section 5.2) and thus ecological improvement and

[23] Kampa, E. and N. Kranz 2005. Workshop "WFD & Hydromorphology", 17-19 October 2005, Prague. CIS Summary Report.

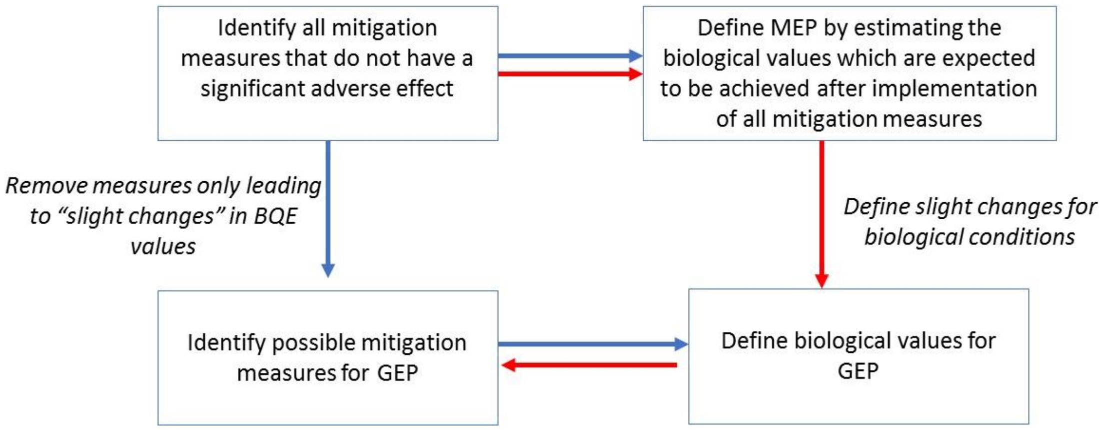
[24] See Annex II of Common Implementation Strategy for the Water Framework Directive 2006: Good Practice in managing the ecological impacts of hydropower schemes; Flood protection works; and works designed to facilitate navigation under the Water Framework Directive. 30 November 2006. Final version.

should be able to deliver comparable results in terms of ecological improvements in the water bodies on the ground.

In the first cycle RBMPs, 3 Member States had clearly used the reference approach, while a larger number of Member States (7 Member States) had defined GEP using the mitigation measures approach, according to the information provided in the RBMPs. Some Member States also used combinations or methods derived from these approaches.[25] In the second cycle RBMPs, about one-third of the Member States report to have defined GEP using the reference approach and about one-fifth of the Member States using the mitigation measures approach. Several Member States report to have used a hybrid approach combining the two approaches, e.g. using one or the other approach for different sub-sets of their water bodies.

As shown inFigure 3, all main steps under the two approaches are in principle the same. Both approaches have exactly the same concept for MEP, i.e. measures are used under both approaches in the same way for MEP. The main difference lies in the derivation of GEP from MEP. In the mitigation measures approach, GEP is derived from the mitigation measures and in the reference approach, GEP is derived from the BQE values at MEP.

Figure 3: Key steps of the reference approach (red arrows, clockwise) and the mitigation measures approach (blue arrows, anticlockwise) for defining GEP



The two approaches should lead to comparable outcomes in ecological terms. There are various ways to describe ecological targets whichever approach is applied. For example, semi-quantitative descriptions of ecosystem functioning or modified ecological quality ratio (EQR) values.

The reference approach follows the WFD requirements more directly but also the mitigation measures approach can be undertaken according to WFD requirements, if the definition of hydromorphological and BQE conditions and comparison of MEP/GEP are carried out. This means, in both approaches, derivation or verification of "slight changes" in comparison of MEP and GEP biological conditions is needed ensuring best approximation to ecological continuum. It is noted that in the mitigation measures approach, mitigation measures by themselves are not the GEP objective, but a means to define GEP. This is also valid for the reference approach.

[25] Commission Staff Working Document (2012), European Overview (2/2). on the Implementation of the Water Framework Directive (2000/60/EC) River Basin Management Plans.

5.2 Approximation of ecological continuum

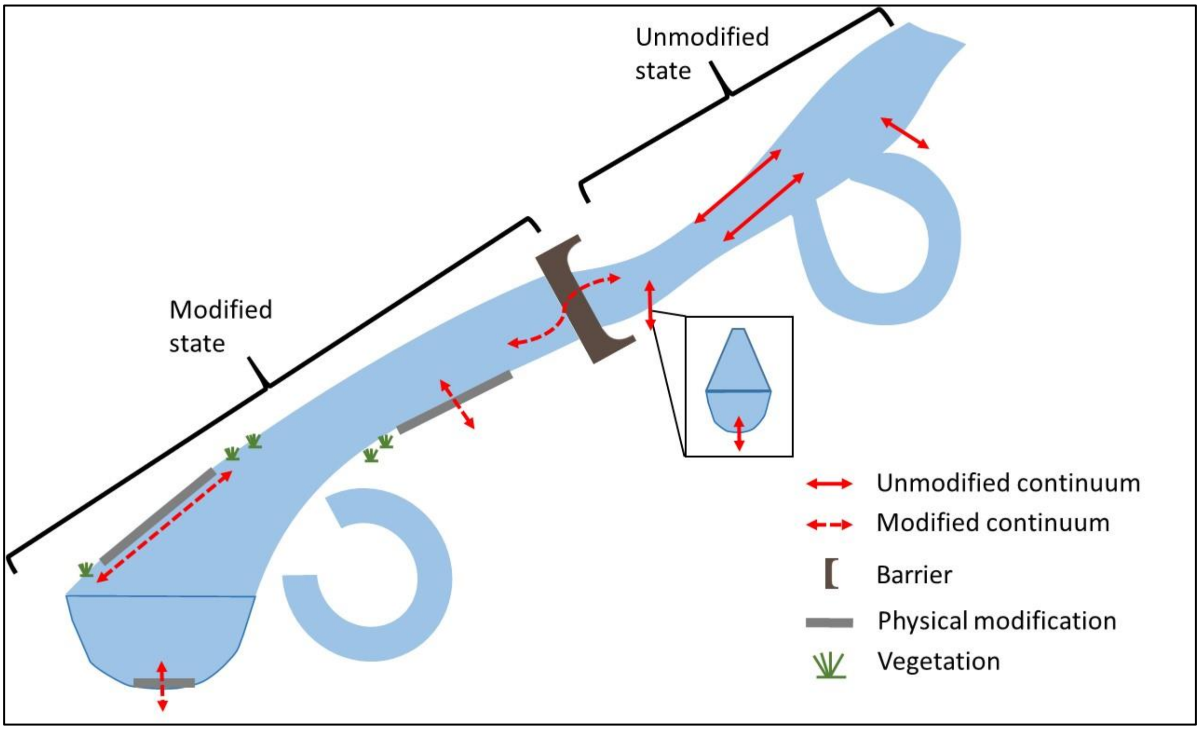
According to the WFD normative definitions in Annex V 1.2.5, the hydromorphological conditions at MEP for heavily modified or artificial water bodies are defined as being "*consistent with the only impacts on the surface water body being those resulting from the artificial or heavily modified characteristics of the water body once all mitigation measures have been taken to ensure the best approximation to ecological continuum in particular with respect to migration of fauna and appropriate spawning and breeding grounds".* This sub-section provides more detailed guidance and interpretation of the aspects related to the best approximation to ecological continuum.

Ecological continuum refers to movements of energy, material, and organisms within the aquatic ecosystem (Figure 4). Achieving ecological continuum ensures that the habitats for type-specific aquatic species are interconnected in space and time **so that the species can fulfil their life cycles**. Aquatic species (fish in particular) need specific habitats during different stages of their life cycle, for example for reproduction (spawning and breeding grounds), but also for feeding, wintering habitats or for shelter from predators. The accessibility of all these habitats at the right times is vital for survival and a prerequisite **to ensure self-sustaining populations**.

Ecological continuum is also necessary for the preservation of aquatic species in the long term, in particular regarding genetic diversity. Allowing migration of species increases genetic exchange between populations, prevents inbreeding, increases their resistance to pollution or disease, and therefore ensures that populations are self-sustained in the long term. Ecological continuum can be interrupted by barriers like transversal or lateral (e.g. river bed revetments) structures but also by changes in flow patterns, including highly reduced flows (in worst case lack of flow) as well as highly increased flow velocities which no longer allow aquatic species (or some of their very sensitive life stages) to migrate to reach their relevant habitats. This is also important, for example, for species being able to return to the original environment after having been swept away by floods.

The benefits of ecological continuum should be considered at a large scale and in the long term. In particular, in some areas, natural populations have been progressively declining due to multiple pressures, or might even have disappeared. Restoration of those populations requires action to tackle all those pressures, and the implementation of all necessary measures may take time. Furthermore, it is important to consider that the recovery and re-colonization of habitats by aquatic species is probably a long process in many cases, in particular for species with a long life cycle.

Figure 4: Different components of ecological continuum (longitudinal, lateral, vertical) in a modified and unmodified state



The best approximation to ecological continuum requires consideration of all hydromorphological measures that can mitigate any obstacles to migration (of biota, sediment and water) and improve the quality, quantity and range of habitats affected by the physical modifications. This can include connectivity to groundwater, to sediment supply and/or to riparian, shore and intertidal zones, as well as a sustainable supply of an appropriate sediment type. WFD emphasises both migration of biota and sediment transport. Priority should therefore be given to appropriate and effective measures reducing any obstacles that significantly inhibit longitudinal (both upstream and downstream) and lateral migration of aquatic biota and ensure appropriate sediment conditions. Overall, ecological continuum should be considered at river basin scale, but action should be taken at local scale.

"Best approximation to ecological continuum", which is mentioned in the WFD normative definitions of MEP, should be understood as a requirement for flow patterns that ensure migration of fish and other aquatic fauna, appropriate sediments for the habitats present (including spawning and breeding grounds) and appropriate sediment transport to ensure the long term sustainability of these habitats. "Best approximation" is interpreted as being as close as possible to undisturbed ecological continuum.

As explained in Figure 5 (section 5.3), MEP requires that best approximation of ecological continuum is ensured. A water body can only be at GEP if a condition close to best approximation is achieved. An approximation of ecological continuum is prerequisite for the functioning of the ecosystem.

It is also noted that ecological continuum should not only be guaranteed for the heavily modified water body, but is also a prerequisite for achieving good ecological status in the natural water bodies.

Example of reservoir created by damming a river: If a river was dammed to a large reservoir, there was a change in category and the biological quality elements (e.g. fish) have been adapted to a lake type, which has to be taken into account when deriving MEP and GEP. With regard to best approximation of ecological continuum and required measures, the following should be considered :

- Is there an ecological benefit or need to restore continuity to the river(s) because a fish species lives in the lake which has its spawning ground in the river(s) up- or downstream?
- Is there an ecological benefit or need to restore continuity from the lake to the river(s) up- and downstream as otherwise the river water bodies up- or downstream cannot achieve their environmental objective (e.g. fish will migrate through the reservoir to get to the river upstream for spawning)?

In this context, it is relevant to take the requirements of WFD Article 4(8) into account.

5.3 Overview of key steps for defining ecological potential in a comparable way

The following flow-chart Figure 5 describes the key steps involved in setting maximum ecological potential (MEP) as a basis for defining good ecological potential (GEP). It provides more detailed descriptions of steps 10 and 11 of the original flow-chart on HMWB designation in CIS Guidance Document No.4 (see steps 10 and 11 in Figure 1 of CIS Guidance Document No.4).

The flow-chart presents a step-wise framework and shows two routes or approaches to follow this framework (the reference approach and the mitigation measure approach). Both approaches (two different routes in the step-wise framework) are acceptable and should lead to the same outcomes (ecological condition), provided there is good knowledge available on the links and interactions between biology, hydromorphology and mitigation effects from relevant measures. The common step-wise framework aims at further clarification and better understanding of the two approaches in the context of WFD definitions and should be used as a basis for the comparability of GEP definition outcomes across water uses, river basins and Member States. Ultimately, the aim is to harmonise GEP definition across Member States, in order to achieve a more transparent and comparable level of ambition in relation to ecological improvements.

The process described in the flow-chart is relevant to all water categories (rivers, lakes, transitional and coastal waters) and closest comparable water body types.

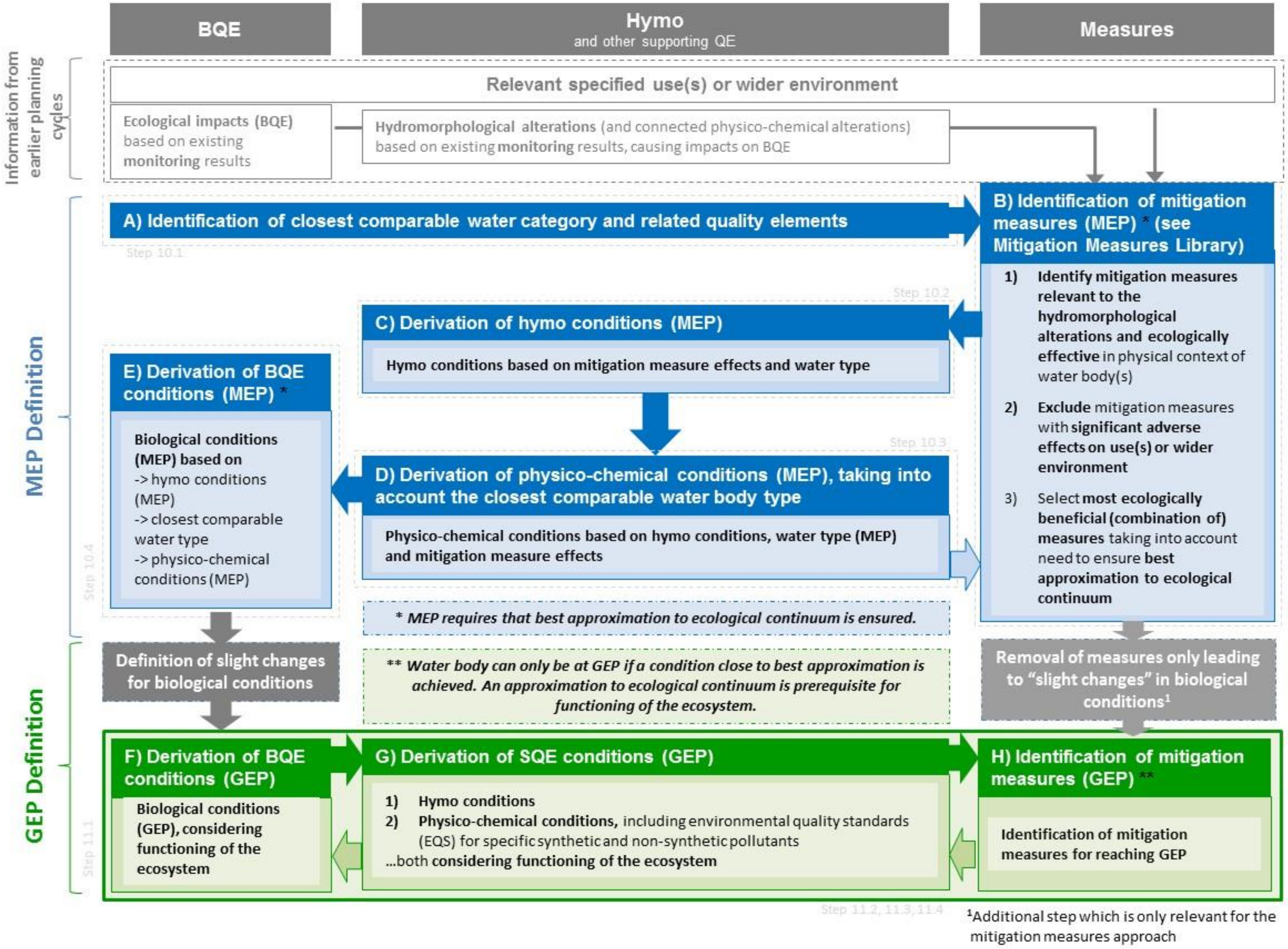
The GEP definition process is structured around eight key steps A to I, and should therefore serve as a check list to ensure that all necessary steps and actions will be taken to mitigate all relevant and significant impacts. The flow-chart is also organised vertically into 3 main columns:

- Biological quality elements (BQEs)
- Hydromorphology (and other supporting quality elements)
- Mitigation measures

This clear distinction should be helpful for communication, discussion and common understanding on the process of objective setting for HMWB.

The good ecological potential (GEP) includes all three steps F-G-H described below, i.e. it is eventually defined in terms of biological conditions, supporting quality element conditions and mitigation measures. In both the reference and the mitigation measures approach, GEP is defined as the biological quality element conditions which are expected to be achieved after implementation of the mitigation measures (prognosis of ecological effect). The definition of GEP in biological terms is supported by the conditions derived for the hydromorphological and the physico-chemical quality elements.

Figure 5: Process with key steps for defining MEP and GEP showing comparability between the two approaches (reference approach and mitigation measures approach)

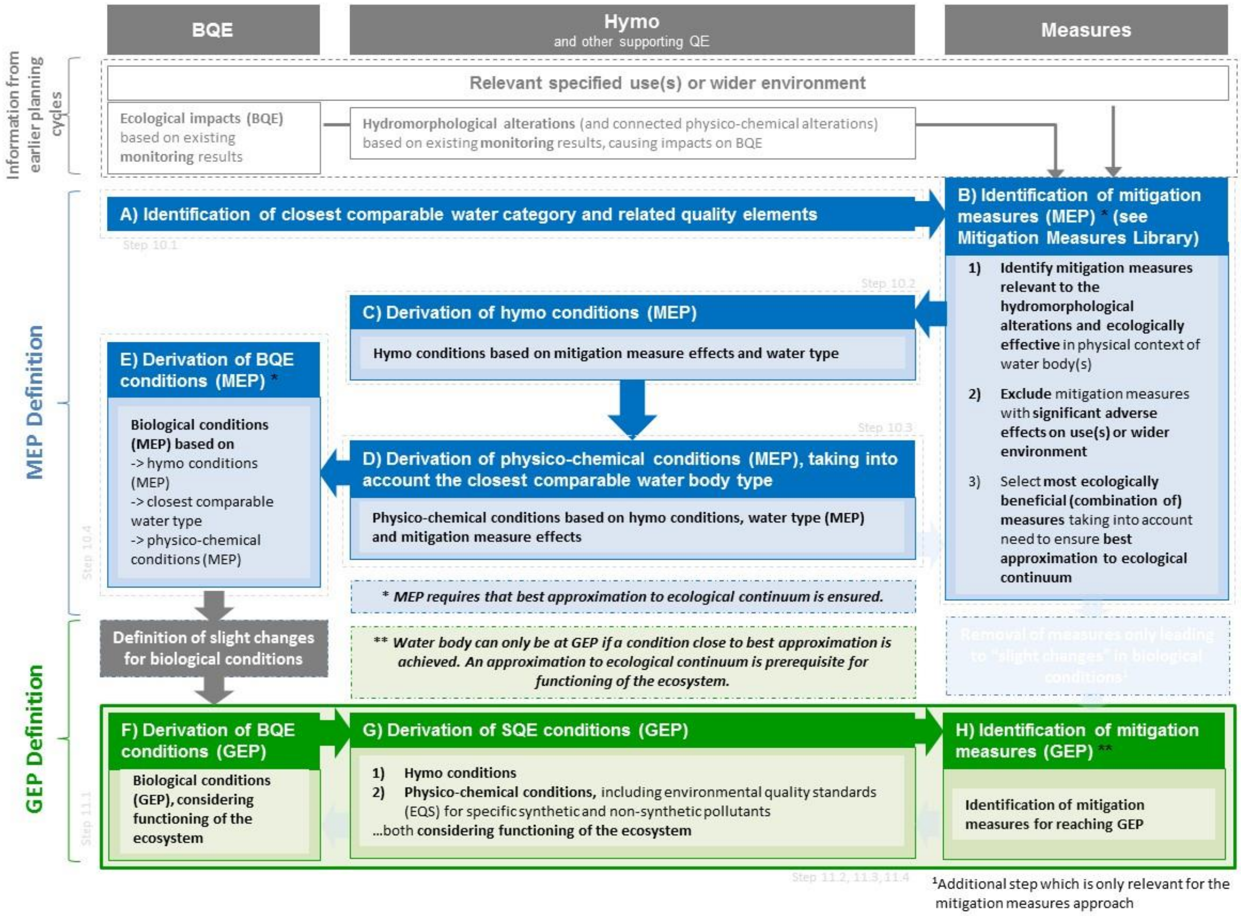


It is important to recognise that an ecological potential of a particular class can imply different ecological conditions in different water bodies. This is due to the local conditions in the water body type, ecological benefits of relevant mitigation measures and the design and operation of the modification(s)/use(s) which is/are the reason why the water body is designated as HMWB

5.3.1 “Route” of the reference approach

The complete step-wise approach in Figure 5 anticipates that Member States have enough information and knowledge (BQE, hydromorphological and physico-chemical data, mitigation measures library, ability to predict the effects of measures) to be able to follow the reference approach as set out in the WFD. In this case, all steps have to be followed to be in line with WFD requirements (route A→B→C→D→E→F→G→H). Figure 6 below indicates the sequence of steps for defining MEP and GEP when applying the reference approach.

Figure 6: Process with key steps for defining MEP and GEP showing the “route” of the reference approach



5.3.2 “Route” of the mitigation measures approach

As an alternative to the reference approach, Member States can use the mitigation measures approach. Such an approach is suggested in case it is not yet possible to predict the MEP conditions for the BQEs due to a lack of knowledge or data.

For the steps referring to MEP definition, Member States should follow steps A and B and should also go through steps C and D, insofar as the availability of information on hydromorphology and physico-chemical elements allows. Step D then feeds back into step B and the process continues from step B to step H and step G. The mitigation measures approach assumes then that the conditions for physico-chemical and biological elements are those deriving from the implementation of measures defined in step H. In summary, the route to be usually followed through the flow-chart in Figure 5, when applying the mitigation measures approach is A→B[→C→D→B]→H→G(→F).

Figure 7 below indicates the sequence of steps for defining MEP and GEP when applying the mitigation measures approach.

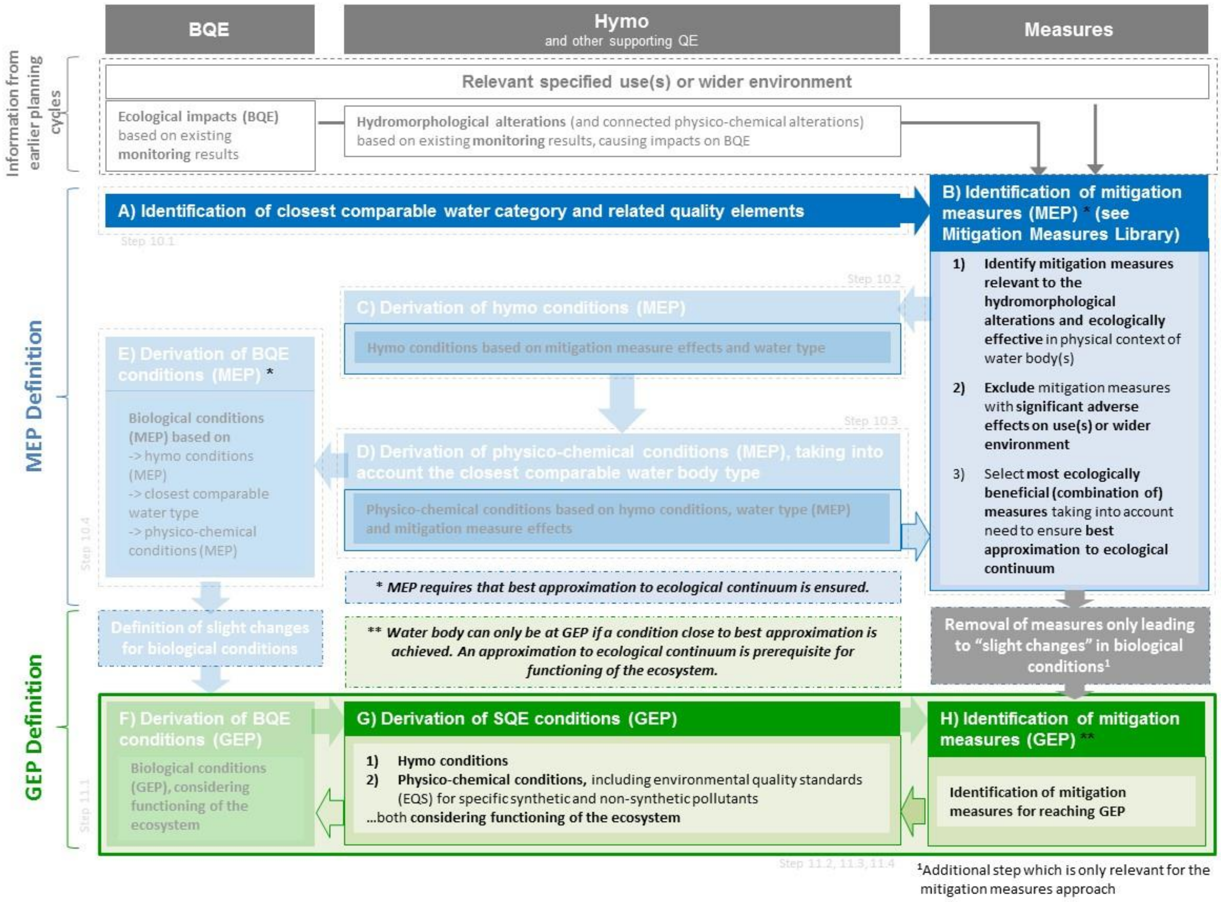
Member States following the mitigation measures approach for this cycle should complete steps E and F (derivation of biological conditions at MEP and GEP) as soon as sufficient data and better knowledge on the biological condition and/or the links between hydromorphology and biology become available. For a final decision on GEP definition, the mitigation measures approach depends on BQE assessment methods which are sensitive to hydromorphological alterations (for the verification of GEP and monitoring the ecological potential), but GEP definition can be undertaken on a preliminary or interim basis without such methods.[26] Thus, although the mitigation measures approach is an alternative route, it is not less ambitious as eventually all steps must be completed to be in line with the WFD.

It is noted that when there is lack of suitable biological assessment methods and/or data sensitive to modifications, the approach to the selection of mitigation measures should be more precautionary and more measures may need to be considered until there is sufficient evidence to exclude measures from MEP. Increased efforts are needed by Member States towards establishing appropriate biological monitoring and hydromorphology-sensitive methods for a more informed basis for the selection of mitigation measures.

The steps included in the step-wise approach follow the requirements of the WFD. If, in following the routes through the framework Figure 5, it is not possible to take all steps, suitable justification is therefore required in the relevant RBMP. Member States should make sure they can complete the remaining steps by improving data availability and knowledge on the links between hydromorphology and biology. In particular, improved monitoring data is crucial.

[26] As explained in section 6, if the classification of the ecological potential is not based on hydromorphology-sensitive biological assessment methods, the classification result in the RBMP should include the information that the confidence level is low.

Figure 7: Process with key steps for defining MEP and GEP showing the "route" of the mitigation measures approach



5.3.3 Overview of individual steps

The individual steps (steps A – H) of the step-wise process are briefly illustrated below, while the following sub-sections describe these steps in more detail:

Information from earlier planning cycles (pre-step): In this pre-step, information on the assessment of biological and hydromorphological impacts from the designation phase of HMWB and existing monitoring results are used to support the subsequent steps of defining MEP and GEP.

Step A (Identification of the closest comparable water category and related quality elements): This involves the identification of the most comparable water category (e.g. lake, river, transitional or coastal water) which should in general be derived from the original water category (i.e. prior to modification). If a change in category is necessary due to the modifications, the most comparable category should be chosen, e.g. for a reservoir created on a former river, the most comparable water category would be a lake.

Step B (Identification of relevant mitigation measures (MEP)). This involves the selection of mitigation measures for defining MEP. Measures should be ecologically effective, relevant to the water body and the modifications that have taken place, and ensure the best approximation of ecological continuum. The mitigation measures can be selected from a national or European mitigation measures library based on information about the water category and water body type, the nature of the physical modification, its effects on the hydromorphological (and physico-chemical) supporting elements and their effects on the BQEs. Mitigation measures that have significant adverse effects on use(s) or the wider environment are then excluded. Having excluded measures with significant adverse effects, it is necessary to identify the measure or combination of measures that delivers the best improvement, taking into account the need to ensure best approximation to ecological continuum.

Step C (Derivation of hydromorphological conditions for MEP): The derivation of hydromorphological conditions for MEP should be based on the hydromorphological conditions in the water body altered by the physical modifications linked to the use and a prediction of the effects of the set of mitigation measures (for MEP) on hydromorphological conditions. MEP hydromorphological conditions are impacted by physical modifications. The values for the biological and general physico-chemical quality elements at MEP depend on the MEP hydromorphological conditions. The hydromorphological conditions may resemble those of a different type compared to the natural water body type before the physical modification. Thus, the hydromorphological conditions defined for MEP can be used to identify or derive the closest comparable water body type, which is in particular relevant for defining the MEP conditions for biological quality elements and those physico-chemical parameters which are affected by the hydromorphological conditions.

Step D (Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type): The physico-chemical conditions for MEP result, inter alia, from the hydromorphological conditions at MEP and a prediction of the effects of the mitigation measures (for MEP) on physico-chemical parameters, which is comparable to an assessment of the remaining impacts. The identification of the closest comparable water body type is a supportive tool in this context. For physico-chemical parameters, the closest comparable water body type is in general the original natural water body type prior to physical modification. For those physico-chemical parameters that are significantly modified by the hydromorphological alterations causing the heavily modified character, and that cannot be mitigated, other types should be considered (the closest comparable natural water body type, or combinations of water body types). Requirements for specific synthetic pollutants at MEP are the same as those for natural water bodies.

Step E (Derivation of BQE conditions for MEP): The derivation of biological quality element conditions for MEP is based on the identification of the closest comparable water type, the predicted hydromorphological and physico-chemical conditions (for MEP) and a prediction of the values for BQEs based on methods used for status assessment. When deriving BQE conditions for MEP, it is also critical to consider the WFD requirements concerning the best approximation of the ecological continuum.

Step F (Derivation of BQE conditions for GEP): Good ecological potential is defined in WFD Annex V 1.2.5 as an ecological state in which “there are slight changes in the values of the relevant biological quality elements as compared to the values found at maximum ecological potential”. With respect to “slight changes”, HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP. Slight change cannot be equivalent to a complete/temporary absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone). Slight changes to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, “slight change” means that a condition close to best approximation of ecological continuum should be ensured (instead of best approximation).

Step G (Derivation of supporting quality elements for GEP): The derivation of supporting quality elements (SQE) for GEP entails hydromorphological conditions and physico-chemical conditions. The hydromorphological conditions have to be consistent with the biological values set for GEP. For physico-chemical conditions, the same values should be met as for good ecological status of the original natural water body type, except if the parameter is impacted by the hydromorphological alteration having led to HMWB designation (e.g. changed water temperature due to hydropeaking).

Step H (Identification of mitigation measures (GEP)): The mitigation measures within GEP are those needed to achieve the derived biological conditions by improving conditions of relevant supporting elements for GEP. Following the mitigation measures approach, mitigation measures for GEP are obtained after removing, from the set of mitigation measures identified for MEP, any measures which only lead to slight changes in biological conditions (alone or in combination).

It is noted that Annex H to this document presents illustrative case studies which demonstrate how to apply the key steps of the flow-chart for defining MEP and GEP. The case studies follow either the reference-approach or the mitigation measures approach or both.

Please note that with step H in the flow-chart, the definition of GEP is concluded. After having defined GEP with corresponding GEP conditions for the biological and supporting quality elements, mitigation measures are to be implemented within the programme of measures and the relevant process is explained in section 6 of this document.

5.4 Detailed key steps for defining ecological potential in a comparable way

5.4.1 Information from earlier planning cycles (pre-step)

The process of defining MEP and GEP is closely related to the steps of the iterative process used to designate HMWB (either of existing HMWB designated in previous cycles or new HMWB designated in the current cycle). As a starting point, the following issues from the designation phase need to be taken into account for the water body:

- The identification of relevant specified uses/human activities or the wider environment which would be significantly adversely affected by measures to achieve GES and are thus reasons for the designation.
- The assessment of the main ecological impacts based on the BQEs, which is based on existing monitoring results (from earlier planning cycles) (see Box 5 below). The assessment of biological impacts takes into account measures already taken in the previous planning cycle(s).
- The identification of key hydromorphological alterations (and related physico-chemical alterations) that cause impacts on the BQEs, taking into account the water type. This assessment is also based on existing monitoring results from earlier planning cycles.
- Information from monitoring on which quality elements fail good status is important for a more targeted selection of mitigation measures in the later process of defining MEP and GEP. Information on the conditions of the quality elements should already exist from the earlier operational monitoring prior to designation of the water body as HMWB, as the prerequisite for HMWB designation is that the water body fails good status due to hydromorphological alterations.
- In this context, the water body type based on national typology should be considered, as this is important for the selection of mitigation measures in the first steps of defining MEP and GEP.

It is noted that the assessments of hydromorphological impacts and biological impacts may be further refined within the process of GEP definition, using the relevant assessments that were carried out in the designation phase as a starting point.

Box 5: Monitoring results from earlier planning cycles

The requirements of the WFD with regards to monitoring are mainly set out in Article 8, Annex II and Annex V. As for natural water bodies, biological, hydromorphological and physico-chemical quality elements and chemical status for HMWB must be monitored. This means that the monitoring programmes for HMWB must follow the same monitoring requirements as for the natural water bodies. CIS Guidance Document No.7 "Monitoring under the Water Framework Directive" gives in-depth guidance regarding these monitoring requirements. The establishment of an appropriate monitoring programme, including monitoring of hydromorphological quality elements, is key as an information basis for the initial designation of HMWB and for reviewing the designation of HMWB in subsequent planning cycles. Part of the designation process is to assess whether or not the water body fails good status due to hydromorphological alterations and therefore should be designated as HMWB; this is done by applying the targeted (to hydromorphological problems) methods used in **operational monitoring**. For a water body that was designated as HMWB in a previous cycle, the operational monitoring gives evidence on whether or not the water body is at GES and if it still qualifies as a HMWB. If the operational monitoring shows that conditions have improved so much that the water body reaches GES, the water body is de-designated as HMWB and has to be treated as a natural water body. If the water body is not in GES and GES cannot be reached, the environmental objective may be good ecological potential (GEP) (if the requirements of WFD Art. 4(3) are fulfilled) and the procedure for defining MEP and GEP should be followed (i.e. GEP should be re-assessed). When selecting sites for operational monitoring of water bodies designated as HMWB, it is recommended to focus on how and where it is best to monitor the impact resulting from the water body being substantially changed in character.

!	**Reference approach ←→ Mitigation measures approach** The pre-step using information from earlier planning cycles is used under both the reference approach and the mitigation measures approach.

5.4.2 Identification of the closest comparable water category and related quality elements (Step A)

According to WFD Annex V 1.1.5, "the quality elements applicable to artificial and heavily modified surface water bodies shall be those applicable to whichever of the four natural surface water categories (above) most closely resembles the heavily modified or artificial water body concerned".

In general, the closest comparable water category should only be different from the original water category if this is necessary due to the modifications, e.g. for a reservoir created on a former river, the closest comparable water category would be a lake. The following are the most common situations for the identification of the closest comparable water category:

a) A river remains a river category
b) A river resembling a lake category[27]
c) A lake remains a lake category[28]
d) A transitional water body remains a transitional water body category
e) A transitional water body resembling a lake category
f) A coastal water body remains a coastal water body category
g) A coastal water body resembling a transitional water category (e.g. if a lagoon is formed)

5.4.3 Is the closest comparable water category for HMWB always clear?

For coastal and transitional waters, the closest comparable water category it is usually clear. For rivers and lakes (reservoirs), it may be less clear, as for instance some water bodies used for water storage may be in the transition between river and lake-type aquatic ecosystems. A relatively clear case is when a river has been dammed to create a large reservoir. In such a case, there is a change in category and the water body is a heavily modified river that resembles a lake. The biological quality elements (e.g. fish) which have to be taken into account when deriving MEP and GEP therefore have to be those of a lake. However, conditions in impounded rivers may range from very close to river conditions (e.g. with high flow velocities and the same quantity of flow upstream and downstream of the impoundment, indicating a short residence time) to more still water conditions (e.g. with significantly reduced flow velocities and long residence times) resembling lake-like ecosystems.

In case of river water bodies used for water storage that are in transition between river and more lake-type aquatic ecosystems (e.g. large impoundments with permanent flow and a short residence time of a few days), it needs to be decided whether a river or a lake is used as closest comparable water category. Where conditions are in-between clearly defined water categories, both categories should be considered in the process of defining MEP and GEP. For example, if a river is chosen as the closest comparable water category, lake measures and habitats as well as quality elements, species and assessment methods also need to be considered. Conversely, if a lake is chosen as the closest comparable water category, river measures (e.g. measures for improving continuity, by-pass channels, etc.) and habitats as well as quality elements, species and assessment methods should be considered, too. In such cases, it might even be appropriate to use different categories depending on quality elements. For example, a hydromorphological assessment method for lakes could be most suitable describing the hydromorphological conditions at MEP and GEP, while biological quality elements could be assessed with river methods (e.g. for fish) with the highest confidence.

[27] Including cases of several brooks which have become one large lake reservoir.
[28] Including cases of small lakes which have become one large reservoir.

!	**Reference approach ←→ Mitigation measures approach** Step A is identical for both the reference approach and the mitigation measures approach.

5.4.4 Identification of relevant mitigation measures (MEP) (Step B)

The mitigation measures for defining MEP should be a selection of measures which are relevant to each of the hydromorphological alterations, ecologically effective **and** which alone or in combination ensure the best approximation of ecological continuum.

The identification of mitigation measures for MEP involves three sub-steps:

- Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body or water bodies (step B1)
- Exclude or redesign restoration measures that have a significant adverse effect on use or the wider environment (step B2)
- Select the most ecologically beneficial (combination of) measures addressing all hydromorphological alterations, taking into account the need to ensure the best approximation of ecological continuum (step B3)

In summary, the (potentially relevant) mitigation measures can be excluded from MEP (and GEP) due to the following reasons:

1. The mitigation measure is **not relevant** for the type of water body, hydromorphological alterations or impacts causing failure in achieving good status (see section 5.4.4.1).
2. The mitigation measure is **not ecologically effective** or does not give sufficient ecological benefits in the physical context of the water body or water bodies, e.g. lack of spawning habitat upstream (see section 5.4.4.1).
3. The mitigation measure has **<u>significant</u> adverse effects** on use(s) or the wider environment (see section 5.4.4.2).

The following paragraphs explains in more detail the sub-steps (B1, B2 and B3) which need to be taken into account to define the set of mitigation measures for deriving MEP conditions.

!	**Reference approach ←→ Mitigation measures approach** Step B is identical for both the reference approach and the mitigation measures approach.

5.4.4.1 Identify mitigation measures relevant to each of the hydromorphological alterations and ecologically effective in the physical context of the water body or water bodies (Sub-step B1)

The first step identifies the mitigation measures that are relevant to the type of hydromorphological alterations or impacts causing failure in achieving good status.

The relevant mitigation measures can be selected from a national or European **mitigation measures library** based on information about the water category and water body type, the nature of the physical modification, its effects on the hydromorphological (and physico-chemical) supporting elements and their effects on the BQEs.

The **"GEP_mitigation_measures_library.xlsx"** (https://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm) is a supporting tool to this document and presents a European library of mitigation measures for use in defining MEP and GEP. This mitigation measures library is structured in distinct tables for different water categories (rivers, lakes/reservoirs, transitional/coastal waters) (see overview of key elements in Table 6). Please note that due to the Europe-wide nature of this library, it was not possible to produce fully comprehensive lists and some of the physical modifications or mitigation measures that are considered in the Member States may not be included. The library of mitigation measures is a living document and updates will be provided at regular intervals.

Table 6: Overview of key elements included in European library of mitigation measures for rivers, lakes/reservoirs and transitional/coastal waters to be considered in the stepwise approach for defining the ecological potential of HMWBs

<table>
<tr><th>Elements in library / Water categories</th><th>Rivers</th><th>Lakes/reservoirs</th><th>Transitional/coastal</th></tr>
<tr><td>Uses</td><td colspan="2">Navigation; ports
Flood protection
Hydropower
Water supply
Recreation
Drainage
Urbanisation</td><td>Navigation; ports
Recreation; marinas; infrastructure
Urbanisation including industry
Flood protection
Energy (renewables, oil and gas, associated infrastructure)
Fishing activity; fish farms; aquaculture</td></tr>
<tr><td>Existing physical modification</td><td>List of physical modifications of rivers, e.g.
Dam, weir, barrage or other transversal structure
Channel straightening
Embankments, dykes</td><td>List of physical modifications of lakes/reservoirs, e.g.
Shore fixation or modification
Physical modifications caused by maintenance activities (e.g. sediment dredging)
Deepening of lake by excavation</td><td>List of physical modifications of transitional/coastal waters, e.g.
Dredged for navigation, flood conveyance
Aggregate extraction
Breakwater, groynes, jetties, piers</td></tr>
</table>

Elements in library / Water categories	Rivers	Lakes/reservoirs	Transitional/coastal
Potential for direct or indirect effect on hydromorphological supporting elements at water body scale *[++] always or usually* *[+] sometimes* *[o] rarely or never*	Hydrology: quantity and dynamics of flow Hydrology: connection to groundwaters River continuity Morphology: river width and depth Morphology: river bed structure, substrate Morphology: riparian zone structure	Hydrology: quantity and dynamics of flow Hydrological regime: residence time Hydrology: connection to groundwaters Morphology: depth Morphology: quantity, structure, substrate of bed Morphology: structure of shore	Morphology: depth variation Morphology: bed structure, substrate Morphology: intertidal zone structure Tidal regime: freshwater flow (only transitional water bodies) Tidal regime: dominant currents direction (only coastal water bodies) Tidal regime: wave exposure
Potential for direct or indirect effect on physico-chemical supporting elements at water body scale *[++] always or usually* *[+] sometimes* *[o] rarely or never*	Thermal conditions Oxygenation Salinity Acidification Nutrient conditions Specific pollutants	Transparency Thermal conditions Oxygenation Salinity Nutrient conditions Specific pollutants	Transparency Thermal conditions Oxygenation Salinity Nutrient conditions Specific pollutants
Likelihood of effect on BQEs *[++] strong or moderate likelihood* *[+] low likelihood*	Phytoplankton Macrophytes and phytobenthos Benthic invertebrate fauna Fish fauna		Phytoplankton Macroalgae (seaweeds) Angiosperms (seagrass, saltmarsh) Benthic invertebrate fauna Fish (only transitional water bodies)
Overview of typical impacts on original ecology	Short descriptions provided per physical modification		
Relevance of typical mitigation measures* *[++] always or usually* *[+] sometimes* *[o] rarely or never*	List of typical mitigation measures, e.g. Fish migration aids Environmental flow Increase habitat diversity Sediment management	List of typical mitigation measures, e.g. Ecological/environmental friendly water level regulation practice Enhancement of shore/shallow habitats Creation of secondary habitats Removal/replacement of shore fixation	List of typical mitigation measures, e.g. Improve morphological and/or habitat diversity of seabed Intertidal habitat restoration, enhancement or creation Beach or foreshore replenishment

** The typical mitigation measures are groups of measures, each of which includes specific practical measures. Examples for these specific practical measures are given in additional supporting tables in mitigation measures library.*

The mitigation measures library promotes the following approach to the identification of mitigation measures for the definition of ecological potential and delivering improvements in the biological and supporting quality elements of HMWB:

i) Confirm the specific nature of the physical modification (pressure)
ii) Understand which hydromorphological supporting elements have been directly or indirectly changed (adversely affected) as a result of the modification, and how they have been affected (state)
iii) Consider whether any physico-chemical supporting elements have been adversely affected (either directly by the modification, or indirectly as a result of changes to the hydromorphological character of the water body) (state)
iv) Establish which biological quality elements have been adversely affected and how, including any wider implications for ecological functioning and/or for ecosystem goods and services (impact)
v) Identify the range of typical and modification-specific mitigation measures that may contribute, alone or in-combination, to an improvement in the conditions of the water body (response)
vi) Evaluate possible mitigation measures to define MEP and GEP

Stages i – v are supported by the relevant spreadsheet tables in the mitigation measures library. Reference to these tables ensures an overarching approach to the selection of mitigation measures, depending on the nature of physical modifications. Stage vi on the evaluation of possible mitigation measures to define MEP and GEP is discussed in the following sections on sub-steps B2 and B3, concerning the assessment of significant adverse effects and the selection of most ecologically beneficial (combinations of) measures.

The paragraphs below describe the different elements included in the library tables and how the library can be used as a tool for selecting mitigation measures for MEP and GEP definition as well as for the identification of measures for implementation.

i) Specific nature of existing physical modification (pressures)

The starting point when using the mitigation measures library is to confirm the specific nature of the physical modification (pressure) for which a HMWB was designated or of the modification that is otherwise affecting the ability of the water body or water bodies to meet WFD objectives. All physical modifications in the mitigation measures library might be relevant reasons for designation of a water body as HMWB. In most if not all cases, it is the type of physical modification rather than the use *per se* that affects the hydromorphological character of the water body.

Example: An impounding structure might be required to support use for water supply or navigation; a water body might be straightened and deepened for agricultural drainage, navigation or flood conveyance purposes; or embankments might be constructed or raised to meet flood defence or water storage needs. The effects from such pressures on the WFD hydromorphological supporting elements and hence on the biological quality elements will be determined by the particular nature of the modification. Two examples to illustrate this point in river water bodies are provided in

Box 6 below.

Box 6: Examples of generic physical modifications to water body hydromorphological and biological quality elements

An impounding structure on a river typically affects continuity for biota and sediment. One of the most important effects is the reduction of flow velocity, which is directly related to a change in sediment composition and bed structure. Benthic invertebrates are highly sensitive to impact by those alterations, but fish are also significantly affected (e.g. by a reduction of habitats or by the transversal structure which functions as a migration barrier) and macrophyte communities are severely impacted (e.g. by reduction of flow velocity that causes changes in abundance and occurrence of species with different growth forms).

Riparian zone structure and depth are also affected by an impounding structure with a reduced flow velocity, and there may be indirect implications for certain physico-chemical supporting elements (e.g. a higher temperature caused by reduced flow velocity and reduced shading). As a consequence of these changes in hydromorphology the ability of the water body to meet its ecological objective of GES will be compromised.

Deepening also changes the hydromorphological characteristics of a water body, in this case particularly affecting depth variation and bed structure., However, there may also be implications for other hydromorphological supporting elements. Such modifications to the character of the bed of the water body typically lead to changes in benthic invertebrate fauna and phytobenthos as well as in macrophyte and fish communities.

The mitigation measures required to improve the ecological conditions of a water body are not specifically related to the use for which the water body is designated. Rather, mitigation measures should ideally aim to reduce or rectify the changes in hydromorphological character such that the natural recovery of the affected BQEs is promoted. If this is not possible, mitigation measures should aim to replicate ecological function through other means. Box 7: Examples of common mitigation measures irrespective of use below provides two examples of how mitigation measures relate to the nature of the modification rather than the use of the water body. The existing physical modifications in a HMWB determine which checklists of measures are applicable for MEP definition.

Box 7: Examples of common mitigation measures irrespective of use

Irrespective of the use for which a particular water body is designated, if an impounding structure has prevented the upstream and downstream movement of fish, the installation of a fish pass/fish migration aid may be required. Measures to improve flow of both water (e.g. e-flows) and sediments (e.g. sediment bypassing) might also be needed, along with measures to enhance riparian or benthic habitats and their diversity. In certain situations it will also be relevant to establish whether the operation of the structure (e.g. a sluice or lock) can be modified or managed so as to reduce the effects of the impoundment and improve ecological conditions.

Similarly, whether a water body has been embanked to improve flood protection or to accommodate navigation or agricultural use is less important when considering possible mitigation measures than the nature of the hydromorphological alteration. In all cases, if benthic invertebrates, fish or aquatic flora have been detrimentally affected by the construction of the embankments, the use of soft (e.g. vegetation, natural stone) rather than hard (e.g. concrete) engineering will need to be considered along with opportunities for habitat creation or enhancement elsewhere in the water body (e.g. in

backwaters or by setting back the defences). Depending on the particular circumstances, re-profiling the embankments or sediment management measures such as sediment supplementation might also be explored.

In many cases, a water body may have been physically modified in a number of ways by more than one use. For example, it may have been straightened and also deepened (e.g. for navigation), or a dam (impounding structure) might also be associated with hydropeaking from a hydropower plant, resulting in multiple pressures (Table 7). If this is the case, the single uses and/or pressures should be identified based on the tables separately prior to being combined.

In using the tables of the mitigation measures library, it should be noted that the descriptions in the column headed 'Specific nature of existing physical modification' are not intended to be comprehensive. Rather, they represent the most common types of physical interventions that (broadly) impact on the water body in a characteristic way. For example:

- steel sheet piling used to create a hard water's edge in an urban landscape, masonry walls in old harbour areas, and wooden piling installed to prevent erosion or for flood defence all share the same characteristics in that they create a vertical face at the water's edge, and
- dams, sluices, weirs, barriers and barrages are all transversal structures that usually interrupt flow and interfere with continuity (especially in rivers) or potentially impact on wave exposure (in transitional or coastal water bodies).

Table 7: Example from mitigation measures library on TraC: Uses and physical modifications

DRIVER						**PRESSURE**
Uses						***Specific nature of existing physical modification***
Navigation; ports	Recreation; marinas; infrastructure	Urbanisation including industry	Flood protection	Energy (renewables, oil and gas, associated infrastructure)	Fishing activity; fish farms; aquaculture	*See list below*
+	+	+	+			Dredged for navigation, flood conveyance

ii-iii) Effects on hydromorphological or physico-chemical supporting elements (state)

The next stage is to understand how the state of the water body or water bodies has been affected by the physical modification. This is achieved by identifying the WFD hydromorphological (and, where relevant, physico-chemical[29]) supporting elements that have been directly or indirectly changed or otherwise impacted as a result of the modification(s).

The tables of the mitigation measures library use typical situations (Table 8). For both hydromorphology and the physico-chemical supporting elements, they indicate how typical it is for each element to be directly or indirectly affected by the particular type of physical modification at the water body scale. They illustrate this by differentiating between effects that are ‘always or usually’ experienced; those that are ‘sometimes’ experienced; and those that are ‘rarely or never’ experienced.

In addition to illustrating how this stage could be undertaken in the absence of an established national practice or procedure, the typical situations presented on the tables of the mitigation measures library might also be useful in situations where there are no detailed hydromorphological or physico-chemical data about the water body or water bodies in question. In most cases, however, Member States will have relevant and detailed information, e.g. obtained during the classification exercise or more recent WFD monitoring. Where such locally relevant data exist, the actual effects on the water body (or group of similar water bodies) should be confirmed by identifying the hydromorphological and physico-chemical supporting elements that are at less than good status (potential) or that are otherwise compromised in some way by the physical modification.

Finally, whichever method is used to establish the effects of the modification on the WFD supporting elements, there are likely to be some considerations linked to particular sites or certain elements that are too specific to be considered in the general context of this document. For example:

- when establishing whether quantity or dynamics of flow has been affected by the modification, it is important to consider and if necessary differentiate between the effects on quantity and the effects on flow dynamics
- indirect effects can sometimes be more important than direct ones (e.g. downstream bed erosion can be a significant indirect effect if a structure interferes with sediment transport)
- oversaturation of nitrogen that may lead to diving disease for fish downstream of the tailrace of high-head hydropower plants
- temperature alterations such as cooler water during summer (resulting in decreased fish growth) and warmer water during winter (resulting in increased metabolism, fish mortality, and a lack of ice cover in alpine rivers).

[29] Changes in physico-chemical supporting elements are only relevant in the context of identifying MEP and GEP mitigation measures if the change is caused by or associated with the identified changes in hydromorphology. If, for example, a change in the concentration of nutrient compounds or impacts (e.g. increased eutrophication effect) results from the impoundment of water behind a dam, this is a relevant consideration, but if a change in nutrient concentrations is the result of an increased discharge into the water body, this is an issue to be dealt with in the WFD Programme of Measures, not through GEP mitigation measures.

Table 8: Example from mitigation measures library on TraC: Physical modifications and effects on hydromorphological or physico-chemical supporting elements

PRESSURE	STATE (hydromorphological, physico-chemical alteration)											
Specific nature of existing physical modification	***Potential for direct or indirect effect on hydromorphological supporting elements at water body scale [++] always or usually [+] sometimes [o] rarely or never***						***Potential for direct or indirect effect on physico-chemical supporting elements at water body scale [++] always or usually [+] sometimes [o] rarely or never***					
See list below	Morphology: depth variation	Morphology: bed structure, substrate	Morphology: intertidal zone structure	Tidal regime: freshwater flow (only transitional water bodies)	Tidal regime: dominant currents direction (only coastal water bodies)	Tidal regime: wave exposure	Transparency	Thermal conditions	Oxygenation	Salinity	Nutrient conditions	Specific pollutants
Dredged for navigation, flood conveyance	++	++	+	+	+	+	o	+	+	+	+	o

iv) Effects on BQEs (impact)

The tables of the mitigation measures library also present 'typical' effects (impacts) on the biological quality elements (Table 9). In this case, however, the likelihood of the identified changes in the hydromorphological or physico-chemical elements resulting in direct or indirect detrimental effects on each of the BQEs is identified as being 'strong or moderate' or 'low'. In addition to considering each BQE, the tables provide a brief narrative, summarising the typical impacts on the original (pre-modification) ecology. This is relevant insofar as it highlights some of the more potentially complex interrelationships and/or on the ability of the system to sustain the provision of ecosystem goods and services.

The way in which hydromorphological alterations (and, where relevant, associated alterations in physico-chemical supporting elements) have affected the BQEs in the HMWB will often be evident from classification or monitoring evidence. The typical effects listed in the tables in the mitigation measures library should therefore be checked against the collated (monitoring-based) evidence and the significance of the measured effect in each case should be quantified or recorded accordingly.

Overall, the generic nature of the tables in the mitigation measures library needs to be taken into account, noting that it will always be necessary to understand the scale of the effect and hence its significance in the context of the particular water body.

In cases where no detailed data are available or where there are data gaps, the typical impacts identified in the mitigation measures library tables will provide an insight into how the pressure may have affected the pre-modification ecology, in turn enabling the likely need for mitigation measures to define MEP and GEP and to achieve GEP to be considered. It should be recognized, however, that such generalisations may not be reliable in all site-specific circumstances.

Table 9: Example from mitigation measures library on TraC: Physical modifications, effects on hydromorphological or physico-chemical supporting elements and effects on BQEs

PRESSURE	STATE (hydromorphological, physico-chemical alteration)												IMPACT				
Specific nature of existing physical modification	*Potential for direct or indirect effect on hydromorphological supporting elements at water body scale [++] always or usually [+] sometimes [o] rarely or never*						*Potential for direct or indirect effect on physico-chemical supporting elements at water body scale [++] always or usually [+] sometimes [o] rarely or never*						*Likelihood of effect on BQEs [++] strong or moderate likelihood [+] low likelihood*				
See list below	Morphology: depth variation	Morphology: bed structure, substrate	Morphology: intertidal zone structure	Tidal regime: freshwater flow (only transitional water bodies)	Tidal regime: dominant currents direction (only coastal water bodies)	Tidal regime: wave exposure	Transparency	Thermal conditions	Oxygenation	Salinity	Nutrient conditions	Specific pollutants	Phytoplankton	Macroalgae (seaweeds)	Angiosperms (seagrass, saltmarsh)	Benthic invertebrate fauna	Fish (only transitional water bodies)
Dredged for navigation, flood conveyance	++	++	+	+	+	+	o	+	+	+	+	o	+	++	++	++	++

v) Potentially relevant measures (response)

Once the nature of the modification (pressure), the effects on supporting elements (state), and the implications for the BQEs (impacts) are essentially understood, a list of potentially appropriate mitigation measures for MEP and GEP definition and achievement of GEP should be developed.

The tables in the mitigation measures library include key groups of mitigation measures. These are expected to be considered during MEP and GEP definition in order to address certain modifications, in the absence of good reasons for excluding the measures. Whereas some mitigation measures are useful only to address a particular type of impact (e.g. meandering would usually only be considered if a water body has been straightened or canalised), others are more widely applicable. For each water category, a number of good practice measures have been confirmed in technical reports and workshops carried out in the context of the Common Implementation Strategy[30] as being potentially suitable to

[30] Halleraker et al, Working Group ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies - Part 1: Impacted by water storage; EUR 28413; doi:10.2760/649695.
- Vartia et al, WG ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for Heavily Modified Water Bodies, EUR 29132 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-80305-5, doi:10.2760/444293, JRC110959.
- Bussettini et al, Working Group ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies - Part 2: Impacted by flood protection structures, EUR 29131 EN; Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-80290-4, doi:10.2760/875939, JRC110957
- Workshop report, Workshop on mitigation measures and GEP for Inland Navigation water use, 29th – 30th June 2017, Brussels.

mitigate a wide range of impacts. Habitat enhancement and sediment management are two such generic measures. The mitigation measures in the European library represent emerging good practice, especially for rivers and TraC waters. However, the library content on mitigation measures for lakes will need to be improved and updated based on further discussions in the future.

For each characteristic physical modification type, the tables of the mitigation measures library highlight the typical relevance of these commonly used measure groups and indicate whether the measure group is 'always/usually', 'sometimes' or 'rarely/never' considered for use to mitigate the effects of the modification type in question (Table 10).

Table 10: Example from mitigation measures library on TraC: Physical modifications and potentially relevant mitigation measures (key measure groups)

PRESSURE	**RESPONSE**											
Specific nature of existing physical modification	***Relevance of typical mitigation measures **** ***[++] always or usually [+] sometimes [o] rarely or never***											
See list below	Improve morphological and/or habitat diversity of seabed	Intertidal habitat restoration, enhancement or creation	Beach or foreshore replenishment	Sediment management	Beneficial use of dredged material	Modification or management of operations or structures e.g. sluices, vessel traffic	Soft engineering solutions; use of vegetation	Realign to mitigate effects on flow	Reprofile embankments, structures	Fish pass	Seasonal or tidal constraints on activity	Selection of methods or equipment
Dredged for navigation, flood conveyance	++	+	o	++	o	++	++	+	o	o	o	o

Additional supporting tables in the library elaborate on these commonly used measure groups and provide examples of specific practical measures which are included in the measure groups (

Table 11). Experts working on the definition of ecological potential should be familiar with the broad range of different measures included in the measure groups. The mitigation measures library provided as a supporting tool to this document helps increase understanding of the breadth of available measures. Member States should therefore consider a wide range of potentially available measures to deliver the needed ecological improvements.

Table 11: Example from mitigation measures library on TraC: Examples of specific measures for selected key measure groups

Key groups of measures	**Examples of specific measures**

Improve morphological and/or habitat diversity of seabed	- Placement of rocks, artificial reefs etc. to form reef and/or other types of habitats for BQEs - Use breakwaters or groynes or shore parallel islands to create local variations in depth, exposure/shelter, etc. - Local deepening by dredging or excavation where sustainable
Intertidal habitat restoration, enhancement or creation	- Habitat rehabilitation - Managed realignment to new line - Re-open polders; setback (to higher ground; to existing secondary defence line) - Step back (create intertidal shelf against vertical wall) - Planter baskets; other planting initiatives - Improve creek or backwater habitats - Use breakwaters, shore parallel islands or similar to create sheltered conditions promoting intertidal enhancement - Offsetting measures e.g. spawning habitat for fish

For both the measure groups and the specific measures in each group, it is important to understand that the lists provided in the library are not intended to be comprehensive. Rather, these measures are intended to provide ideas and inspiration. Many Member States have their own mitigation measure libraries and these should also be referred to in determining whether alternative or more locally appropriate options exist that would deliver a similar outcome in terms of ecological improvement and definition of ecological potential. The European library of mitigation measures can support and supplement national mitigation measure libraries if such exist, and can support the development of new national libraries, if none exist in certain Member States so far.

In selecting potential mitigation measures, measures should be selected which are relevant to the hydromorphological alterations and ecologically effective in the context of the specific water body or water bodies . Box 8: below describes in more detail the meaning of “relevant” and “ecologically effective” mitigation measures.

Box 8: Selection of relevant and ecologically effective mitigation measures

The selection of potential mitigation measures, which are **relevant** to the hydromorphological alterations and **ecologically effective** in the context of the specific water body or water bodies should take into account the following:

- The natural hydromorphological and physicochemical characteristics of the water body
- Other water body or water bodies characteristics relevant to the biota, e.g. is the modification within or outside the fish zone, fish community types, sediment (e.g. coarse, fine) and habitats (e.g. river types)
- Whether measure is appropriate for addressing the existing ecological impacts and can deliver a proven ecological benefit. In this sense, measures that are not likely to deliver an ecological benefit should not be considered.

Example: The reconnection of side-arms is typically a relevant mitigation measure for restoring ecological continuum in rivers. However, if no side-arms exist to be “reconnected” in a specific HMWB, the measure is not relevant in the context that water body.

Example: Connectivity is typically relevant for all migrating biota, for the concerned water body as well as for water bodies upstream or downstream. If there is no significant ecological benefit from measures which restore continuity (e.g. due to a very short river reach within the fish zone upstream, or the connection of different river basins leading to dispersal of invasive species), continuity measures can be excluded from the selection of potential mitigation measures for MEP.

The selection of mitigation measures that are both relevant to the particular hydromorphological alterations and ecologically effective in the context of the specific water body or water bodies should not be confused with the justification of "technical feasibility" under WFD Article 4(4) and of "infeasible achievement" under WFD Article 4(5) (exemptions).

In addition, it may also be appropriate to consider inter-water body parameters and processes, when selecting potentially relevant mitigation measures. Specifically, if the effect that requires mitigation directly or indirectly[31] involves or affects fish migration, sediment transport or similar ecological or hydromorphological processes that operate beyond the water body boundary, the selection of measures should take into account the need to sustain and/or improve these processes.

Example: Measures for fish continuity may be selected whilst defining MEP and GEP in a river water body, because they are needed to reconnect upstream water bodies.

Example: Insofar as sediment is concerned, if the enhancement of a coastal fish nursery area requires a supply of sediment, it may be preferable to modify an updrift breakwater to facilitate the natural, long term movement of sediment from along the coast rather than extracting and transporting material from a source downdrift.

In practice, this means that when using the mitigation measures library, in some cases, it may be necessary to select mitigation measures that are not directly linked to the physical modifications in the particular HMWB or are even related to the list of measures for another water category in the library.

Example: In the case of a reservoir as illustrated in Figure 8, a former river section (now a reservoir) is designated as a river HMWB but is shaped more like a lake. However, the river reaches (natural water bodies) upstream and downstream also need to be taken into account when designating HMWB and defining MEP and GEP for the HMWB, based on the condition before the physical modification (natural river types).[32] Additional measures to allow the upstream and downstream river sections to achieve their objectives might be needed, as ecological continuum (e.g. possibility to migrate) also has to be ensured for the type-specific fish species of the downstream and upstream natural water bodies. In this context, it is relevant to take the requirements of WFD Article 4(8) into account.[33] It is also assumed that water bodies have been properly delineated in line with CIS Guidance Document No.2 on the identification of

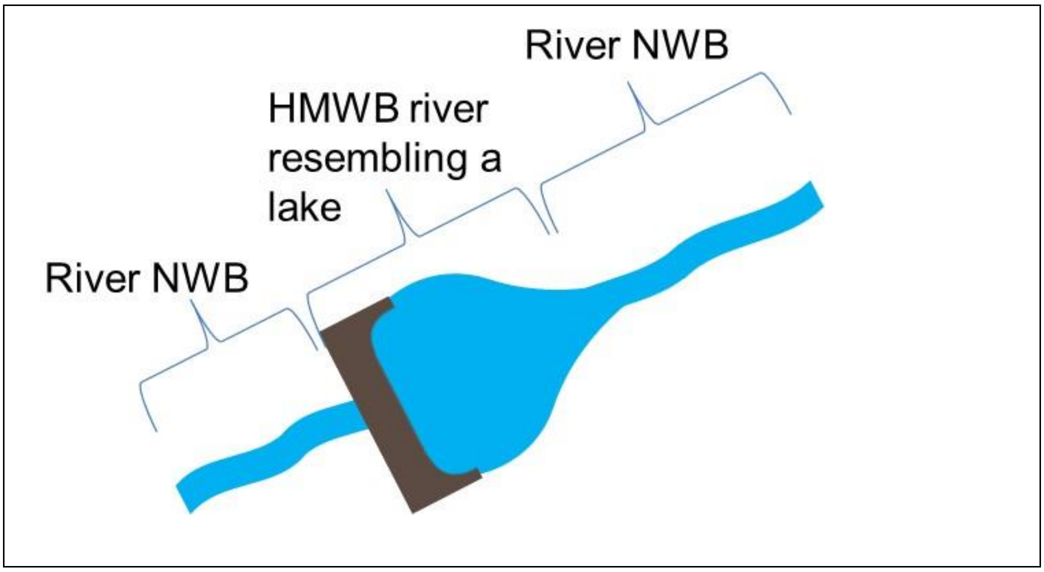
[31] Direct effects may result from the construction of a barrier or the physical removal of habitat through dredging. Indirect effects on habitats can be experienced as a result of a change in hydromorphological processes – for example deepening or widening can increase or reduce flow velocities, in turn making the environment less suitable for certain species or changing patterns of sediment accretion or erosion, indirectly changing the habitat type locally.

[32] Workshop on GEP inter-comparison case studies on water storage, 13- 14 February 2017 – Vienna, Summary Report.

[33] Article 4(8) specifies that when applying Article 4(3), "a Member State shall ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation."

water bodies. For example, if this guidance is followed, a reservoir cannot include longer free flowing river sections, except for small stretches (e.g. up to 1 km). Therefore, there should not be a mixture of different water categories in a single HMWB.

Figure 8: Change of river into lake and links to upstream/downstream river sections



Notes: NWB=natural water body. The river water bodies upstream/downstream might also be HMWB but separate water bodies.

Differentiation between measures for defining MEP/GEP and (restoration) measures for achieving GES

The measures considered as potential MEP/GEP mitigation measures in designated HMWBs will be largely the same as restoration measures potentially contributing to GES and addressing the effects of hydromorphological pressures. However, the GES objective of restoring natural hydromorphological processes has already been rejected in the designation phase, on the basis that this would adversely affect the existing use and/or the wider environment of the water body. Therefore, full restoration measures (e.g. involving the removal of a dam, flood defence, breakwater, etc. to facilitate reinstatement of natural processes) do not need to be considered as mitigation measures for GEP. Rather, the full range of measures that aim to restore the natural hydromorphological processes wherever possible and/or to restore the ecological function insofar as this can be achieved in relation to the closest comparable water category and type will need to be considered.

Example: In the example of an impoundment (change of a riverine condition to a more stagnant one), measures such as the construction of bypass channels with riverine character, creation of habitats at the head area of the impoundment etc. (or their combinations) could significantly improve the situation but would not completely reach the riverine conditions needed for achieving GES.

Furthermore, in many cases, the intensity/level of ambition of a measure and the combination of measures may be crucial for distinguishing between measures for achieving GES and measures for defining and achieving GEP.

Example: In the case of measures related to flow, while the achievement of GES is related to a set of environmental standards for ecological flow (restoring flow), the achievement of GEP is related to fewer flow components (mitigating flow) than those required to meet environmental standards. Therefore, the selection of the mitigation measure of additional flow for GEP will depend on the amount of flow available; some water can also be required for the achievement of GEP to support improvements in biological terms (GEP flow).

Initial list of potential mitigation measures for further evaluation

In the absence of an existing national library of measures and a methodology for their identification and review, it is recommended that the typical and modification-specific measures in the tables of the European mitigation measures library are assessed to determine whether each measure, alone or in combination with other measures, might contribute to an improvement in the ecological conditions of the water bodies being assessed.

This process will lead to the identification of an initial list of potential mitigation measures to be subject to further, more detailed, evaluation under the following steps, enabling the MEP/GEP objectives to be defined.

5.4.4.2 Exclude or redesign measures that have a significant adverse effect on use or wider environment (Sub-step B2)

The next step after creating an initial list of mitigation measures for MEP is to exclude measures that have significant adverse effects on use(s) or the wider environment. According to CIS Guidance Document No.4, MEP represents the maximum ecological quality that could be achieved for a HMWB once all mitigation measures that do not have significant adverse effects on use or on the wider environment have been applied.

The reasons and criteria for judging the significance of effects should be made clear in a transparent way, and decisions on when such adverse effects are significant are important as they may affect the level of ambition of ecological improvements and how intensely measures are applied.

When Member States exclude measures due to significant adverse effects on use or the wider environment, they should do so on the level of specific mitigation measures included in one of the measures groups. Whole measure groups should not be excluded, as this would not allow for case-specific differentiation (e.g. in relation to certain amounts of water in the river system).

Important!

Overall, no significant adverse effect on use cannot be equated to no effect on use, unless this is properly justified in the RBMP.

The following issues are considered as necessary to be addressed in order to achieve a transparent and clear process for assessing significant adverse effects:

- **Issue 1**: Define the key uses and the scope of wider environment interests
- **Issue 2**: Define the benefits of the key uses and of wider environment
- **Issue 3**: Define in generic terms the types of effects of measures on the key uses and the wider environment
- **Issue 4**: Define the scale of assessment of significant adverse effects for each key use and the wider environment
- **Issue 5**: For each key type of adverse effect, define criteria for assessing adverse effects and thresholds of significance

This process is developed at a strategic level in order to follow consistent approaches within the Member States.

Issue 1: Define the key uses and the scope of wider environment interests

While the definition of some uses may be clear (e.g. storage for hydropower use), for other uses it may require some further clarification (e.g. urbanisation) or a clearer definition of the scope (e.g. for wider environment). Further guidance on the scope of uses and the wider environment under WFD Article 4(3)(a) is given in section 3 of this document.

Issue 2: Define the benefits of the key uses and of wider environment

It is important to define the specific benefits of the different uses (e.g. in the case of hydropower, the importance of energy generation or for certain types of facilities providing for peaks in energy demand and regulatory power). Examples of the main benefits of the key uses and the wider environment are given in the Summary Report of the CIS Workshop on Significant Adverse Effects on use or the wider environment from measures (April 2018)[34].

Issue 3: Define in generic terms the types of effects of mitigation measures on the key uses and the wider environment

Adverse effects on the uses may include losses of/in important services (e.g. flood protection, drainage, navigability or recreation) or production losses (e.g. hydropower or agricultural goods). In assessing "significant adverse effects" on the uses, economic effects may play an important role (see Box 98 below on economic issues) and social aspects may also need to be considered (e.g. removal of flood defences may lead to displacement of population) (CIS Guidance Document No.4). Other considerations include possible health and safety, or legal implications (e.g. if an authority is legally required to provide a certain function).

[34] Kampa et al. (2018). Summary Report. Workshop on Significant Adverse Effects on use or the wider environment from measures, 23-24 April 2018, Brussels.

Examples on the types of effects of measures on the key uses and the wider environment are given in Table 12 below.

Table 12: Generic adverse effects of mitigation measures on key uses

Types of generic adverse effects of mitigation measures on use	Use-specific examples of adverse effects of mitigation measures
Loss of production	• Storage for hydropower: Loss of electricity production • Agriculture: Reduction of agricultural/forestry production
Risk to security of use	• Storage for hydropower: Significant risk to regional or national energy security • Storage for water supply: Reduction of security of water supply, also for navigation • Agriculture: Risk to food security
Risk to safety/health, societal well-being	• Flood protection: Increase of flood risk in close-by areas • Navigation: Safety implications for commercial/recreational/military navigation
Socio-economic impacts with measurable consequences for public welfare	• All uses: Loss of jobs/employment, Loss of revenue for Government (associated taxes) • Agriculture: Impact on thriving rural communities
Effects on reduced GHG emissions	• Storage for hydropower: Increased emissions from partly replacing hydropower production with conventional energy • Navigation: Additional emissions from tonnage moved to other forms of transport, especially road or air

Box 98: Significant adverse effects versus financial cost of measures

Generally speaking, the assessment of significant adverse effects should be based on the wider economic effects, while the income of a specific company should not be included in this assessment.[35] The assessment should be made in relation to the needs of society and not in relation to the economic situation of the individual. Whilst significant adverse effects from measures can be linked to a loss of revenue (benefits arising for specific water use), the ability of the user to pay is not relevant at this stage as this would potentially discriminate against efficient and profitable enterprises (CIS Guidance Document No.4). Overall business economics are part of the socio-economic assessment. The assessment must be made by Member States and should be supported by national targeting strategies. The ability of the user to pay is taken into consideration at another stage of the process when implementing measures for achieving GEP as part of the RBMPs.

CIS Guidance Document No.4 gives an overview of the related cost (and benefit) considerations for the measures that are to be considered in the different steps of the designation of HMWB and the definition of GEP (see table 4 in CIS Guidance Document No.4). Overall, the assessment of significant

[35] CIS Workshop on GEP inter-comparison case studies on water storage, 13- 14 February 2017 – Vienna.

adverse effects of measures on use or wider environment must not be confused with the assessment of disproportionate costs.

According to CIS Guidance Document No.4, the financial costs of measures are not considered in the classification process of HMWB. The costs of measures are taken into account in the objective setting process when defining the programme of measures for reaching the environmental objectives under the WFD (i.e. when determining which measures will be implemented in practice). At that stage, a decision needs to be taken on which GEP measures to include in the RBMP for implementation. This is the point at which costs are considered along with the possibility of applying an exemption based on WFD Article 4.5 per 2027 or later. Considerations at this stage include the question of disproportionate cost, which can involve political decisions.

Issue 4: Define the scale of assessment for each key use and the wider environment

At the stage of MEP definition, the local scale is generally relevant for assessing significant adverse effects. This is because, depending on the local conditions, a measure may have significant adverse effects in one location, but not in another site. After a water body is designated as HMWB, a Member State should seek to do the best it can for the ecology given the use(s) responsible for the modifications. Therefore, the assessment is about understanding how the measures that could be taken to improve or restore the ecological function will compromise or have another effect on use(s).

However, the assessment at local scale should not be related to the private interest of one person/or company but to broader public interest (e.g. safe electricity supply for people or a specific community). In addition, the assessment has to be linked to a general or national method on how to assess adverse effects and set criteria. Otherwise, cases at which mitigation has already taken place would be disadvantaged. It is thus necessary to ensure that the starting point for the assessment of significant adverse effects for different users is the same.

Example: This can be exemplified by looking at two different water abstractions from a river. The first abstraction runs on an old licence, whereby it is allowed to abstract all of the water and there is no obligation to retain some flow in the river. The other abstraction runs on a permit, which already includes a requirement for an environmental flow; however, this flow is not sufficient to achieve GES. The requirement to provide an ecological flow to achieve GES would lead to the fact that the production loss of the first abstraction would be much higher (e.g. 20%) than of the second abstraction (e.g. only 5%). It would be a large disadvantage for the second abstraction (which already follows a requirement for environmental flow) if the production loss for the first abstraction is assessed to be significant and for the second abstraction as insignificant. For this reason, production loss should in this case not be referred to a specific abstraction activity, but to the economic sector and to the effects on regional or national scale.

The scale of assessing significant adverse effects can be different for different uses and, in the Summary Report of the CIS Workshop on Significant Adverse Effects on use or the wider environment from measures (April 2018)[36], examples are given on the most appropriate scale of assessment for each of the key uses of storage, flood protection, drainage and navigation.

In addition, it is often important to consider the whole river system when taking decisions on the significance of adverse effects. In particular, a measure might have a negative effect on a use at a certain location of the river system, but at the same time have a positive effect on the same type of use at another location of the river system.

Example: In the case of energy production, energy losses at the scale of an installation upstream may in the meantime increase the energy production for another hydropower plant further downstream. Therefore, economic losses upstream may be compensated by benefits further downstream. For this reason, there is a need to assess the effects on use not only with regard to a specific installation/local situation but also with regard to possible effects at the whole river system.

Issue 5: For each key type of adverse effect, define criteria on what is significant and what is not significant adverse effect

Overall, "no significant adverse effect on use" cannot be equated to "no effect on use", unless this is properly justified in the RBMP. At the same time, according to CIS Guidance Document No.4, "significance" may vary between sectors and uses and will be influenced by the socioeconomic priorities of Member States. It is however possible to give an indication of the difference between "significant adverse effect" and "adverse effect". A significant adverse effect on use should not be small or unnoticeable but should make a notable difference to the use. The distinction between the level of significance and levels of natural variation is important. For example, an effect should not usually be considered significant where the effect on use is smaller than the normal short-term variability in performance (e.g. output per kilowatt hour regarding base load, safe navigable depth, quantity of drinking water provided). However, the effect would clearly be significant if it compromised the long-term viability of the use by significantly reducing its performance.[37]

Example: For instance, how does a level of significance of adverse effect of less than 5% of reduction in annual electricity base load production compare to natural variation in annual production of 5-10%? Natural variation implies that, in dry years, a country would have certain energy loss, therefore any reduction to energy (base load) production should not be considered automatically as significant adverse effect.

However, in some cases, the distance between "no effect" and "significant effect" can be comparably small, for example in case of 100-year flood safety or regulatory power provision.

Overall, Member States need to establish criteria and thresholds for deciding whether measures would have a significant (or not significant) effect on use. This is a key issue for achieving a clear and

[36] Kampa et al. (2018). Summary Report. Workshop on Significant Adverse Effects on use or the wider environment from measures, 23-24 April 2018, Brussels.

[37] A factor to consider in this context is the length of time in which there should be a significant effect. This may be on a yearly basis and only in exceptional cases in the longer term. The likelihood that the effect will occur must be weighed against the damage that occurs on the use.

transparent process of defining MEP.[38] Criteria need to reflect the effect on different benefits provided by the water use. Thus, several criteria may need to be used rather than using a single criterion.

Look out!
The reasons and criteria for judgement on significance of effects should be made clear and transparent, and set in a consistent way at the national level. The set criteria can be applied at different scales. Setting thresholds for significance can also be relevant in some cases.

CIS Guidance Documents No.1 and No.4 have highlighted the type of methods that can be used in the assessment of significant adverse effects. Table 13 provides examples (open list) of how some generic effects have been developed into more specific lists of possible benefits, types of adverse effects and criteria for assessing adverse effects on water storage for hydropower. The significance thresholds listed in the last column of the table are examples of thresholds that have been used by Member States in their 2nd RBMPs to assess the significance of adverse effects. These thresholds show a wide variation and thus are not necessarily best practice examples. In general, when carrying out quantifications of adverse effects of measures on use, we should not use numbers only (such as loss of production in kWh), but also relate these to percentages (such as % of total production).

Table 13: Examples of adverse effects of mitigation measures on water storage for hydropower and assessment of significance

Benefits of storage for hydropower	Effects of measures on storage for hydropower	Criteria for assessing adverse effect on use	Level/scale at which this assessment may take place	When is an adverse effect significant
Electricity production (base load)	Production loss (base load) *Effect on climate change drivers and CO2 emissions (effect on wider environment)*[39]	Exact figure (production, MWh) Compared to annual production (%)	National, regional	*Examples of national estimates of significance:* Scotland >2% of annual national production[40] AT >3% loss of annual national production at any

[38] JRC technical report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies (2016).
[39] It is necessary to evaluate CO2-effects of mitigation measures corresponding directly to the storage reservoir aiming at depicting clearly the consequences for EU and national CO2 reduction goals when assessing possible cuts in reservoir uses.
[40] For Scotland, the 2% maximum reduction in generation is to deliver the measures set out for all RBMP cycles up to 2027. It is a cumulative annual total across the three cycles. Sources: https://www.sepa.org.uk/media/163444/appendices-to-the-river-basin-management-plan-for-the-scotland-

Benefits of storage for hydropower	Effects of measures on storage for hydropower	Criteria for assessing adverse effect on use	Level/scale at which this assessment may take place	When is an adverse effect significant
		Compared to renewable energy targets (%)		rate (maybe already even less)[41] SE >2.3% loss of annual national production[42] NO estimates available but no specific threshold of significance[43]
Flexibility (regulatory power, peak load production)	Loss of flexible capacity; Loss in minimum safe capacity *Effect on climate change drivers and CO2 emissions (effect on wider environment)*	Range of flexibility	National, local level	Quite unlikely to set quantitative threshold for significance
Regional or national energy security[44]	Significant risk to regional or national energy safety of electricity supply Significant risk to regional or	Risk to security	National, local level	No significant risk to security can be accepted

river-bsin-district-2015-2027.pdf (Appendix 3) and https://www.sepa.org.uk/media/218891/rbmp_appendices_2015_update_solway_tweed.pdf (Appendix 8.1)

[41] Sources: https://www.bmnt.gv.at/wasser/wasser-oesterreich/plan_gewaesser_ngp/nationaler_gewaesserbewirtschaftungsplan-ngp/ngp2009.html, https://www.bmnt.gv.at/wasser/wisa/fachinformation/ngp/ngp-2015.html

[42] Sources: https://www.havochvatten.se/hav/fiske--fritid/miljopaverkan/fysisk-paverkan/nationell-strategi-for-vattenkraft-och-vattenmiljo.html and "National strategy" (In Swedish) https://www.havochvatten.se/hav/samordning--fakta/samverkansomraden/energi/nationell-strategi-for-vattenkraft-och-vattenmiljo.html.

[43] Source: http://www.vannportalen.no/brev-og-foringer1/nasjonale-foringer-for-regulerte-vassdrag/ (in Norwegian).

[44] A clear definition would be needed: security of supply and/or grid security. Whereas enhancing security of supply aims to decrease energy imports from outside EU, the stable operation of electricity grids aims at providing the commonly known low level of shortages of electricity delivery.

Benefits of storage for hydropower	Effects of measures on storage for hydropower	Criteria for assessing adverse effect on use	Level/scale at which this assessment may take place	When is an adverse effect significant
	national security of grid stability			

Note: "Run-of-river hydropower plants usually produce base load electricity while (pumped) storage hydropower plants produce electricity on demand (peak load, regulatory power). The significance of production losses thus has to be assessed differently, in particular because peak load or regulatory power are much more difficult to be replaced by another renewable energy source.

Cross-cutting issues

In addition to avoiding adverse effects on use for which the water body is designated, it is important to ensure that measures to achieve GEP also avoid adversely affecting other legitimate (i.e. sustainable human) uses. If "unintended consequences" are to be avoided, it is important to consult with all users of a water body in order to understand possible impacts of mitigation measures on other uses, including uses that have not triggered a HMWB designation.

Example: Measures to achieve GEP in water bodies affected by flood protection in rivers or estuaries may have an impact on (safety of) navigation. For instance, the measure of flood bank removal to reconnect the river with its floodplain may be selected for achieving GEP. Changing the flow of water can result in a shift in location of the main channel or in general shallowing, both of which can have potentially significant consequences for navigational safety.

Example: Another example is on a river channel which has been deepened and widened for flood defence purposes. The adverse ecological effects of the modifications could be mitigated in this case without a significant reduction in the channels' capacity to convey flood water by the establishment of a two stage channel (i.e. a deeper central channel and shallower margins within the artificially widened channel). This measure would increase habitat diversity and allow rooted plants to grow in the shallower areas adjacent to the banks. However, if the channel is also being used for navigation, such a measure might have a significant adverse effect on the navigability of the channel and therefore be inappropriate.[45]

The following are possible outcomes when assessing possible adverse effects on more than one use:

- Where several uses are present, if the effect of the mitigation measures on any one of these uses is significant, then a 'significant adverse effect on use' conclusion is triggered for that measure.
- If there are several uses present and none of these is significantly affected, but several effects are very close to the relevant threshold (i.e. are nearly 'significant'), this might trigger further investigation whether the overall cumulative effect is considered as significant.

[45] WFD and hydromorphological pressures – Technical report. Good practice in managing the ecological impacts of hydropower schemes; flood protection works; and works designed to facilitate navigation under the Water Framework Directive. November 2016.

- In other cases, if none of the uses are close to being significantly affected by a particular measure (i.e. alone), the in-combination effects would not be expected to be significant.

Assessment of significant adverse effects as an iterative process

The selection of mitigation measures that do not have significant adverse effects on use or the wider environment might also be an iterative process. The level of ambition of a measure plays a role in the selection process; a measure with a significant adverse effect could potentially be re-designed to have a reduced level of ambition, which may not have a significant adverse effect and should therefore be taken into account in the definition of MEP.

In many cases, there are several reasons than can lead to a need for case-specific differentiation, e.g. on quantity of water or length of morphological mitigation measures to be implemented.

Example: In the case of measures related to flow, the provision of a certain amount of water necessary to establish a GEP flow[46] could have a significant adverse effect on use. The establishment of additional flow with a different (reduced) volume of water may not have a significant adverse effect, and should thus be part of the set of measures to define MEP conditions.

In addition, combinations of measures can be relevant for re-designing measures in order to have a reduced adverse effect. In this context, it should be checked whether the adverse effect can be reduced by using an additional measure (including technical upgrade/refurbishment/modernisation).

Example: In the case of hydropower, production loss due to the provisioning of an environmental flow can be significantly reduced by installing a “residual flow turbine”. This turbine uses the amount of water needed for environmental flow to produce additional electricity.

5.4.4.3 Select most ecologically beneficial (combinations of) measures addressing all hydromorphological alterations, taking into account need to ensure best approximation to ecological continuum (Sub-step B3)

Having excluded from the initial list of potential mitigation measures, those measures that would have a significant adverse effect on use or the wider environment, the next step is to select the measure or combination[47] of measures that deliver the best improvement in ecological function and address all relevant hydromorphological alterations, **taking into account the need to ensure best approximation of ecological continuum**. Overall, mitigation measure(s) selected for the definition of MEP and GEP are assumed to deliver sufficient improvements to aspects of ecological functioning. Improvements to ecological functioning should clearly relate to the key impacts of the physical modifications.

In order to select mitigation measures, clear knowledge is needed on type-specific ecological impacts based on BQEs and on what hydromorphological conditions should be improved to improve the

[46] GEP flow is here defined equivalent to the definition of Ecological Flow in CIS Guidance #31 as “a hydrological regime consistent with the achievement of the environmental objectives of the WFD in heavily modified surface water bodies as mentioned in Article 4(1).

[47] From a practical perspective, the meaning of “combinations” highlights that measures should take into account other measures, which might be necessary for significant improvements, e.g. a creation of floodplain habitats can be ecologically effective only if the flooding regime is sufficiently improved.

biological conditions. This means that there should be sufficient knowledge of the biological response to related mitigation measures that are relevant to the particular hydromorphological alterations. The benefits of each measure or a combination of measures to the relevant BQEs should be considered, considering timings based on ecological requirements (e.g. reproductive seasons, impacts on vegetation encroachment).

If there is sufficient information available on which quality elements are failing good status and if different measures make a contribution to the relevant ecological improvements needed, all these measures should be included in the initial list of mitigation measures for MEP definition. Furthermore, whilst identifying mitigation measures for MEP, measures should be sufficient for mitigating the ecological deficits to the maximum extent possible, i.e. measures which are only predicted to have a slight contribution to ecological improvement should be included.

In case of lack of data, a precautionary approach should be adopted. More relevant mitigation measures should be included on the initial list, which can be excluded later when sufficient supporting evidence becomes available.

It is also considered good practice to first consider mitigation measures where there is a high degree of confidence that they will improve ecological conditions and ensure the best approximation of ecological continuum.

MEP requires that the best approximation of ecological continuum is ensured. If this is ensured on the basis of the selected set of mitigation measures, the list of measures is used to define MEP and then GEP conditions, and later to select measures for the PoM to achieve GEP. In this context, the most relevant water category and water type must also be taken into account, to ensure that all relevant mitigation measures have been considered.

If the set of measures does not ensure best approximation of ecological continuum (e.g. the water body is dry at least seasonally), the initial list of mitigation measures needs to be reviewed, to check if there is another (second option) combination of measures by which best approximation of ecological continuum will be achieved.

5.4.5 Derivation of hydromorphological conditions for MEP (Step C)

The WFD defines the hydromorphological conditions for MEP as those "consistent with the only impacts on the surface water body being those resulting from the artificial or heavily modified characteristics of the water body once all mitigation measures have been taken to ensure the best approximation to ecological continuum, in particular with respect to migration of fauna and appropriate spawning and breeding grounds".

The hydromorphological conditions for MEP are therefore the hydromorphological conditions expected if all the mitigation measures that are relevant to the particular hydromorphological alterations, ecologically effective in the physical context of the water body or water bodies, and which do not have a significant adverse effect on use or the wider environment, are implemented. Though this definition is based on an assumption of which measures will be implemented, a prediction is fundamental for the following steps prior to the implementation of measures.

The derivation of hydromorphological conditions for MEP should be based on:

- the hydromorphological conditions in the water body altered by the physical modifications linked to the use.
- the expected effects of the set of mitigation measures (for MEP) on the hydromorphological conditions.

The hydromorphological conditions for MEP may resemble those of a different type (compared to the natural water body type before the physical modification). Thus, the hydromorphological conditions defined for MEP can be used to identify or derive the closest comparable water body type, which is in particular relevant for defining MEP conditions for biological quality elements and those physico-chemical parameters that are affected by the hydromorphological conditions. The closest comparable water body type is based on the most comparable water category (see Step A), national typology, hydromorphological conditions for MEP and the ecological impacts resulting from the hydromorphological alteration.

Closest comparable water body type

According to WFD Annex V 1.2.5, "the values of the relevant biological quality elements reflect, as far as possible, those associated with the **closest comparable surface water body type**, given the physical conditions which result from the artificial or heavily modified characteristics of the water body".

If possible, the closest comparable water body type should be derived from the original natural water body type (i.e. prior to the physical modification). It is noted, however, that although the closest comparable type can be the same as the original natural water body type, it is characterised by reduced habitat quality, i.e. lower than the hydromorphological quality for good status of the original natural water body type.

The closest comparable water body type may also differ from the original natural water body type, after adopting the changed hydromorphological conditions due to the modifications of the HMWB.

Example: When a river is modified by an impoundment (not a reservoir), it changes from a more rhithral (fast flowing, high energy, associated with the upper parts of a system) to a more potamal (slower flowing, lower energy, associated with the lower parts of a system) river type; here, the most important change is the significant reduction of the flow velocity consistent with a larger river type further downstream in the river basin. The river type of a size category different to that of the original natural river type would therefore be used in this situation.

Example: With regard to a reservoir used for water storage (e.g. for hydropower generation), there is no natural lake type with comparable water level variations. Nevertheless, the reservoir can be treated like a lake type in the same region, altitude and geology, with the exception of the water level variation and all quality elements directly or indirectly influenced by this variation. This means that the nutrient level required for MEP or GEP of the reservoir will be similar to the nutrient requirements of the natural lake type. For water level variation and all other hydromorphological, physico-chemical and biological quality elements influenced by the level variation, MEP and GEP conditions/values have to be derived by taking account of the relevant mitigation measures.

Look out!
Please note that it is not considered as good practice to compare the characteristics to a type that is not already prevalent in the same region, e.g. to relate the hydromorphological conditions of a permanent river to those of a temporary river, if such features do not already occur naturally within the same landscape unit of the water body before modification.

!

Reference approach ←→ Mitigation measures approach

Step C should be taken under both the reference approach and the mitigation measures approach. Take note though that the necessary monitoring data and other information may initially be lacking, requiring further refining of step C in later planning cycles as data availability and method sensitivity improve.

5.4.6 Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type (Step D)

According to WFD Annex V 1.2.5 normative definitions for MEP:

- The [general] physico-chemical quality elements correspond totally or nearly totally to the undisturbed conditions associated with the surface water body type most closely comparable to the artificial or heavily modified water body concerned.
- Nutrient concentrations remain within the range normally associated with such undisturbed conditions.
- The levels of temperature, oxygen balance and pH are consistent with those found in the most closely comparable surface water body types under undisturbed conditions.
- Concentrations [of specific synthetic pollutants] are close to zero and at least below the limits of detection of the most advanced analytical techniques in general use.
- Concentrations [of specific non-synthetic pollutants] remain within the range normally associated with undisturbed conditions found in the surface water body type most closely comparable to the artificial or heavily modified water body concerned (background levels = bgl).

The physico-chemical conditions for MEP should be based, inter alia, on the hydromorphological conditions at MEP and on the estimation of correspondence “totally or nearly totally to the undisturbed conditions” associated with the closest comparable water type. The physico-chemical conditions have an important influence on the values for the biological quality elements at MEP.

The identification of the closest comparable water type is a supportive tool in this context. For physico-chemical parameters, the physico-chemical reference conditions for the closest comparable water body type are often the same as for the original natural water body type (before physical modification). However, this is not always the case and, in some cases, the reference conditions are different. The example bellow illustrates such a case.

Example: In the case of an impoundment within a river, nutrient concentrations will generally not be different following modification. However, the same nutrient concentrations can have stronger “eutrophication” effects when compared to the natural river type, due to the water being more “stagnant” in the modified situation. Nevertheless, in most cases this does not lead to nutrient values for MEP and

GEP that differ from those of the original natural water body. In exceptional cases, e.g. if this occurs on a large scale where a chain of impoundments characterize a river water body, this “eutrophication” effect might be taken into account and lead to lower nutrient boundaries through the use of the reference conditions of another, closest comparable, water type which is usually a larger river type downstream of the water body.

An exceptional case are those physico-chemical parameters that are inevitably determined by the hydromorphological alterations causing the heavily modified character. In general, the closest comparable water body type for physico-chemical conditions can only be different from the original natural water body type (before the physical modification) if the altered physico-chemical conditions are caused by the modified hydromorphological conditions.

If the values of those physico-chemical conditions that are directly connected to the hydromorphological alterations of the HMWB would not correspond totally or even nearly totally with the surface water body type most closely comparable to the artificial or heavily modified water body concerned, these differences should be taken into account when setting MEP.

Example: In the case of a large impoundment in a river (not a reservoir), temperature conditions might be different after the modification that might lead to the use of reference conditions of a larger and warmer river type downstream of the water body as closest comparable water type. Temperature is usually inevitably changed if a river is modified to a lake reservoir leading to a change in category and the closest comparable lake type as basis for derivation of temperature values for MEP.

Requirements for specific synthetic pollutants at MEP are the same as those for natural water bodies.

!	**Reference approach <-> Mitigation measures approach** Step D should be taken under both the reference approach and the mitigation measures approach. Take note though that the necessary monitoring data and other information may initially be lacking, requiring further refining of step D in later planning cycles as data availability and method sensitivity improve.

5.4.7 Derivation of BQE conditions for MEP (Step E)

According to WFD Annex V 1.2.5, the values for the biological quality elements at MEP should reflect, “as far as possible, those associated with the closest comparable surface water body type, given the physical conditions which result from the artificial or heavily modified characteristics of the water body”.

The BQE conditions for MEP are the biological conditions expected if the hydromorphological conditions at MEP are assumed to be achieved after implementation of all mitigation measures that are both relevant to the particular hydromorphological alterations and ecologically effective in the physical context of the water body or water bodies.

In practice, the derivation of biological conditions for MEP is based on:

- The identification of closest comparable water type
- The predicted hydromorphological and physico-chemical conditions (for MEP)
- The available BQE methods for ecological status assessment

When deriving BQE conditions for MEP, it is also critical to **consider the WFD requirements concerning the best approximation of the ecological continuum**, as described in section 5.2. The closest comparable water type (e.g. river type) also has a fundamental importance for derivation of BQE conditions at MEP.

It is suitable to use the BQE assessment methods used for natural water bodies of the same category if those methods are sensitive to hydromorphological alterations and can cover the relevant gradient of degradation for the HMWB. In principle, BQE conditions for MEP are the reference conditions of the closest comparable type, but adjustments are needed if the hydromorphological and physico-chemical conditions for MEP differ from those conditions in the closest comparable type. In the same way, it might be suitable to combine elements of different assessment methods (e.g. different metrics) to get an appropriate system of assessment. Whichever approach is used, a transparent and reproducible way to assess ecological potential has to be found.

In some cases, it may be difficult or not possible to find a closest comparable water body type. It may however be possible to predict the BQE conditions for MEP from the hydromorphological and physico-chemical conditions for MEP, even when a comparable water body is missing.

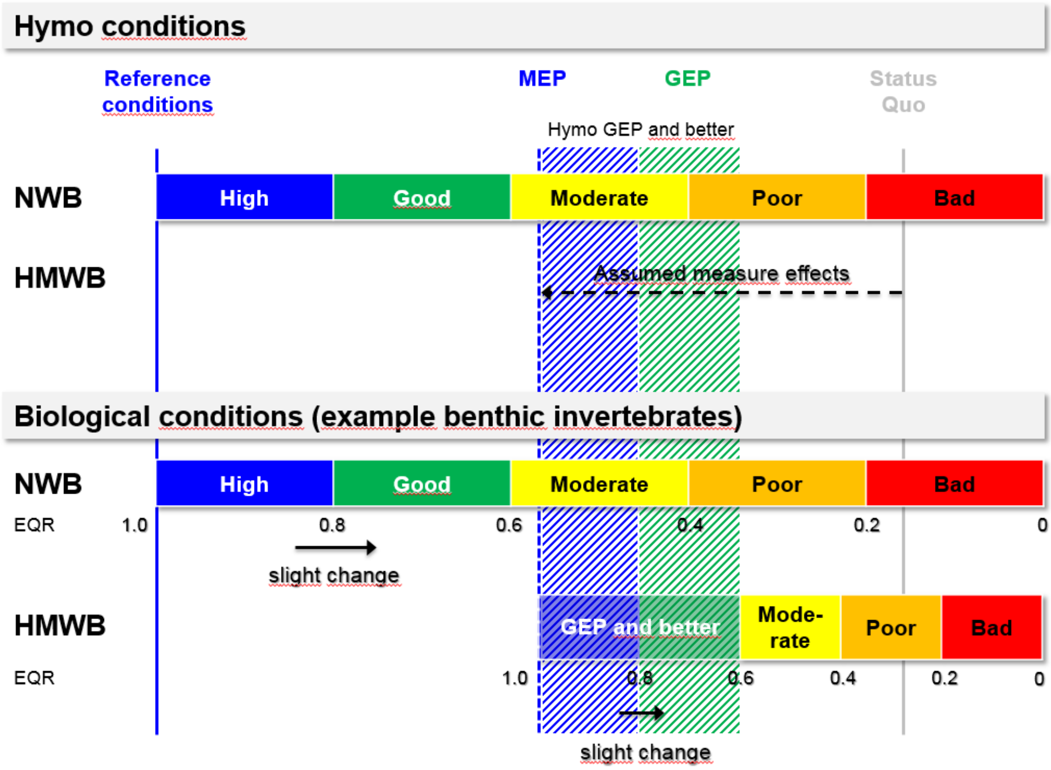
The values for BQEs at MEP might vary between countries, biological quality elements and river types depending particularly on the approach used, structure of the BQE assessment system, river characteristics and the availability of hydromorphological and biological data.

Example: Figure 9 below illustrates an example that uses equidistant classes for defining ecological potential based on benthic invertebrates. It is noted that the values used in this example can be different in other examples.

The example focuses on a river water body that is in bad ecological status considering hydromorphological conditions and the condition of benthic invertebrates (status quo). The relevant and ecologically effective mitigation measures (step B) result in hydromorphological conditions at MEP (step C) that are within the class of a moderate status taking into account the assumed effects of the set of measures. The physico-chemical conditions (step D, step G) are the same as of the original natural river water type, these are therefore not pointed out in the figure.

The conditions of benthic invertebrates at MEP (step E) result from the hydromorphological conditions at MEP that are defined by the method for hydromorphological status assessment. A maximum EQR value of 1.0 for benthic invertebrates at MEP correlates with an EQR value of approximately 0.57 in the ecological status assessment system (moderate class). Dividing the whole gradient of ecological potential into five equidistant classes results in class boundaries for all five classes for benthic invertebrates and defines the “slight change” between MEP and GEP (step F). For instance, GEP correlates with a poor to moderate ecological status for this example depending on the EQR value. The status quo shows a poor ecological potential with an EQR value of <0.3. The EQR value of >0.6 describes GEP for the water body that can be transferred into hydromorphological conditions at GEP (step G) and be used to identify the mitigation measures needed to reach these values (step H).

Figure 9: Example of five equidistant classes for ecological potential based on benthic invertebrates



!	**Reference approach ←→ Mitigation measures approach** In theory, step E should be undertaken in both the reference approach and the mitigation measures approach. In practice, however, the mitigation measures approach is often followed where there is no or insufficient data on BQEs. As a result, if step E cannot be undertaken in the current planning cycle, it should be clearly stated in the RBMP how this gap will be completed during a later cycle. In particular, this implies efforts to collect more data and improve knowledge on the links between hydromorphology and biology.

5.4.8 Derivation of BQE conditions for GEP (Step F)

Good ecological potential is defined in WFD Annex V 1.2.5 as an ecological state in which “there are slight changes in the values of the relevant biological quality elements as compared to the values found at maximum ecological potential”. “Slight changes” are discussed further in Box 9.

Box 9Definition of slight changes for biological conditions

What are slight changes?

A crucial aspect in the context of defining GEP is a common understanding of “slight changes”. Guidance on how to interpret “slight changes” can be found in CIS Guidance Documents No. 10, 13 and 14. CIS Guidance Document No.13 on the “Overall approach to the classification of ecological status and ecological potential” provides guidance on the interpretation of the term “slight changes” with reference to the (type-specific) conditions specified for the BQE benthic invertebrates at good status:

- There must be no more than slight changes in composition and abundance
- There must be no more than slight changes in the ratio of disturbance sensitive taxa to insensitive taxa
- There must be no more than slight signs of alteration to the level of diversity

With respect to “slight changes”, HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP. A “slight change” cannot be equivalent to a temporary or complete absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone). “Slight changes” to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, “slight change” means that a condition close to best approximation of ecological continuum should be ensured (instead of best approximation itself) .

Overall, the biological conditions at GEP should be indicative of a functioning ecosystem**, taking into account the need to ensure close to the best approximation of ecological continuum**, as described in section 5.2. If the biological conditions for GEP can be validated through monitoring results of a hydromorphology-sensitive assessment method, it should be assumed that a condition close to best approximation to ecological continuum is achieved. If there is no definition of biological conditions at GEP or no biological monitoring data available, this check might be preliminarily undertaken based on hydromorphological data and mitigation measures. According to the most comparable water body type, the use of assessment systems and the level of detail for GEP description, the same principles are valid as described for biological conditions of MEP (see section 5.4.7).

!	**Reference approach ←→ Mitigation measures approach** In theory, step F should be taken under both the reference approach and the mitigation measures approach. For the mitigation measures approach, the route to step F is different than for the reference approach. While in the reference approach, step F follows from step E (derivation of biological conditions for MEP), in the mitigation measures approach, step H (identification of mitigation measures for GEP) leads to step G (derivation of supporting quality elements conditions for GEP) and step F. Under the mitigation measures approach, the BQE conditions at GEP can initially only be derived from the predicted hydromorphological and physico-chemical conditions in a situation where all GEP measures are assumed to be in place. At first, mitigation measures (or certain habitat functions that can be expected to be achieved after implementation of these measures) are identified, excluding those that, in combination, are only predicted to deliver “slight changes” (slight improvements) compared to biological conditions of MEP. In the mitigation measures approach, the measures that would only result in “slight changes” to hydromorphology are discarded, assuming that they will not modify the habitat conditions sufficiently to promote an enhancement in the biological conditions. GEP is therefore defined by the biological conditions expected from considering the remaining measures. Thus, a prediction of the improved hydromorphological conditions is needed. The mitigation measures approach assumes that by improving hydromorphological conditions, the connectivity and the habitat will improve and this will in turn elicit an enhancement in the biological conditions. If step F cannot be undertaken in the current planning cycle, it should be clearly stated in the RBMP how this gap will be addressed at a later cycle. It implies in particular efforts to collect more data and improve knowledge on the links between hydromorphology and biology.

5.4.9 Derivation of supporting quality elements (SQE) conditions for GEP (Step G)

The derivation of supporting quality elements (SQE) for GEP entails identification of hydromorphological conditions and physico-chemical conditions, including environmental quality standards (EQS) for specific synthetic and non-synthetic pollutants.

Hydromorphological conditions (GEP)

The hydromorphological conditions at GEP must support the achievement of the biological values defined for GEP. The hydromorphological conditions necessary to support the GEP values for biological quality elements must therefore be identified, in particular the values for those biological quality elements that are sensitive to hydromorphological alterations.

The hydromorphological conditions at GEP should consider ecological functioning, **taking into account the need to ensure close to best approximation of ecological continuum**. As mentioned in section 0, GEP is defined by only slight changes in the biological values set for MEP and the hydromorphological conditions have to be consistent with the biological values set for GEP. This means that, for GEP, hydromorphological conditions still have to take into account the ecological continuum with regards to migration possibilities, flow and sediment/habitat requirements that might be adequate for slightly reduced specifications for the biological criteria mentioned in CIS Guidance Document No.13 (e.g. species abundance and/or composition) of relevant BQE (particularly fish and benthic invertebrates) compared to MEP.

Physico-chemical conditions (GEP)

The physico-chemical conditions have such values to support the achievement of the GEP biological values. It is also required that the values for the general physicochemical quality elements at GEP are such as to ensure the functioning of the ecosystem.

If the mitigation measures approach for GEP definition is used, the physico-chemical conditions are based on the effects of mitigation measures (for GEP) on physico-chemical parameters.

In general, the same values for physico-chemical conditions should be met as for good ecological status for the original natural water body type, except if the parameter is impacted by the hydromorphological alteration having led to HMWB designation (e.g. changed water temperature due to hydropeaking) (see also section 5.4.6 above on the derivation of physico-chemical conditions for MEP).

Environmental Quality Standards (EQS) for the specific synthetic and non-synthetic pollutant quality elements are to be considered, with the same values to be achieved as for good ecological status.

!	**Reference approach ←→ Mitigation measures approach** Step G should be undertaken in both the reference approach and the mitigation measures approach. For the mitigation measures approach, the route to step G is different than for the reference approach. While in the reference approach, step G follows from step F, in the mitigation measures approach, step H (identification of mitigation measures for GEP) leads to step G and step F. In case the mitigation measures approach for GEP definition is used, the hydromorphological conditions at GEP are based on the effects of mitigation measures (for GEP) on hydromorphological quality elements excluding those delivering only “slight changes” (improvements) to biological conditions.

5.4.10 Identification of mitigation measures (GEP) (Step H)

In this step, the mitigation measures for reaching GEP are identified, which are in general:

- Relevant to each of the hydromorphological alterations causing failure to achieve good status and ecologically effective

- Do not have significant adverse effects on use(s) and/or the wider environment
- Take into account the need to ensure approximation to ecological continuum.

The mitigation measures within GEP are those needed to achieve the derived biological conditions by improving conditions of relevant supporting elements for GEP.

As indicated in step B (section 5.4.4), the selection of mitigation measures for GEP can be an iterative process, particularly where the mitigation measure approach is applied.

If there are still several measures remaining to choose from the list defined for MEP, it is also recommended that the principles enshrined in the mitigation hierarchy are applied. The mitigation hierarchy forms an important element in environmental impact assessment for new projects, but it is equally relevant and important for the selection of measures to define GEP objectives. The mitigation hierarchy, interpreted in the context of establishing priorities for the definition of GEP objectives, is described below:

1. First, measures that address the hydromorphological (and physico-chemical, if relevant) alteration such that the biological quality elements can recover naturally (alone or in combination with other measures) should be favoured
2. Second, measures which reinstate or improve the ecology on-site should be considered where natural recovery is not possible.
3. Third, (if neither of the above are possible) measures to create new features, communities, etc. off-site, taking into account the need for these to be self-sustaining, should be considered. Such measures often do not directly address the original hydromorphological alteration but rather seek to improve other aspects of the system such that the net effect is to reach GEP.

In addition, for the selection of detailed measures, it is important to take the whole river/catchment into account (e.g. according to interactions between river stretches). For example, measures for upstream stretches may impact downstream ones, and thus influence measures selection. In this context, it is relevant to take account of the requirements of WFD Article 4(8).

For the selection of the most effective measures combination (in terms of ecology), there is a need to consider differentiated criteria and objectives depending on the scale and size of the catchment:[48]

- In large catchments where international cooperation is important, migrators (longitudinal continuity – medium & long distance migrators), wetlands (lateral connectivity) as well as sediment and flow should be considered.
- On the regional/catchment level (national/regional level), details of the water body scale and status as well as priorities regarding the improvement potential vis-a-vis the size of stretches (e.g. improvement expected in 1 or 100 km of river length) are also important.

[48] CIS 2007 WFD hydropower workshop summary report

!

Reference approach ←→<-> Mitigation measures approach

Step H should be taken under both the reference approach and the mitigation measures approach.

For the mitigation measures approach, the route to step H is different than for the reference approach. While in the reference approach, step H follows from step F and G, in the mitigation measures approach, step H (identification of mitigation measures for GEP) follows from step B (identification of mitigation measures for MEP). In the mitigation measures approach, mitigation measures for GEP are obtained after removing, from the set of mitigation measures identified for MEP, any measures which only lead to slight changes in biological conditions (alone or in combination).

It is noted that when there is lack of suitable biological assessment methods and/or data sensitive to modifications, the approach to the selection of mitigation measures should be more precautionary and more measures may need to be considered until there is sufficient evidence to exclude measures from MEP. Increased efforts are needed by Member States towards establishing appropriate biological monitoring and hydromorphology-sensitive methods for a more informed basis for the selection of mitigation measures.

5.5 Moderate, poor and bad ecological potential

WFD Annex V 1.2.5 provides normative definitions for maximum, good and moderate ecological potential. According to these normative definitions, at moderate potential, “there are moderate changes in the values of the relevant BQEs as compared to the values found at maximum ecological potential. These values are significantly more distorted than those found under good quality.” The hydromorphological and physico-chemical conditions are consistent with the achievement of the values specified for the BQEs. The ecological potential classification presented in WFD Annex V 1.4.2 also refers to poor and bad potential.

Overall, it is very important that Member States quantify also the classes “moderate”, “poor” and “bad” for ecological potential and include them in their assessment system. National assessment systems should at least differentiate between these classes according to the values of appropriate metrics.

An example of a Member State’s description of the different ecological potential classes for benthic invertebrates, using metrics, is provided below. Furthermore, the importance of working towards the best approximation of ecological continuum is also relevant for the definition of ecological potential in classes less than good. As already noted, if it is not possible to ensure a condition close to best approximation to ecological continuum (linked to the functioning of the ecosystem), the water body cannot be classified as good ecological potential but only as a class lower than good.

In case a water body can reach good ecological potential on the basis of its hydromorphological status, it may still be classified as moderate or worse potential due to physico-chemical impacts (e.g. nutrient pollution) which are still unaddressed in the water body.

For those HMWB that are classified as moderate ecological potential or lower (i.e. where improvement is required), measures which have been identified during the definition of good ecological potential should be taken forward to the objective setting process.

The description of all ecological potential classes is important also in case of new projects which have to be assessed according to the requirements of WFD Article 4(7) (see also CIS Guidance Document No.36).[49] The non-achievement of good ecological potential or deterioration of the potential class of a HMWB due to a new modification is only allowed in case the conditions under Article 4(7) are met. A sound definition of MEP and GEP biological conditions provides the fundamental basis for the definition of the different ecological potential classes below good potential.

Example. Requirements of benthic invertebrates in river type HMWBs with land drainage in small to medium sized sand-dominated lowland rivers:

For many types of HMWB, benthic invertebrates are considered to be one of the most sensitive BQEs to hydromorphological alterations. Table 14 presents an example from a Member State of how requirements for the different classes of ecological potential relevant to benthic invertebrates in heavily modified rivers with land drainage can be defined. In the specific Member State example, these requirements are based on a multi-metric assessment system. The assessment system contains three single metrics resulting in one multi-metric index. This index value determines the overall class of ecological potential for benthic invertebrates and meets the requirements for a functioning aquatic ecosystem and best approximation to ecological continuum. The single metrics include positive (e.g. relative abundance of positive indicator species group, %) and negative indicator species (relative abundance of negative indicator species group, %). Basis for the assessment of ecological potential is the combination of natural river type and use. For comparability reasons with the ecological status classes, the boundaries are also indicated for the natural river type (small to medium sized sand-dominated lowland river).

Table 14: Member State example of definition of different ecological potential classes for benthic invertebrates in small to medium sized sand-dominated lowland river-HMWBs with land drainage

River type	**Small to medium sized sand-dominated lowland river**	
Category	**Natural water bodies**	**HMWB (Land drainage)**
Ecological potential class boundaries for benthic invertebrates		
Metric 1 (Relative abundance of positive indicator species group, %)		
high/good (HES/MEP)	51	41
good/moderate (GES/GEP)	44	32
moderate/poor	33	23
poor/bad	24	14
Metric 2 (Number of positive indicator species)		
high/good (HES/MEP)	10	6
good/moderate (GES/GEP)	8	4
moderate/poor	6	3

[49] CIS Guidance Document No 36. Exemptions to the Environmental Objectives according to Article 4(7). New modifications to the physical characteristics of surface water bodies, alterations to the level of groundwater, or new sustainable human development activities.

River type	Small to medium sized sand-dominated lowland river	
Category	**Natural water bodies**	**HMWB (Land drainage)**
poor/bad	3	1
Metric 3 (Relative abundance of negative indicator species group, %)		
high/good (HES/MEP)	9	13
good/moderate (GES/GEP)	13	18
moderate/poor	19	24
poor/bad	25	30

6 IMPLEMENTATION OF MEASURES TO ACHIEVE GEP

Key messages for this section

- For HMWB to reach GEP, sufficient mitigation (ecological improvement) is expected from measures implemented in the hydromorphologically altered water bodies, without significant adverse effects on use or the wider environment from any of these measures.
- A clear distinction between the selection of measures needed to define and achieve GEP and the implementation of measures (objective setting in the RBMP) is crucial for more transparency and a common understanding.
- To assess the effects of any mitigation measures already in place and the need for further mitigation measures, the ecological condition of the HMWB should be monitored. The main decisive elements are (apart from specific pollutants) the biological quality elements that determine the class of ecological potential. These are supported by hydromorphological and physico-chemical quality elements. If a proper assessment based on biological quality elements is not yet possible (e.g. due to a lack of hydromorphology-sensitive methods), monitoring of hydromorphological (and physico-chemical) quality elements can be used as a proxy to estimate the effectiveness of the mitigation measures already in place and thereby the ecological potential class. If the classification of the ecological potential is not based on hydromorphology-sensitive biological assessment methods, the classification result should indicate that the confidence level is low.
- If one or more of the selected GEP measures cannot be implemented due to disproportionate costs or infeasibility, it has to be confirmed whether the remaining measures will mitigate sufficiently to achieve the biological conditions required for GEP. If this is not the case, a review and possibly re-design of the measures will be needed to avoid the need to use exemptions: for example, selecting another combination/intensity of measures may deliver the desired ecological improvement.
- If it is not possible to implement all the measures needed to achieve GEP, it will not be possible to reach GEP conditions (like ecological continuum), so the water body will have to be classified as being at moderate potential or lower and would therefore need an exemption. Nevertheless, all the remaining measures would still have to be applied to improve/avoid deterioration of the conditions of the water body as far as possible.
- If monitoring shows that expected GEP conditions are not achieved after the implementation of all measures, it should be checked whether the reasons for not achieving GEP are linked to delayed biological restoration, overestimation of the biological response or to other significant impacts (e.g. multiple pressures) and the measures may need to be refined accordingly, if appropriate. This requires well-defined goals to be established as well as suitable methods for monitoring.

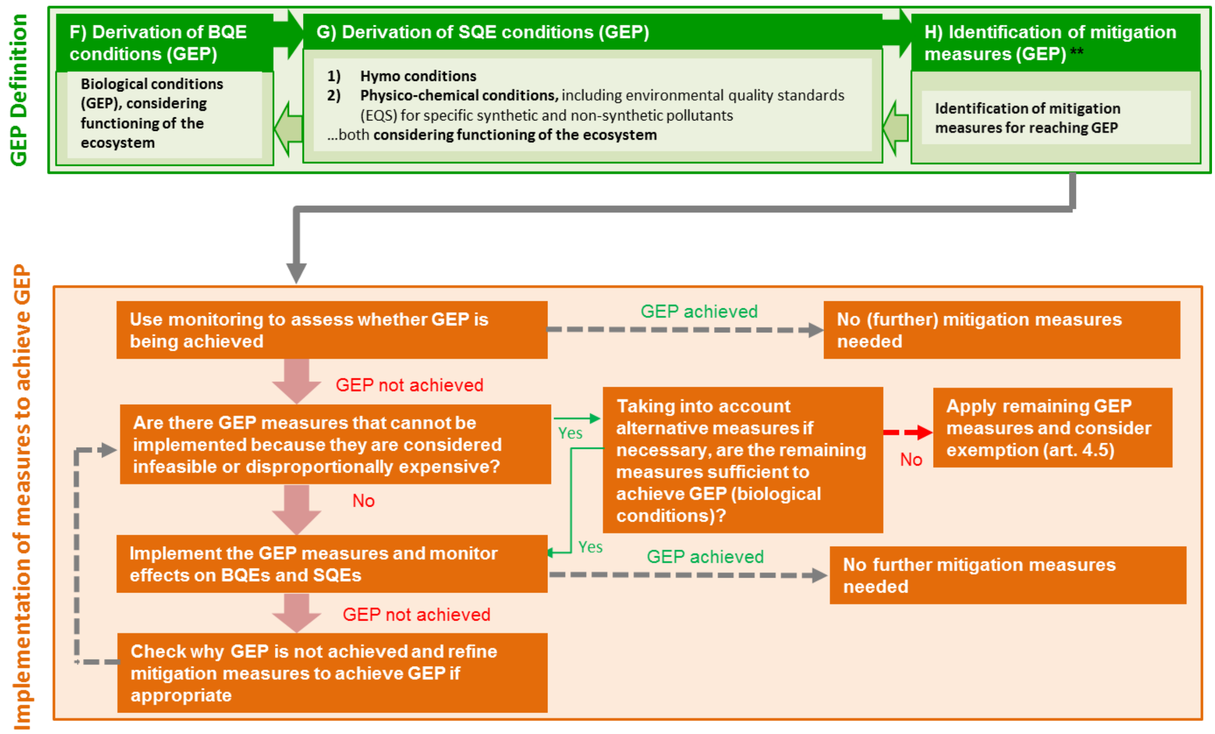
- Implementation of measures to achieve GEP should be seen as an iterative process.

The implementation of the measures to reach the objective for the HMWB (defined GEP) should be distinguished from the identification of measures for defining the GEP objective. These are two different processes related to measures for GEP, though both are closely interconnected. A distinction between these two processes is crucial for the management of HMWBs and for ensuring a more transparent and common understanding of whether GEP can be reached or not.

The identification and planning of measures to mitigate the ecological effects of hydromorphological modifications (i.e. for defining and thereby predicting GEP) takes place prior to updating RBMPs, as described in the previous sections. The final decision on whether it will be possible to implement all measures, out of those which are needed to achieve GEP, takes place for single water bodies and is an individual River Basin Management decision in the context of the programme of measures (objective setting in the RBMP). If several of the measures for GEP are de-selected for implementation at this stage because they are infeasible or disproportionally expensive, and the possibility of achieving GEP is compromised, an exemption (Article 4.5) from GEP should be considered.

The flow-chart on Figure 10 explains in more detail the process for implementing mitigation measures to achieve GEP within the programme of measures.

Figure 10: Process of implementing mitigation measures to achieve GEP



Use monitoring to assess whether GEP is being achieved

To assess the effects of any mitigation measures already in place and the need for further mitigation measures, the ecological condition of the HMWB should be monitored (see Box 10 below on monitoring of HMWB). In case of lack of existing monitoring, appropriate site-specific monitoring needs to be set up in order to assess whether the expected mitigation from the measures already in place has been delivered and whether GEP is being achieved.

Other than specific pollutants, the main decisive elements are the biological quality elements that determine the class of ecological potential. These are supported by hydromorphological and physico-chemical quality elements. If a proper assessment based on biological quality elements is not yet possible (e.g. due to a lack of hydromorphology-sensitive methods), monitoring of hydromorphological (and physico-chemical) quality elements can be used as a proxy to estimate the effectiveness of the mitigation measures already in place and thereby the ecological potential class. If the classification of the ecological potential is not based on hydromorphology-sensitive biological assessment methods, the classification result should indicate that the confidence level is low (see WFD Annex V, 1.3 on estimates of the level of confidence and precision of the results provided by the monitoring programmes). The conditions for GEP should at least be differentiated from the conditions of an ecological potential lower than GEP, so that it can be estimated if GEP is achieved or not. The classification should be reviewed in each planning cycle.

If GEP is achieved or estimated to be achieved, no (further) actions in terms of hydromorphological mitigation measures are needed. However, there might be a need for hydromorphological measures to address larger scale issues (e.g. improving continuity in the considered HMWB because this is relevant for another water body upstream to achieve and maintain the environmental objective).

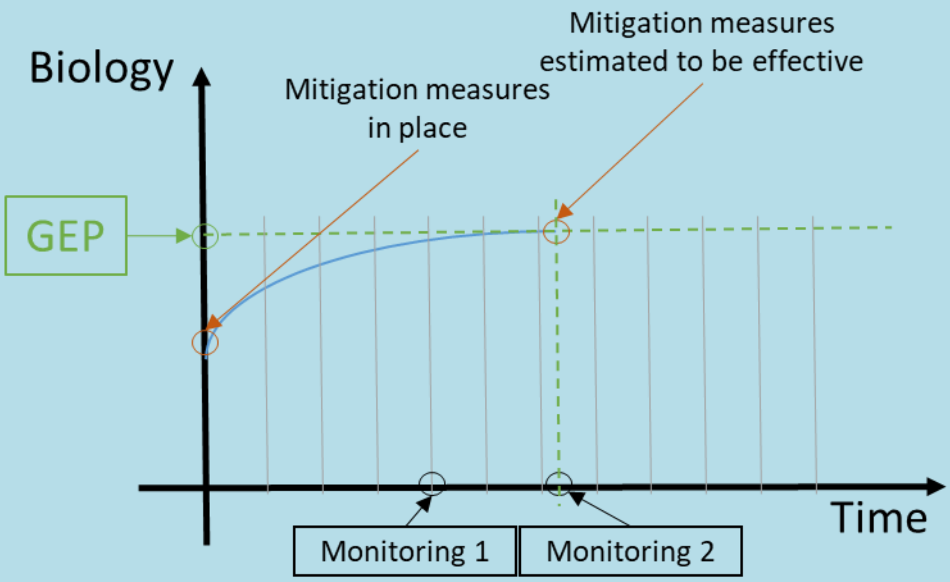
If the ecological potential is less than good (i.e. GEP is not achieved), then the reasons for this need to be clarified. As for natural water bodies, there might be several reasons, such as i) the improvement is taking longer than expected, ii) other significant pressures might have been missed or neglected, iii) the intensity of measures may not be sufficient, or iv) additional measures may be needed. Therefore, further action in terms of hydromorphological mitigation measures might be required. Otherwise an exemption (Article 4.5) from GEP should be considered. In case all mitigation measures without significant adverse effects on use are implemented but GEP values for biological quality elements are not achieved due to an overestimation of the biological response when defining the biological conditions for GEP, there is no need for further measure refinement or action; instead, GEP values have to be adapted to the proven monitored biological values.

Box 10: Monitoring to classify the ecological potential of HMWB and assess effects of mitigation measures

Operational monitoring, which is focused on hydromorphological issues, is required in HMWB to determine their ecological potential (classification), evaluate the effects of the mitigation measures after their implementation, and allow adaptive management.

The methods to be used in both cases are the targeted hydromorphology-relevant methods used for operational monitoring. Operational monitoring also makes sense in case of activities in the HMWB or within its catchment which have led to a risk of failing GEP in the risk analysis.

There is a slight but important difference between monitoring natural water bodies and HMWB regarding designing an operational monitoring program in order to monitor progress in meeting the objective. The objective for HMWB (GEP) is based on a forecast of how the biology in the water body is expected to be when all mitigation measures are in place and effective. The objective for natural water bodies (good ecological status), on the other hand, is a known value described using biological quality elements. Since GEP is a forecast, monitoring needs to measure the response of the biological communities to the measures implemented. Monitoring should be undertaken at the time when the measures are expected to be effective (see Monitoring 2 in the figure below). These values, derived from the monitoring, correspond to the exact values for GEP (see green line indicating the biological value for GEP in the figure below), once the measures are effective. However, it can be important to monitor earlier to detect progress (see Monitoring 1 in the figure below). If the reaction of the biology is different compared to the forecast, there has to be room for adaptive management resulting in change of either mitigation measures, of the objective or both.



Are there GEP measures that cannot be implemented because they are considered infeasible or disproportionally expensive?

River Basin Authorities may be of the opinion that some of the GEP measures identified in step H are disproportionately expensive (e.g. because the investment costs of measures are high) or infeasible. If this is the case, it needs to be checked if it is still possible to achieve GEP.

Example: A transboundary river is impacted by hydropeaking stemming from the upstream neighbouring country. Measures are only ecologically effective if they are implemented upstream in and by the neighbouring country. This decision is only in the national competence of the neighbouring country.

Taking into account alternative measures if necessary, are the remaining measures sufficient to achieve GEP (biological conditions)?

If one or more of the selected GEP measures have been excluded according to cost considerations or infeasibility, it has to be checked whether the remaining measures are still sufficient to achieve the biological conditions at GEP (step F in Figure 5. If this is not the case, a review and possibly re-design of the measures will be needed to avoid the need to use exemptions: for example, selecting another combination/intensity of measures may deliver the desired ecological improvement. The effects of the measures as well as the hydromorphological and physico-chemical conditions at GEP (step G) should be used as the basis for this re-design, particularly of the set of GEP measures (step H).

Besides the conditions at water body level, the conditions up- and downstream (for rivers) as well as at the catchment level have to be considered to make a valid estimation. Large scale issues can significantly override the local effects of measures in both positive (e.g. good water quality, no or extensive land use) and negative (e.g. fine sediment input, continuity interruptions) directions, so both should be considered in this context. Even if some GEP measures are disproportionately expensive or infeasible, GEP might be reached if the remaining measures have a sufficient effect (in combination). This can particularly be the case if positive effects predominate on a larger scale (e.g. on catchment scale).

If the following is the case: a) no other/additional mitigation option can be implemented, and b) approximation to ecological continuum as needed for GEP cannot be achieved, it will not be possible to reach GEP conditions and the water body will have to be classified at moderate potential or lower and would need an exemption according to WFD Article 4.5. Nevertheless, the remaining measures would have to be applied to improve the conditions of the water body as far as possible.

Implement the GEP measures and monitor effects on BQEs and SQEs

All GEP measures that can be applied and are assumed to be sufficient to achieve GEP biological conditions are then implemented. The effects of the implemented GEP measures on BQEs and supporting quality elements should subsequently be monitored and the ecological potential of the water body should be classified accordingly (see Box 10 above on Monitoring of HMWB).

If GEP is achieved based on the monitoring results, no further mitigation measures are needed.

If monitoring results indicate that the mitigation measures have such an effect on quality elements that the water body reaches good ecological status, the water body cannot be considered as heavily modified and should be redesignated as a natural water body with good status as its environmental objective. If the monitoring indicates that the mitigation measures are not sufficient to achieve good status, the designation of the water body as HMWB remains valid and the defined GEP remains as its environmental objective.

If monitoring shows that expected GEP conditions are not achieved after the implementation of all measures, then the reasons (see above) for this need to be clarified, and it is possible that the combination or intensity of measures will need to be refined. Therefore, the implementation of measures to achieve GEP should be seen as an iterative process, starting with typical measures normally expected to mitigate a certain hydromorphological pressure-impact (see the European mitigation measure library which is a supporting tool to this document) that are known to be effective in most situations. These can be subject to future refinement or even the implementation of additional measures later on, taking into account the monitoring results.

Check why GEP is not achieved and refine mitigation measures to achieve GEP if appropriate

As stated above, if the ecological potential is less than good (i.e. GEP is not achieved) after implementing all measures and monitoring the effects on biological and supporting quality elements, the mitigation measures should be further refined to improve the conditions of the water body.

In this context, the reasons for not achieving GEP should first be checked because, as indicated above, non-achievement may be due to a delay in the biological reaction, overestimation of the biological response, an insufficient intensity of measures, or the presence of other significant pressures that are not sufficiently mitigated.

The results of biological monitoring and other (e.g. hydromorphological) investigations should be used as a basis to better determine the need for refinement of the mitigation measures. It can thus be defined in further detail "how much" of a specific measure is needed to achieve GEP and/ or "where in the water body" the measure should be introduced or intensified to reach the target GEP conditions.

The refined mitigation measures then need to be checked again in terms of disproportionate costs and infeasibility (see above) before proceeding to their practical implementation or to the application of an exemption (Article 4.5).

If the defined biological conditions for GEP cannot be reached after having implemented all measures without significant adverse effects on use (considering all relevant pressures) and allowing sufficient time for type-specific organisms to react and adapt, there is no need for further measure activities but a need to amend the biological values forecasted and defined in the GEP definition process.

7 INTERCOMPARISON OF ECOLOGICAL POTENTIAL

Key messages for this section

- As for natural water bodies, the requirement for intercalibration of HMWB implies that there is a need to ensure that classification methods for GEP are set in compliance with the WFD, and that classification results are comparable between EU Member States.
- To ensure comparability, a national, regional or basin-specific method for GEP definition has to be developed, although the application will be on water body level taking into account site-specific conditions.
- The step-wise approach and the mitigation measures library set out in this document should ensure a more common understanding and support the intercomparison of ecological potential.
- Comparability of classification results can be evaluated by analysing how Member States have addressed key steps of the procedure, especially:
    - Identification and assessment of hydromorphological impacts and alterations linked to the use causing failure of good status (from the designation phase)
    - Identification and consideration of the full range of potentially relevant mitigation measures, then excluding measures with a significant adverse effect on use or the wider environment in a transparent and consistent way
    - Definition of "slight" changes for biological conditions and removal of measures only leading to "slight" changes as well as consideration of approximation of ecological continuum

Intercalibration in the WFD and applicability to heavily modified water bodies

Intercalibration is a process aimed at achieving comparable classification boundaries for the biological quality elements set in compliance with the WFD requirements. The requirement for intercalibration is specified in WFD Annex V 1.4.1, that applies both to natural and heavily modified water bodies.

The intercalibration exercise is to be carried out by the Member States and facilitated by the Commission, with a deadline set in the WFD for 2007. Intercalibration activities started soon after the WFD came into force in 2000, as a key activity under the Common Implementation Strategy (CIS). In practice the intercalibration exercise proved to be much more complicated than originally foreseen; only a part of the work could be completed by the 2007 deadline, and a second and third phase were necessary. For natural waters, it has been possible to agree on a technical intercalibration process where Member States' classification methods are checked for their compliance with the normative definitions specified in WFD Annex V. Subsequently, the high-good and good-moderate boundaries are compared and harmonised either directly or by using a common metric. A common understanding of broad intercalibration types and the type-specific reference conditions is a key prerequisite to carry out the comparability analysis for good status classification methods. An important part of intercalibration of natural waters has been to apply/agree on common criteria for reference conditions. Several CIS guidance documents describe the common understanding and agreed procedures:

- CIS Guidance Document No.6 "Towards a guidance on establishment of the intercalibration network and the process of the intercalibration exercise (2003)
- CIS Guidance Document No.14 "Guidance on the intercalibration process 2004-2006" (2005)
- Updated CIS Guidance Document No.14 "Guidance on the intercalibration process 2008-2011" (2011)
- CIS Guidance Document No.30 "Procedure to fit new or updated classification methods to the results of a completed intercalibration exercise (2015)

Results of the completed intercalibration exercises were published in COM Decisions 2008/915/EC (phase 1), 2013/480/EU (phase 2) and 2018/REF (phase 3). With the 2018 COM Decision, the exercise has been completed for the natural water bodies.

In 2011 a concept paper on Intercalibration of GEP was endorsed by the Water Directors, discussing possibilities to fulfil the WFD requirement for intercalibrating good ecological potential and providing recommendations on assessing and improving comparability of good ecological potential assessments. A pragmatic approach was proposed, including the following three elements:

a) **Review of the current state of play in defining good ecological potential taking into account the requirements** of the WFD and existing guidance documents;
b) Development of a **methodological framework** for defining and assessing good ecological potential taking into account the results of the review; and
c) **Simple comparisons** of practical approaches for good ecological potential for common uses.

The first two steps of this process are completed with this new CIS Guidance no. 37, also partly based on several background documents (JRC technical reports and CIS workshop summaries related to the main water uses), and provide the basis for a subsequent intercomparison exercise.

Proposed practical approach for assessing comparability of good ecological potential for common uses

It is not possible to apply the same intercalibration procedures that were developed for the natural water body types to heavily modified water bodies. The main reason is that ecological potential class boundaries are not 'simply' derived from agreeing what constitutes a moderate deviation from type-specific reference conditions, but also include considerations of mitigation measures and their effect on supporting and biological quality elements, as well as socio-economic considerations when taking into account significant adverse effects on use and the wider environment from measures (policy-related issues).

As for natural water bodies, the requirement for intercalibration implies that there is a need to ensure that classification methods for GEP are set in compliance with the WFD, and that classification results are comparable between EU Member States. The step-wise approach and the mitigation measures library with DPSIR-information set out in this document should ensure a more common understanding and practice for ecological standards in HMWB, following the WFD principles and requirements and allowing different approaches.

Therefore, compliance can be evaluated by analysing and comparing the method and criteria Member States have used to designate and classify their heavily modified water bodies in the latest RBMP following the steps identified in this CIS Guidance Document No.37. Comparability of classification results can then be evaluated by analysing how Member States have addressed key aspects of the procedure, especially:

- Identification and assessment of hydromorphological impacts and alterations causing failure of good status and causing a change in character (from the designation phase). This should be based on the application of suitable methods for the assessment of hydromorphological quality elements, linked to the sensitive biological quality elements (see sections 2 and 4 of this Guidance).
- Identification and consideration of the full range of potentially relevant mitigation measures for MEP based on the expected effects of potential measures on hydromorphological conditions and the biological response.
- Criteria for excluding measures with a significant adverse effect on use or the wider environment in a transparent and consistent way,
- Definition of "slight" changes for biological conditions and removal of measures only leading to "slight" changes and/or removal of mitigation measures only leading to "slight" changes in biological quality element values.
- Consideration of approximation of ecological continuum.

It is foreseen that case studies from Member States where they document how they address the key steps of HMWB designation and defining GEP for typical uses and modifications will be collected, following a common template. The illustrative case studies in the current Guidance (see Annex I) are a first step that can be the basis for the templates to be used in the intercomparison exercise.

The purpose of this exercise will be to describe and compare the national methods to establish maximum and good ecological potential on the basis of the requirements of the WFD. The comparability of Member State approaches will then be evaluated, requiring some form of independent review (similar to the review panel established for the intercalibration exercise). This will allow to identify good practices, to support good implementation of the WFD requirements regarding GEP, to progress through comparable approaches and to identify differences in interpretation/implementation leading to a lack of comparability (e.g. different interpretations of what constitutes “best approximation of ecological continuum” or different interpretations of the necessity of minimum requirements).

The intercomparison will also be an opportunity for Member States that are not able to follow key steps of the procedure (and therefore key requirements of the WFD) to provide justification.

As already pointed out above, the intercalibration of HMWB will be quite different compared to that of natural water bodies and needs to address specific challenges. For this reason, the final outcome of the intercomparison will most likely not be a Commission Decision with numerical class boundaries for the BQEs, but may be presented in a document of common understanding or, if relevant problems of intercomparability are detected, in an additional CIS guidance document to support Member States in ensuring a better comparability of GEP definition.

ANNEX I - ILLUSTRATIVE CASE STUDIES ON THE STEPS FOR DEFINING ECOLOGICAL POTENTIAL

This Annex presents practical illustrations of theoretical case studies for different water categories, which demonstrate how to apply the key steps for defining MEP and GEP (see flow-charts in sections 5 and 6). The theoretical case studies follow the reference approach, the mitigation measures approach, or both approaches. It is noted that irrespective of the water category or the approach followed, if it is not possible to take all steps included in the step-wise approach in Figure 5 of this document, clear justification is needed in the relevant RBMP, while Member States should make sure they can complete the remaining steps by improving data availability and knowledge on the links between hydromorphology and biology.

The case studies are an illustrative summary of the findings of the application of the step-wise approach for defining ecological potential. The actual evidence, e.g. from monitoring on the different steps is not provided.

The sub-sections below present the following theoretical case studies:

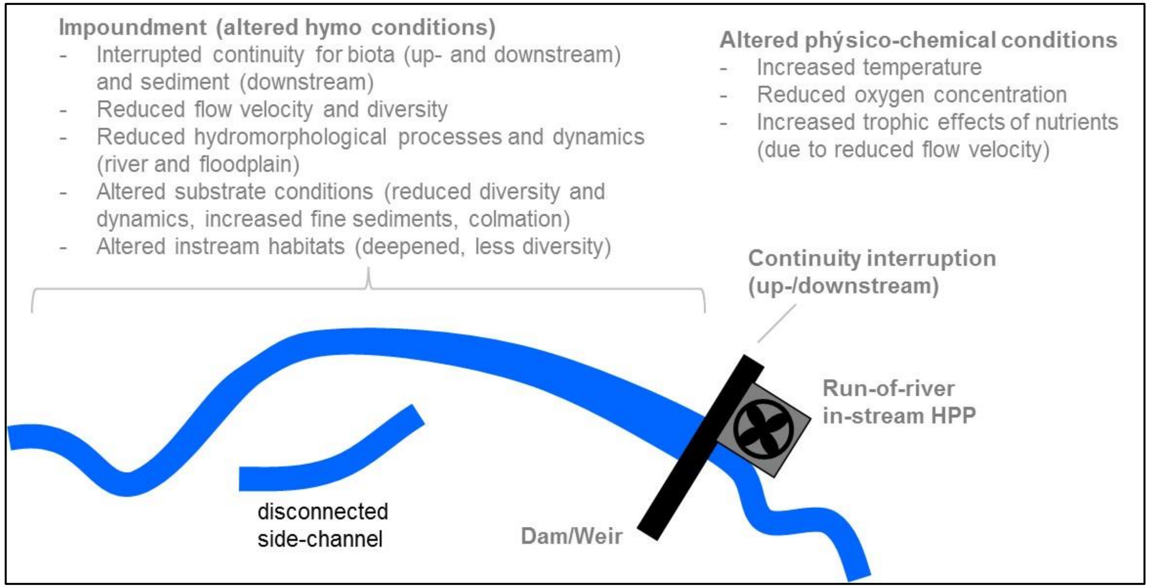
1. Case study of a river impoundment; this case study is described based on both the reference approach and the mitigation measures approach.
2. Case study of a river affected by straightening and bank fixation for navigation; this case study is described based on both the reference approach and the mitigation measures approach.
3. Case study of an estuary impacted by flood defence/embanking; this case study follows the steps of the mitigation measures approach only.
4. Case study on a river affected by drainage; this case study follows the steps of the reference approach only.

Case study 1: River impoundment (reference approach and mitigation measures approach)

Step	Reference approach	Mitigation measures approach
Information from earlier planning cycles (pre-step)	The river water body (high gradient small river, lower mountains (siliceous), coarse substrate, mean flow: 20 m^3/s) is heavily modified because of a low head dam with a run-of-river in-stream hydropower plant, causing a significant impoundment and leading to severe hydromorphological alterations: • Interrupted continuity for biota (up- and downstream) and sediment (downstream) • Reduced flow velocity and diversity • Reduced hydromorphological processes and dynamics (river and floodplain) • Altered substrate conditions (reduced diversity and dynamics, increased fine sediments, colmation) • Altered instream habitats (deepened, less diversity) These resulted in ecological impacts such as: • Reduced abundance / loss of rheophilic species (e.g. fish) • Increased abundance of tolerant species (e.g. benthic invertebrates) • Presence / increased abundance of stagnant species (e.g. macrophytes) See Figure 11 (below).	The river water body (high gradient small river, lower mountains (siliceous), coarse substrate, mean flow: 20 m^3/s) is heavily modified because of a low head dam with a run-of-river in-stream hydropower plant, causing a significant impoundment and leading to severe hydromorphological alterations: • Interrupted continuity for biota (up- and downstream) and sediment (downstream) • Reduced flow velocity and diversity • Reduced hydromorphological processes and dynamics (river and floodplain) • Altered substrate conditions (reduced diversity and dynamics, increased fine sediments, colmation) • Altered instream habitats (deepened, less diversity) There are detailed monitoring data available on hydromorphological conditions (providing detailed knowledge of the hydromorphological alterations, which are used for the HMWB designation). The biological monitoring data are limited or not appropriate to be assessed considering the sensitivity to the hydromorphological alterations. However, there is clear evidence from literature that due to the reduced flow velocity and related changes in habitats the conditions for typical riverine species (e.g. benthic invertebrates) are altered so that GES cannot be ensured with a high degree of confidence. In particular, the dam is a

Step	Reference approach	Mitigation measures approach
	There are detailed monitoring data available on hydromorphological conditions (providing detailed knowledge of the hydromorphological alterations) and on biological quality elements (providing detailed knowledge of the biological impacts on benthic invertebrates and fish). The valid data basis provides the knowledge that is essential for the application of the “reference approach” for defining the ecological potential. The overall ecological status is “bad” based on benthic invertebrates (bad status), fish (poor status) and hydromorphology (bad status). With regard to physico-chemical quality elements, temperature and oxygen concentration are affected by the hydromorphological alterations causing the impoundment (based on detailed data). Reduction of flow velocity will increase the trophic effect of nutrients. There are no other relevant impacts from other water uses.	barrier to fish migration that is relevant to safeguarding the riverine fish population also in the long run. With regard to physico-chemical quality elements, temperature and oxygen concentrations are affected by the hydromorphological alterations causing the impoundment (based on detailed data). Reduction of flow velocity will increase the trophic effect of nutrients. There are no other relevant impacts from other water uses.

Figure 11: River impoundment with indication of impacts

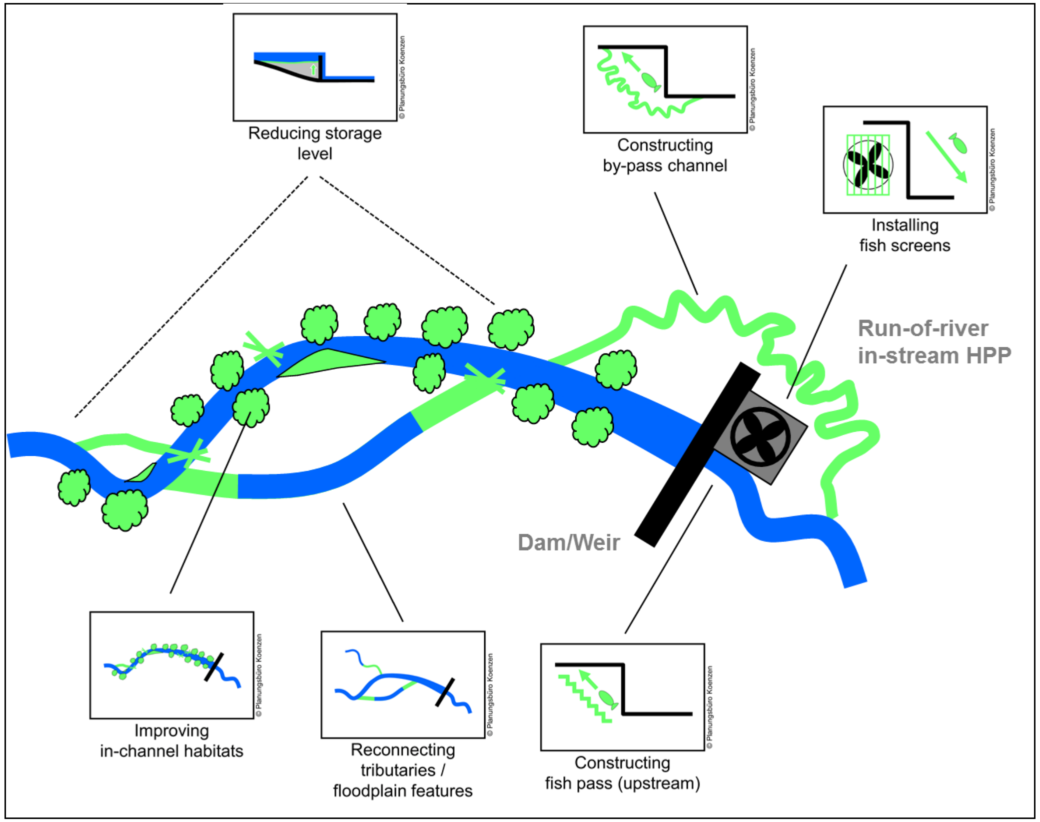


Step	Reference approach	Mitigation measures approach
A. Identification of closest comparable water category	The original river water body remains a river water body taking into account the hydromorphological and biological conditions.	The original river water body remains a river water body taking into account the hydromorphological and biological conditions.
B. Identification of mitigation measures for MEP (see	Based on the hydromorphological alterations and ecological impacts, the following groups of measures might be appropriate (selection of groups of measures from the Mitigation Measures Library):	Based on the hydromorphological alterations and ecological impacts, the following groups of measures might be appropriate (selection of groups of measures from the Mitigation Measures Library):

Step	Reference approach	Mitigation measures approach
Mitigation Measures Library)	- Fish migration aids - Sediment management - Riparian habitat enhancement - Improvement of in-channel diversity - Ecologically optimised maintenance - River depth and width variation improvement - Floodplains/ lateral connectivity improvement - Reduction negative effects of impoundment - River bed restoration	- Fish migration aids - Sediment management - Riparian habitat enhancement - Improvement of in-channel diversity - Ecologically optimised maintenance - River depth and width variation improvement - Floodplains/lateral connectivity improvement - Reduction negative effects of impoundment - River bed restoration
B1. Identify mitigation measures relevant to each hydromorphological alteration and ecologically effective in physical context of water body or water bodies	In this step, the measure groups from the Mitigation Measures Library are further specified and detailed measures identified, considering the physical context of the water body. The following detailed measures are assumed to be relevant and ecologically effective (Figure 12): a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen) b. Connecting side-channel c. Riparian habitat enhancement (flatten shore zones, plant trees) d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris) e. Raising river bed level (reduce negative effects of impoundment) Those measures will contribute to:	In this step, the measure groups from the Mitigation Measures Library are further specified and detailed measures identified, considering the physical context of the water body. The following detailed measures are assumed to be relevant and ecologically effective (Figure 12): a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen) b. Connecting side-channel c. Riparian habitat enhancement (flatten shore zones, plant trees) d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris) e. Raising river bed level (reduce negative effects of impoundment) Those measures will contribute to:

Step	Reference approach	Mitigation measures approach
	- Restore river continuity for biota (up- and downstream) and sediment (downstream) to some extent) - Increase flow velocity and diversity and shorten the length of the water body that is affected by the impoundment - Improve the hydromorphological processes and dynamics (river and floodplain) - Improve substrate conditions for riverine species - Improve riverine habitats and by this conditions for type-specific riverine species The removal of the dam/ barrier would be the most effective measure to improve biological conditions, but was not considered because: - this measure would lead to a restoration towards GES and - was assessed in the HMWB designation process to have a significant adverse effect on use (because no production of electricity would be possible)	- Restore river continuity for biota (up- and downstream) and sediment (downstream) to some extent) - Increase flow velocity and diversity and shorten the length of the water body that is affected by the impoundment - Improve the hydromorphological processes and dynamics (river and floodplain) - Improve substrate conditions for riverine species - Improve riverine habitats and by this conditions for type-specific riverine species The removal of the dam/ barrier would be the most effective measure to improve biological conditions, but was not considered because: - this measure would lead to a restoration towards GES and - was assessed in the HMWB designation process to have a significant adverse effect on use (because no production of electricity would be possible)

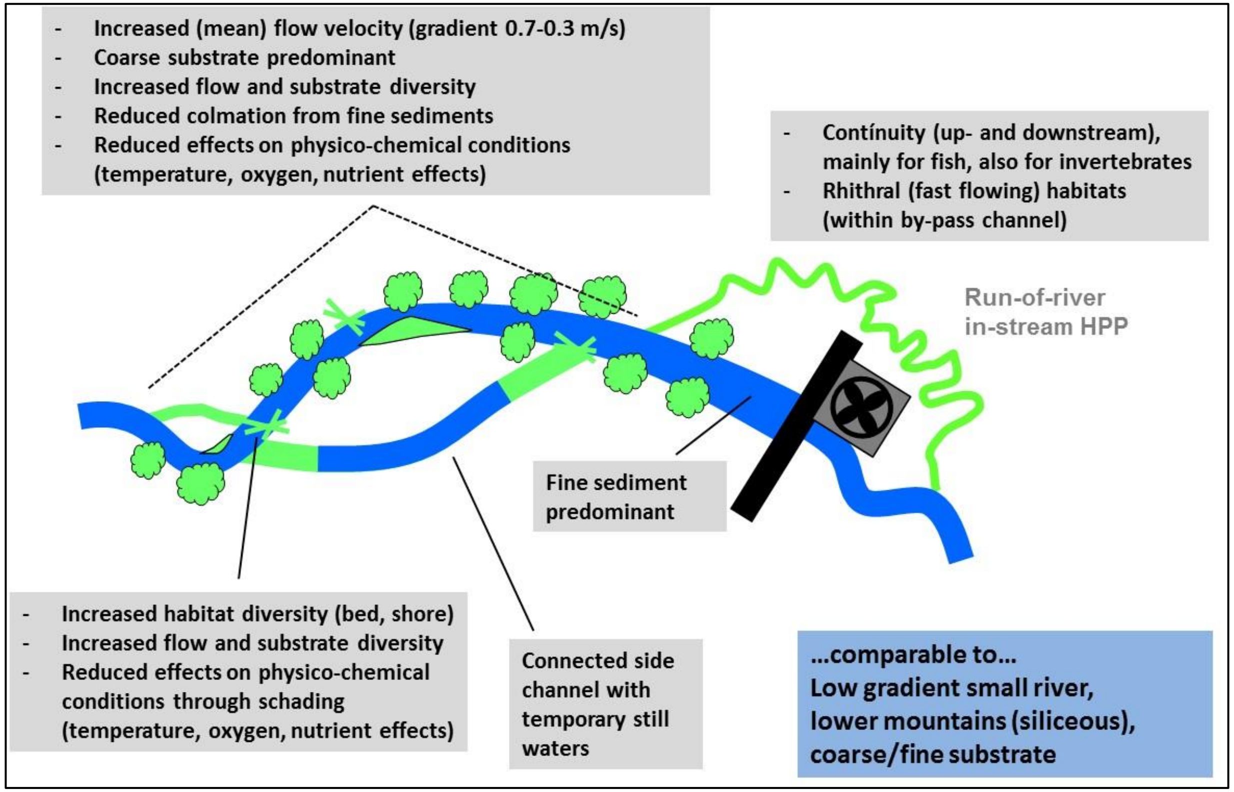
Figure 12: River impoundment with range of possible mitigation measures (MEP)



Step	Reference approach	Mitigation measures approach
B2. Exclude mitigation measures with significant adverse effect on use or wider environment	All the other measures (a-e) do not have per se significant adverse effects on the hydropower use (they do not necessarily mean a reduction of the electricity production).	All the other measures (a-e) do not have per se significant adverse effects on the hydropower use (they do not necessarily mean a reduction of the electricity production).
B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum	• All measures from step B1 (measures a-e) are relevant to the hydromorphological alterations in the water body, ecologically effective and do not adversely impact on use. In combination, therefore, these measures contribute to MEP. • The measures are able to significantly improve ecological continuum.	• All measures from step B1 (measures a-e) are relevant to the hydromorphological alterations in the water body, ecologically effective and do not adversely impact on use. In combination, therefore, these measures contribute to MEP. • The measures are able to significantly improve ecological continuum.
C. Derivation of hydromorphological conditions for MEP	The above measures significantly enhance habitats in the river bed, riparian zone and floodplain. The basis for deriving the hydromorphological conditions for MEP are the predicted measure effects on the existing hydromorphological conditions (see pre-step) considering reference conditions of the original water body type. The sequence of sub-steps is 1) Descriptions of hydromorphological conditions at status quo; 2) Measure effects on these conditions; 3) Description of hydromorphological conditions for MEP. The result has been compared with existing river types in the river basin to identify a closest comparable river type. The closest comparable water	It can be generally expected, that the measures identified in step B3 significantly enhance habitats in the river bed, riparian zone and floodplain. Based on predicted measure effects on the existing hydromorphological alterations (see pre-step) and considering reference conditions of the original natural water body type, hydromorphological conditions for MEP are moderately to severely changed in comparison. All relevant parameters have been defined based on these considerations using the existing national hydromorphological methods.

Step	Reference approach	Mitigation measures approach
	body type is the next more potamal river type within the same landscape from the national typology. In this case (of a high gradient small river, lower mountains (siliceous), coarse substrate), the closest comparable river type is a “low gradient small river, lower mountains (siliceous), coarse/fine substrate”. See Figure 13 for a description of the derived hydromorphological conditions for MEP.	

Figure 13: Derived hydromorphological conditions for MEP



Step	Reference approach	Mitigation measures approach
D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type	Physico-chemical conditions correspond to the values for high ecological status for the original river type, except for parameters that are significantly affected by the remaining hydromorphological alterations at MEP. In this case, temperature and oxygen concentration could be affected according to the closest comparable water body type (“Low gradient small river, lower mountains (siliceous), coarse/fine substrate”). In fact, temperature and oxygen values for MEP correspond to the values of the original river type, in particular based on the direct and indirect influence of groundwater, shading and optimised flow conditions on these parameters that overrule the remaining impacts on flow velocity within the impounded stretch at MEP. With regards to nutrients, trophic effects can be increased within the remaining impoundment in some ways, but this does not require values that are different from the original natural type. In any case, reference values for nutrients of the closest comparable water body type are the same as for the original natural type.	Physico-chemical conditions correspond to the values for high ecological status for the original river type, except for parameters which are significantly affected by the remaining hydromorphological alterations at MEP. In this case, temperature and oxygen concentration could be affected according to the closest comparable water body type (“Low gradient small river, lower mountains (siliceous), coarse/fine substrate”). In fact, temperature and oxygen values for MEP correspond to the values of the original river type, in particular based on the direct and indirect influence of groundwater, shading and optimised flow conditions on these parameters that overrule the remaining impacts on flow velocity within the impounded stretch at MEP. With regards to nutrients, trophic effects can be increased within the remaining impoundment in some ways, but this does not require values that are different from the original natural type. In any case, reference values for nutrients of the closest comparable water body type are the same as for the original natural type.
E. Derivation of BQE conditions for MEP	This step is based on the hydromorphological alterations and ecological impacts (see pre-step), the predicted effects of the relevant mitigation measures (see B1, B3), and the difference between hydromorphological conditions for MEP (see C) and reference conditions for the original natural river type. In conclusion, the difference in hydromorphological conditions between MEP and reference conditions for the original natural river type have been translated to BQE conditions at MEP. Based on this, BQE conditions have been defined based on the biological assessment system for natural water bodies. The EQR values have been	BQE conditions for MEP cannot be derived due to a lack of BQE data in this planning cycle and/or due to a lack of knowledge on hydromorphological alterations and biological response. However, the application of national monitoring methods to this water body in the next and future planning cycles will enable a prediction of BQE conditions at MEP to be made.

Step	Reference approach	Mitigation measures approach
	reduced with the same proportion of the gradient as the difference between reference conditions and MEP based on hydromorphological methods. The reduction is different between the BQEs, because of different sensitivity at least to some of the relevant hydromorphological (and related physico-chemical) parameters. The predicted results have been tested and amended in some aspects using a solid basis of monitoring data from comparable water bodies (same use and comparable river types) considering as much as possible the gradient of different habitat qualities from maximum to bad potential	
F. Derivation of BQE conditions for GEP	BQE conditions for GEP resulted from the biological assessment systems that use the same principle for defining “slight changes” as for the intercalibrated method for natural water bodies. Therefore, the functioning of the aquatic ecosystem can be assumed if BQE conditions result in GEP.	BQE conditions for GEP cannot be derived due to lack of BQE data in this planning cycle/ lack of knowledge on hydromorphological alterations and biological response.
G. Derivation of supporting quality element conditions for GEP	This step is based on the BQE conditions for GEP (see step F). The hydromorphological parameters have been derived based on the difference between BQE conditions of MEP (step E) and GEP (step F), considering the hydromorphological conditions for MEP (step C). Physico-chemical conditions correspond to the values for good ecological status of the original natural river type.	Hydromorphological conditions are derived by expecting conditions with assumed implementation of the GEP-measures set defined in step H. Physico-chemical conditions correspond to the values for good ecological status of the natural river type.

<table>
<tr><th>Step</th><th>Reference approach</th><th>Mitigation measures approach</th></tr>
<tr><td></td><td>Functioning of the aquatic ecosystem is ensured by physico-chemical conditions as well as by the biological GEP conditions identified in step F.</td><td>Functioning of the aquatic ecosystem is ensured by physico-chemical conditions as well as by the hydromorphological conditions which contribute to improve ecological continuum by the GEP measures identified in step H.</td></tr>
<tr><td>H. Identification of mitigation measures for GEP</td><td>The following measures are within the set of qualitative GEP measures:

a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen)
b. Connecting side-channel
c. Riparian habitat enhancement (flatten shore zones, plant trees)
d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris)
e. Raising river bed level (reduce negative effects of impoundment)

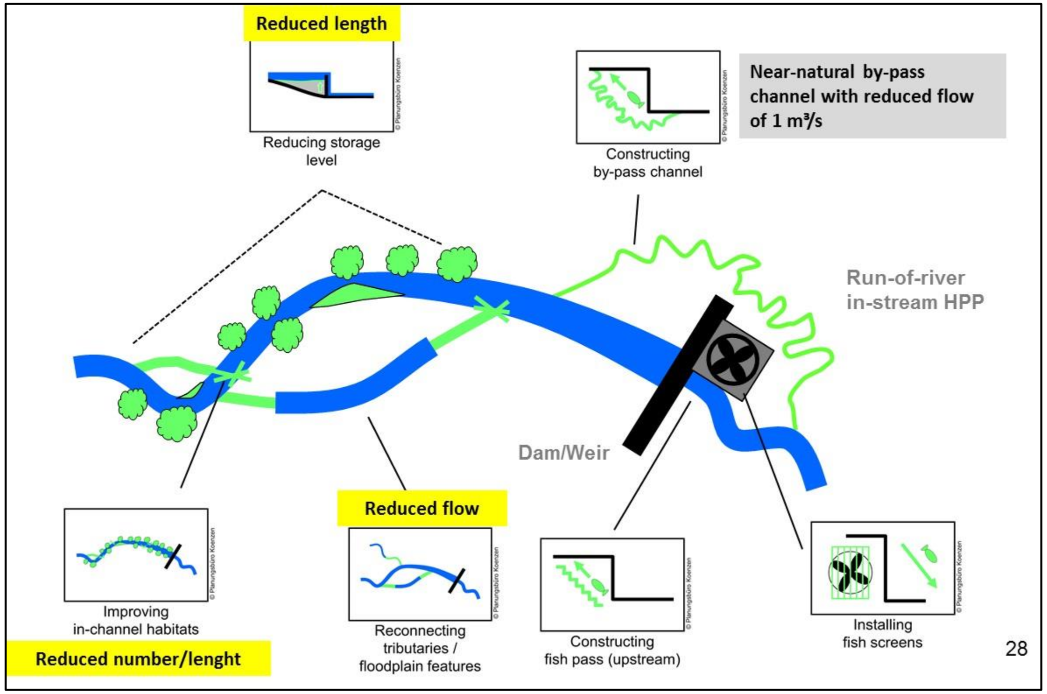
The difference between MEP and GEP is based on BQE values (“slight change”). While the qualitative measure set is the same for GEP as for MEP in this case, the GEP measures significantly differ from MEP measures in quantity (extent) (see Figure 14 below). (There also might be certain cases where certain measures are needed for MEP but not for GEP, but those were identified to be relevant for this example.)</td><td>From the MEP-set of measures (measures a-e), no measures have been deleted because they are assumed to deliver slight improvements to ecology. Based on literature, significant effects on BQE can be expected for all measures. Therefore, the following measures are within the set of qualitative GEP measures:

a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen)
b. Connecting side-channel
c. Riparian habitat enhancement (flatten shore zones, plant trees)
d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris)
e. Raising river bed level (reduce negative effects of impoundment)

This is the same set of measures which was identified for MEP but the quantity/extent of the measures is reduced compared to the extent needed for MEP. See Figure 14.

(There also might be certain cases, that certain measures are needed for MEP but not for GEP, but those were identified to be relevant for this example).</td></tr>
</table>

Figure 14: River impoundment with mitigation measures for reaching GEP



Step	Reference approach	Mitigation measures approach
Monitoring to assess whether GEP is being achieved	The modified HMWB biological assessment systems have been used to classify the ecological potential of the water body. Compared to the MEP values set for the BQEs, the overall biological monitoring results show a strong deviation from the MEP values, so that the actual ecological potential is to be classified as “poor” based on benthic invertebrates and fish. Therefore, hydromorphological mitigation	As biological conditions could not be defined for GEP in this cycle, conditions of the supporting elements have been monitored in the meantime and been compared to the conditions set in step G to identify the deviation from GEP and the need to implement the GEP-measures to achieve GEP.

Step	Reference approach	Mitigation measures approach
	measures (identified in step H) are necessary to improve conditions of the water body and achieve GEP.	Nevertheless, it is recommended to also collect data for biological quality elements (although they are not classified) and to increase the knowledge on hydromorphological conditions-biological response relationships.
Are there GEP measures that are disproportionally expensive or infeasible?	None of the GEP measures are disproportionally expensive or infeasible.	None of the GEP measures are disproportionally expensive or infeasible.
Implement GEP measures and monitor effects on BQEs and supporting quality elements	The following measures have been implemented within the next RBMP Programme of Measures: a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen) b. Connecting side-channel c. Riparian habitat enhancement (flatten shore zones, plant trees) d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris) e. Raising river bed level (reduce negative effects of impoundment) The quantitative design of the measures has been based on the adverse effects on use (e.g. for calculating maximum flow for by-pass channel)	The following measures have been implemented within the next RBMP Programme of Measures: a. Fish migration aids (near-natural by-pass channel, fish pass and fish screen) b. Connecting side-channel c. Riparian habitat enhancement (flatten shore zones, plant trees) d. Improvement of in-channel diversity (introduce type specific substrate in the upper part of the impoundment, introducing large woody debris) e. Raising river bed level (reduce negative effects of impoundment) The quantitative design of the measures has been based on the adverse effects on use (e.g. for calculating maximum flow for by-pass channel) and an estimation of the need to improve biological conditions significantly.

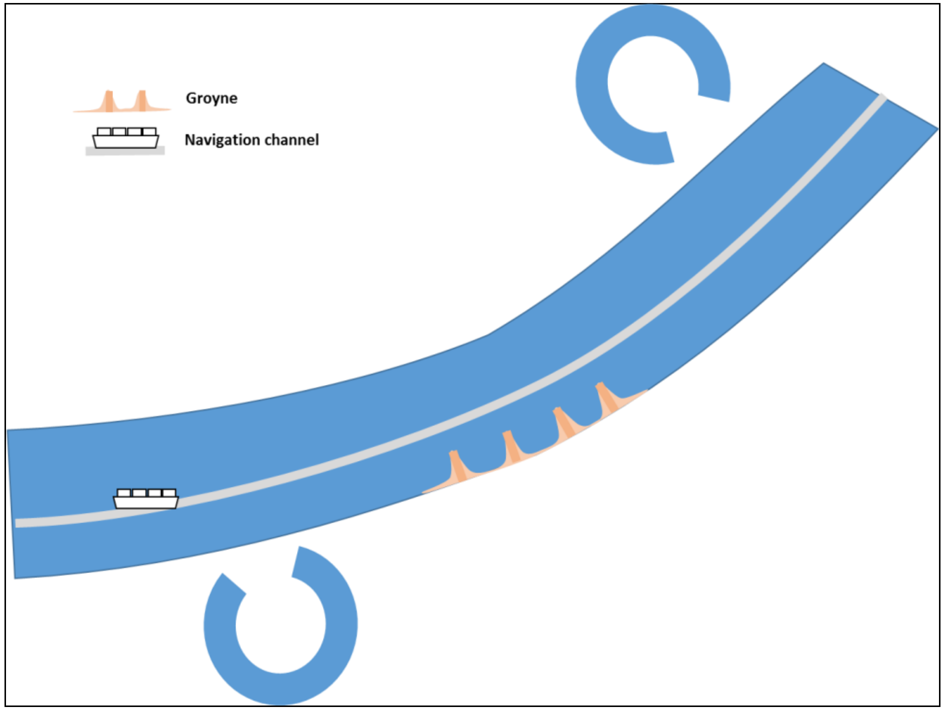
Step	Reference approach	Mitigation measures approach
	and an estimation of the need to achieve biological GEP values (see step F). Monitoring will be undertaken within the next monitoring cycle.	Monitoring will be undertaken within the next monitoring cycle.

Case study 2: River straightening and bank fixation for navigation (reference approach and mitigation measures approach)

Step	Reference approach	Mitigation measures approach
Information from earlier planning cycles (pre-step)	The river stretch is a heavily modified water body designated because of prior straightening in combination with bank fixation and associated incision (consequential deepening) to support navigation use. There are some shore-perpendicular groynes on the outer part of the bend but these structures, together with the increased velocities achieved as a result of the straightening, currently mean there is no requirement for maintenance dredging. Based on detailed hydromorphological data particularly the following alterations are known: • Straightened river with single channel planform • Deepened river profile with reduced floodplain connection • Altered flood plain habitats (e.g. cut-off meanders, infilled side-channels) • Increased flow velocity, reduced flow diversity • Reduced hydromorphological processes and dynamics (river and floodplain) • Bank fixation with hard engineering (e.g. concrete, rip raps)	The river is a heavily modified water body designated because of prior straightening in combination with bank fixation and associated incision (consequential deepening) to support navigation use. There are some shore perpendicular groynes on the outer part of the bend, but these structures, together with the increased velocities achieved as a result of the straightening, currently mean there is no requirement for maintenance dredging. There is a relative lack of WFD monitoring data for this water body but some anecdotal evidence does exist. See Figure 15 below.

Step	Reference approach	Mitigation measures approach
	• Reduced substrate diversity (e.g. lack of woody debris) • Altered river bed and riparian habitats (reduced flat riparian zones, less diversity, reduced vegetation cover) These resulted in ecological impacts such as: • Reduced abundance / loss of rheophilic species (e.g. fish), particularly altered reproduction of river type specific fish species • Increased abundance of tolerant species (e.g. benthic invertebrates) • Reduced abundance / loss of floodplain related species (e.g. fish) • Reduced species diversity (e.g. fish, benthic invertebrates) The overall ecological status is "poor" based on benthic invertebrates and fish.	

Figure 15: River impacted by straightening and bank fixation for navigation



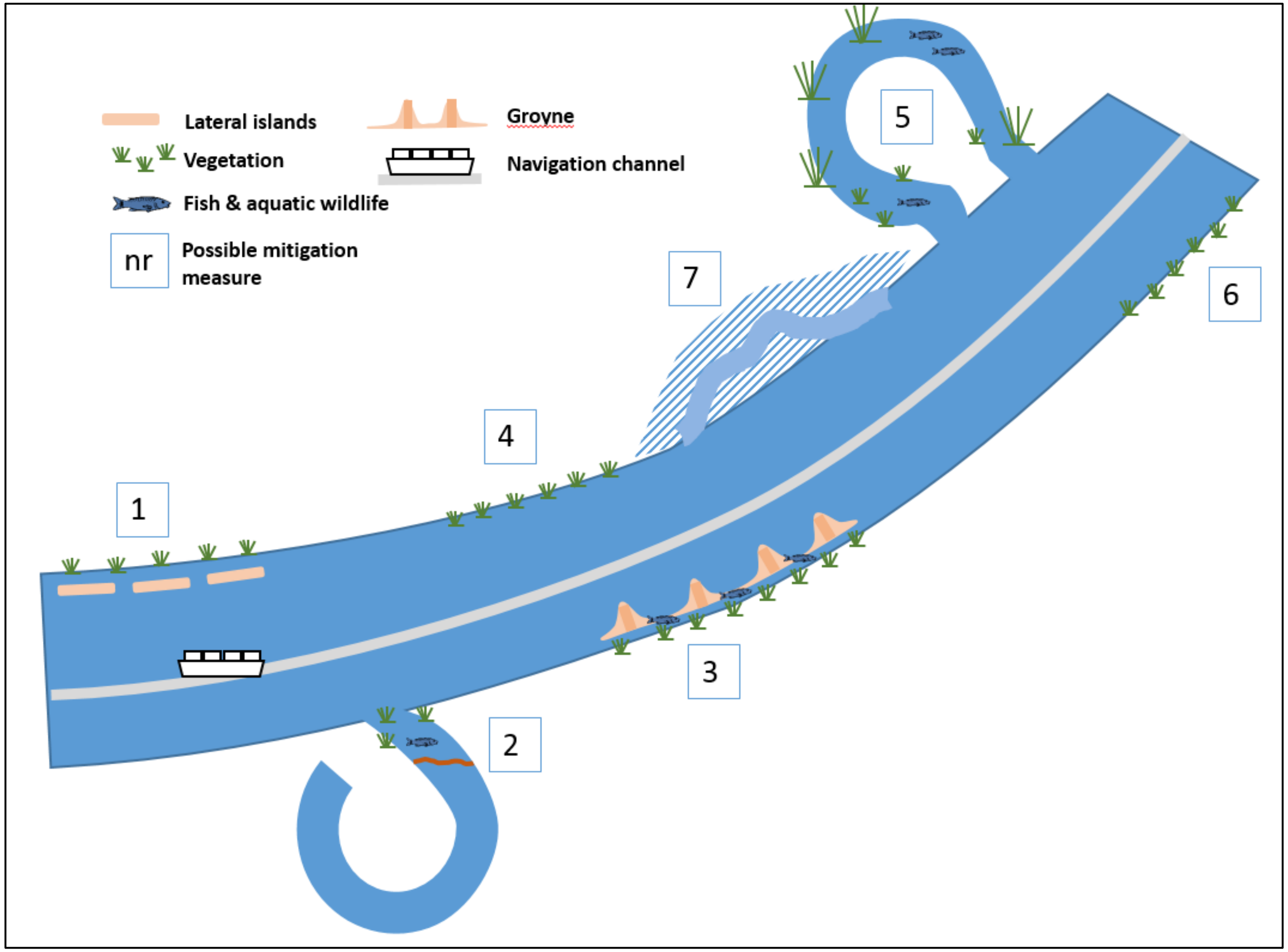
Step	Reference approach	Mitigation measures approach
A. Identification of closest comparable water category	The original river water body remains a river water body taking into account the hydromorphological and biological conditions.	The original river water body remains a river water body taking into account the hydromorphological and biological conditions.
B. Identification of mitigation measures for MEP (see Mitigation Measures Library)	Based on the hydromorphological alterations and ecological impacts (see above in pre-step) the following groups of measures might be appropriate (selection from the Mitigation Measures Library): • Floodplains/off-channel/lateral connectivity improvement • Riparian habitat enhancement • Improvement of in-channel diversity • Increase habitat diversity with improved river depth and width variation • Ecologically optimised maintenance • Vegetation management and rehabilitation • Modification of existing structures • Sediment management • River bed rehabilitation	Reference to the Mitigation Measures Library: (i) Confirms that there are two **specific physical modifications**: channel straightening with changed planform/channel patterns including cut off meanders, and shore-perpendicular structures (i.e. groynes). (ii) Suggests that the **hydromorphological supporting elements** most likely to be affected by these types of modification are quantity and dynamics of flow, changes in (controls on) river depth and width, and changes in riparian zone structure. The presence of groynes also affects continuity in the margins on one side of the river. In this case the modifications have not affected the bed substrate. (iii) Does not identify any typically anticipated implications for **physico-chemical supporting elements**. (iv) Indicates there is a strong likelihood that these types of physical modification will impact on three **BQEs**: macrophytes and phytobenthos, benthic invertebrates, and fish fauna. A visual assessment of the water body confirms this is likely the case here.

Step	Reference approach	Mitigation measures approach
		(v) Suggests the following **groups of mitigation measures** might be appropriate to address such effects: • Improved in-channel diversity • Ecologically optimised maintenance • Enhanced habitat diversity with increased width/depth variability • Riparian habitat enhancement • Off channel/lateral connectivity improvement • Vegetation management and rehabilitation • Modification of existing structures • Sediment management • River bed rehabilitation
B1. Identify mitigation measures relevant to each hydromorphological alteration and ecologically effective in physical context of water body or water bodies	Based on the detailed data of hydromorphological alterations (e.g. with no dredging taking place) the following from the above groups of measures are not expected to be ecologically effective in addressing the identified or observed issues: ecologically optimised maintenance, sediment management and river bed rehabilitation. The focus is therefore on identifying measures for improved in-channel and riparian diversity (habitat enhancement) including width and depth variability; lateral connectivity including improved floodplain connection and floodplain habitat enhancement; vegetation rehabilitation and modification of existing structures.	Taking into account the nature of the modification (with no dredging taking place) the following from the above groups of measures are not expected to be ecologically effective in addressing the identified or observed issues: ecologically optimised maintenance, sediment management and river bed rehabilitation. The focus is therefore on identifying measures for improved in-channel and riparian diversity (habitat enhancement) including width and depth variability; lateral connectivity including improved floodplain connection and floodplain habitat enhancement; vegetation rehabilitation; and modification of existing structures.

Step	Reference approach	Mitigation measures approach
	Figure 16 illustrates the range of detailed mitigation measures corresponding to the above groups of measures. These have been identified taking into account their viability in the context of the river water body and their expected ecological effectiveness, and are described below: 1. Construct lateral islands providing a sheltered, shallow water riparian environment promoting sediment deposition and large woody debris (with fixation) as well as natural vegetation establishment (with initial planting if needed), and creation of habitat for invertebrates and fish. 2. Create a sheltered, shallow backwater in an old meander exit, to promote large woody debris (with fixation) and vegetation establishment with initial planting if needed, resulting in habitat for invertebrates and fish. 3. Sever the roots of the existing groynes to improve lateral connectivity and habitat diversity at the river margins 4. Replace hard engineered river bank with willow spiling to establish vegetation at the margins, creating habitat and improving connectivity. 5. Reconnect oxbow lake to re-establish a former meander (with water control structures if these are needed to sustain the use of the river for navigation). Create a diverse range of habitat types, supporting particularly macrophytes, benthic invertebrates and fish.	Figure 16 illustrates the range of detailed mitigation measures corresponding to the above groups of measures. These have been identified taking into account their viability in the context of the river water body and their expected ecological effectiveness, and are described below: 1. Construct lateral islands providing a sheltered, shallow water riparian environment promoting sediment deposition and natural vegetation establishment (with initial planting if needed), and creation of habitat for invertebrates and fish. 2. Create a sheltered, shallow backwater in an old meander exit, to promote vegetation establishment with initial planting if needed, resulting in habitat for invertebrates and fish. 3. Sever the roots of the existing groynes to improve lateral connectivity and habitat diversity at the river margins. 4. Replace hard engineered river bank with willow spiling to establish vegetation at the margins, creating habitat and improving connectivity. 5. Reconnect oxbow lake to re-establish a former meander (with sluices or other managed water control structures if these are needed to sustain the use of the river for navigation). Create a diverse range of habitat types, supporting macrophytes and phytoplankton, benthic invertebrates and, depending on the extent of engineering required, fish. 6. Replace hard engineered river bank with planted geotextile revetments to establish vegetation at the margins, creating habitat and improving connectivity.

Step	Reference approach	Mitigation measures approach
	6. Replace hard engineered river bank with planted geotextile revetments to establish vegetation at the margins, creating habitat and improving connectivity. 7. Lower riparian zone and create side-channel (from formerly filled side-channel, with water control structures at the upstream part if these are needed to sustain the use of the river for navigation). Create a diverse range of habitat types, supporting particularly macrophytes, benthic invertebrates and fish. The combination of measures is predicted to result in a best approximation to ecological continuum. If monitoring of BQE results in GEP classification, best approximation of ecological continuum can be assumed.	7. Lower riparian zone and create side-channel (from formerly filled side-channel, with water control structures at the upstream part if these are needed to sustain the use of the river for navigation). Create a diverse range of habitat types, supporting particularly macrophytes, benthic invertebrates and fish. Depending on the scale of implementation of one or more of the above measures, it is confirmed that a best approximation to ecological continuum will be ensured.

Figure 16: River impacted by straightening and bank fixation for navigation with range of possible mitigation measures



Step	Reference approach	Mitigation measures approach
B2. Exclude measures with significant adverse effect on use or wider environment	Measure 6 is ruled out because the fixed bank also serves a flood defence purpose and it is shown that the standard of protection would be compromised if the hard engineered structure were removed.	Measure 6 is ruled out because the fixed bank also serves a flood defence purpose and it is shown that the standard of protection would be compromised if the hard engineered structure were removed.
B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum	Measures 1 to 5 and 7 are relevant to the hydromorphological alterations in the water body, ecologically effective and do not adversely impact on use. In combination, therefore, these measures contribute to MEP.	Measures 1 to 5 and 7 are relevant to the hydromorphological alterations in the water body, ecologically effective and do not adversely impact on use. In combination, therefore, these measures contribute to MEP.
C. Derivation of hydromorphological conditions for MEP	The above measures enhance the riparian and floodplain habitat in the water body, increasing diversity in terms of variations in depth and exposure and substrate conditions. Most measures also contribute to improved lateral connectivity/ecological continuum. Based on predicted measure effects on the existing hydromorphological alterations (see pre-step) and considering reference conditions of the original natural river type (which is the closest comparable river type for this case), hydromorphological conditions for MEP are changed in comparison. While relatively near-natural floodplain habitats can be developed under MEP, the riparian habitats are more intensively changed compared to reference conditions and show several artificial elements (like groynes). The river bed habitats have also been changed as a result of the modifications made to maintain the navigation	It can be generally expected that the measures identified in steps B3, all enhance the riparian habitat in the water body, increasing diversity in terms of variations in depth, width and exposure, and providing new substrate for benthic invertebrates, macrophytes and phytobenthos and fish (including juveniles). Most measures also contribute to improved lateral connectivity/ecological continuum.

Step	Reference approach	Mitigation measures approach
	fairway. All relevant parameters have been defined based on these considerations using the implemented hydromorphological methods.	
D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type	Physico-chemical conditions correspond to the values for high ecological status of the original natural river type.	Neither the modification nor the mitigation measures will affect the WFD physico-chemical supporting elements.
D. Derivation of BQE conditions for MEP	Basis for this step were the hydromorphological alterations and ecological impacts (see pre-step), the predicted effects of the relevant mitigation measures (see B1, B3) as well as the difference between hydromorphological conditions for MEP (see C) and reference conditions of the original natural river type. Considering all of these results, BQE conditions have been defined based on the biological assessment system for natural water bodies.	BQE conditions for MEP cannot be derived due to a lack of BQE data in this planning cycle. However, the application of national monitoring methods to this water body in the next and future planning cycles will enable a prediction of the BQE conditions at MEP to be made.

Continuation of step-wise process for **mitigation measures approach** (H→G→F …):

Step	Reference approach	Mitigation measures approach
H. Identification of mitigation measures for GEP	See next table	As indicated in Figure 16, Measure 3 creates a relatively small area of new habitat. Further, because Measure 6 has a significant adverse impact on use, there is limited benefit in improving connectivity along this short stretch on the outer bend. As Measure 3 therefore makes only a limited contribution to ecological potential, it is considered a MEP measure. GEP is defined by a combination of Measures 1, 2, 4, 5 and 7.
G. Derivation of supporting quality element conditions for GEP	See next table	The selected combination of measures would result in a significant improvement in connectivity (continuum) along the inner bend of the river. By tackling the impacts of bank fixation (particularly the loss of shallow margins) each of the measures also contributes substantively to improving riparian zone structure and hence to the enhancement of the riparian habitat for the three affected BQEs: macrophytes and phytobenthos, benthic invertebrates and fish fauna.
F. Derivation of BQE conditions for GEP	See next table	BQE conditions for GEP cannot be derived due to lack of BQE data in this planning cycle
Monitoring to assess whether GEP is being achieved	See next table	Monitoring of the BQEs, flow conditions and riparian zone structure confirms that the water body is not currently at GEP but provides a baseline from which the effectiveness of the mitigation measures can be determined
Are there GEP measures that are disproportionally	See next table	Further investigation is needed to ensure that Measure 5 is feasible without disproportionate expenditure on engineering structures for the water intake and outlet. This measure may therefore be ruled out on the basis of

expensive or infeasible?		disproportionate cost, and GEP may therefore not be achievable. Measure 1 similarly requires modelling to check whether sedimentation rates might compromise the feasibility of this measure.
Implement GEP measures and monitor effects on BQEs and supporting quality elements	See next table	Pending a decision on measures 1 and 5, Measures 2, 4 and 7 will be implemented via the RBMP Programme of Measures. Monitoring for the relevant biological and hydromorphological quality elements will be initiated to evaluate the effectiveness of the measures

Continuation of step-wise process for **reference approach** (F→G→H …):

Step	**Reference approach**	**Mitigation measures approach**
F. Derivation of BQE conditions for GEP	BQE conditions for GEP resulted from the biological assessment systems that use the same principle for defining "slight changes" as for the intercalibrated method for natural water bodies.	See previous table
G. Derivation of supporting quality element conditions for GEP	Basis for this step were the BQE conditions for GEP (see step F). The hydromorphological parameters have been derived based on the difference between BQE conditions of MEP (step E) and GEP (step F) considering the hydromorphological conditions for MEP (step C). Physico-chemical conditions correspond to the values for good ecological status of the original natural river type.	See previous table

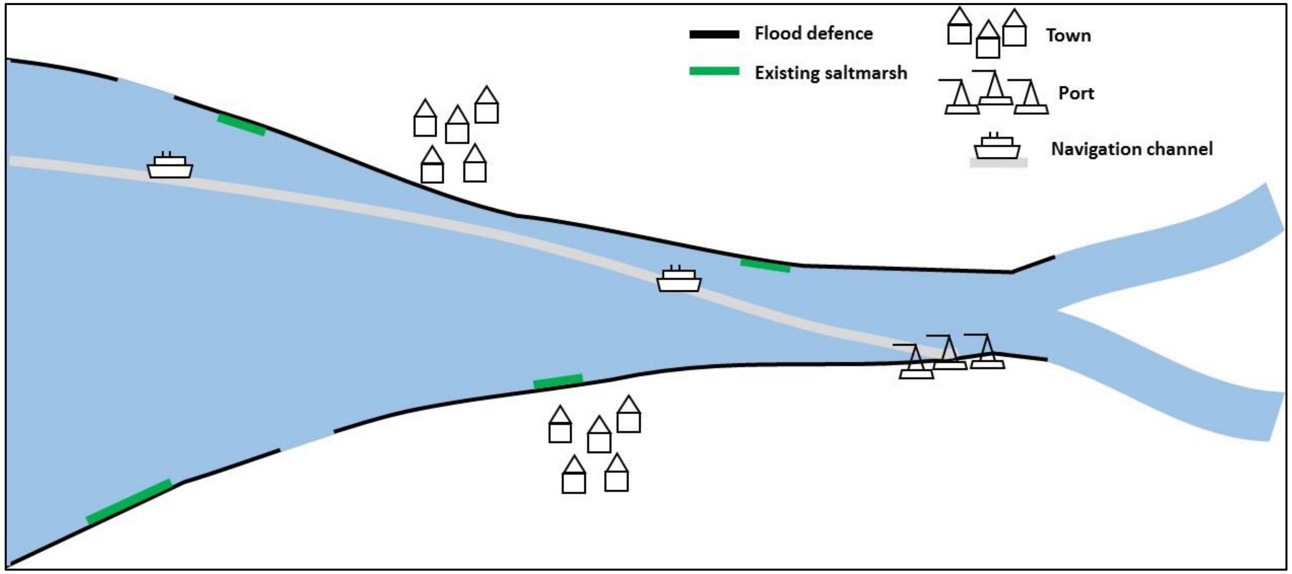
Step	Reference approach	Mitigation measures approach
H. Identification of mitigation measures for GEP	The difference between MEP and GEP is based on BQE values ("slight change"). Based on this, Measure 3 is estimated as not being necessary to reach GEP biological values, because it has only a low effect on BQE. Therefore GEP is defined by a combination of Measures 1, 2, 4, 5 and 7. While the qualitative measure set is the same for GEP as for MEP apart from measure 3 in this case (see B3), both classes significantly differ in the quantity of measures needed to achieve each class.	See previous table
Monitoring to classify ecological potential of HMWB	The modified assessment systems have been used to classify ecological potential of the water body. The overall result is "moderate" based on benthic invertebrates and fish. Therefore, hydromorphological mitigation measures are necessary to improve conditions of the water body and achieve GEP.	See previous table
Are there GEP measures that are disproportionally expensive or infeasible?	Further investigation is needed to ensure that Measure 5 is feasible without disproportionate expenditure on engineering structures for the water intake and outlet. This measure may therefore be ruled out on the basis of disproportionate cost. BQE monitoring has to show whether GEP can still be reached or not (and less stringent objectives have to be applied). Measure 1 similarly requires modelling to check whether sedimentation rates might compromise the feasibility of this measure.	See previous table
Implement GEP measures and monitor effects on BQEs and	Pending a decision on measures 1 and 5, Measures 2, 4 and 7 will be implemented via the RBMP Programme of Measures.	See previous table

Step	Reference approach	Mitigation measures approach
supporting quality elements	Monitoring will be undertaken within the next monitoring cycle.	

Case study 3: Estuary with flood defence/embanking (mitigation measures approach)

Step	Mitigation measures approach
Information from earlier planning cycles (pre-step)	The estuary is a heavily modified water body designated as such because almost 100% has been embanked for flood defence purposes. There are settlements on each side of the estuary and a small port at the upstream end. Navigation to the port uses a naturally deep channel in an otherwise fairly shallow, sediment-rich estuary. Dredging of this channel takes place occasionally. There is relative lack of WFD monitoring data but anecdotal evidence is available showing that since the estuary was embanked in the 1950s, most of the previously extensive saltmarsh has been lost due to 'coastal squeeze' caused by sea level rise. See Figure 17 below.

Figure 17: Estuary water body impacted by flood defence/embanking

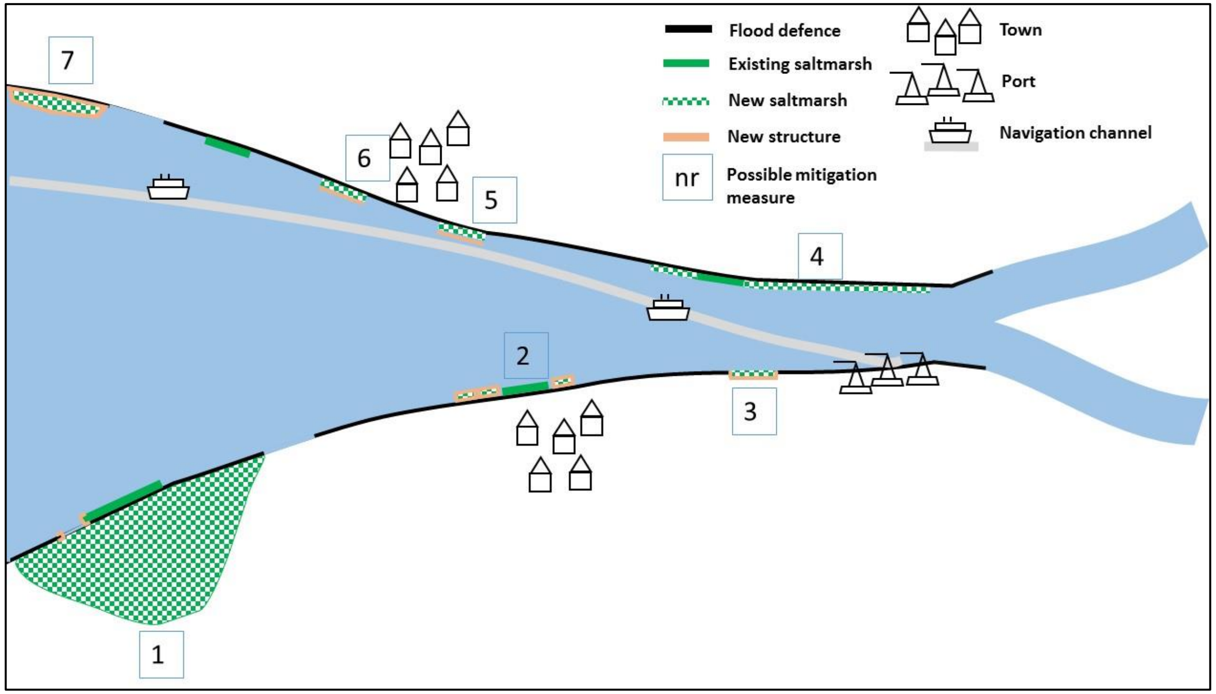


Step	Mitigation measures approach
A. Identification of closest comparable water category	The estuary was and remains a transitional water body.
B. Identification of mitigation measures for MEP (see Mitigation Measures Library)	Reference to the Mitigation Measures Library: (i) Confirms that the **specific nature of the physical modification** is ‘constructed or raised dyke / levee / embankments - no water exchange (e.g. flood protection)’. (ii) suggests that the **hydromorphological supporting elements** most likely to be affected by this type of modification are morphology (intertidal zone structure) and tidal regime (wave exposure). Expert knowledge of the water body confirms this is the case. The library also indicates the possibility of effects on bed structure and substrate, and on freshwater flow. The latter effects are not evident in the water body. (iii) does not identify any typically anticipated implications for **physico-chemical supporting elements**; local experts confirm this is the case here. (iv) indicates there is a strong likelihood that this type of modification will have an effect on two **BQEs** – angiosperms (including saltmarsh; this is known to be the case) and fish. Whereas there is no site specific data on fish, saltmarshes in other estuaries locally are known to be fish nurseries, so it is possible that fish could be affected here. (v) suggests that the following **groups of mitigation measures** might be appropriate to address such effects: - intertidal habitat restoration, enhancement or creation - beach or foreshore replenishment - beneficial use of dredged material

Step	Mitigation measures approach
	- soft engineering solutions; use of vegetation - realign to mitigate effects on flow - reprofile embankments, structures
B1. Identify mitigation measures relevant to each hydromorphological alteration and ecologically effective in physical context of water body or water bodies	Taking into account the nature of the estuary (i.e. shallow, sediment rich) and what is known about the problem (loss of intertidal fine sediment substrate at an appropriate elevation relative to the tide to support saltmarsh), the latter three groups of measures are unlikely to be ecologically effective. The focus is therefore on identifying measures for intertidal habitat restoration, enhancement or creation. In this case, beach or foreshore replenishment, using dredging material if this is available, might contribute to the development of suitable habitat. Figure 18 below illustrates the range of detailed measures considered from the groups of measures indicated above, taking into account their viability in the context of the estuary and their expected ecological effectiveness (i.e. ability to support and sustain saltmarsh vegetation): 1. Managed realignment achieved via an engineered breach in the existing flood defence, allowing the tide to flood an area currently used for summer livestock grazing; sediment deposited naturally could be supplemented with dredged material if appropriate to ensure an elevation suitable for saltmarsh establishment 2. The creation of engineered 'islands' of saltmarsh on the foreshore in front of the town in an area currently used for mooring fishing boats 3. The 'step back' of a short area of redundant quay wall to create a 'shelf' at an elevation suitable for saltmarsh to establish 4. The simple replenishment and raising, using material extracted from offshore, of an area of foreshore opposite the port (i.e. in a relatively sheltered part of the estuary) 5. The construction of breakwater (1) using brushwood fencing or silt-filled geotextiles tubes in front of the town, designed to encourage the deposition and retention of silt (supplemented if necessary by the beneficial placement of dredged material) to create an area suitable for saltmarsh re-establishment

Step	Mitigation measures approach
	6. The construction of breakwater (2) using brushwood fencing or silt-filled geotextiles tubes in front of the town, designed to encourage the deposition and retention of silt (supplemented if necessary by the beneficial placement of dredged material) to create an area suitable for saltmarsh re-establishment 7. The reclamation of an area seaward of an area of high grade arable land, to be achieved by building and reveting earth embankments, in-filled with dredged material or aggregate sourced from offshore, all designed to an elevation suitable for saltmarsh establishment Depending on the scale of implementation of one or more of the above measures, a best approximation of ecological continuum will be ensured.

Figure 18: Estuary water body impacted by flood defence/embanking with range of possible mitigation measures



Step	Mitigation measures approach
B2. Exclude measures with significant adverse effect on use or wider environment	Measure 5 is ruled out because its proximity to the navigation channel is shown to pose an unacceptable risk to safety of navigation. Measure 6 is ruled out because of its adverse impact on an internationally protected rocky foreshore area with exposed fossils.
B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum	Measures 1, 2, 3, 4 and 7 are relevant to the hydromorphological alterations in the estuary, ecologically effective and do not adversely impact on use. In combination, therefore, these measures contribute to MEP.

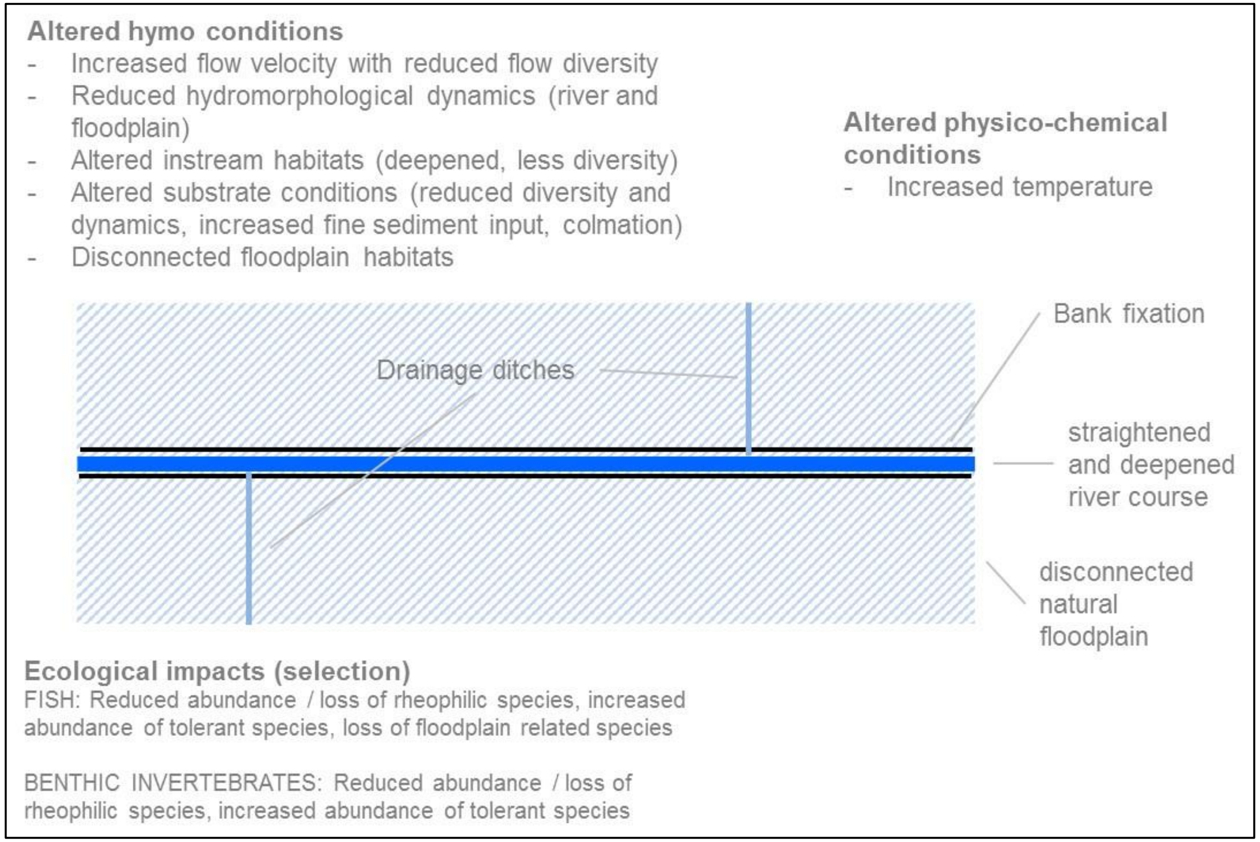
Step	Mitigation measures approach
C. Derivation of hydromorphological conditions for MEP	The above measures all have the effect of improving intertidal zone structure and elevation and thus creating a substrate suitable for the re-establishment of saltmarsh. Further, by providing a buffering effect, these measures will reduce wave exposure, in turn helping to protect the remaining remnants of original saltmarsh from erosion.
D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type	Neither the modification nor the mitigation measures will affect the WFD physico-chemical supporting elements.
E. Derivation of BQE conditions for MEP	BQE conditions for MEP cannot be derived due to lack of BQE data in this planning cycle. However, monitoring of angiosperms in the next and future planning cycles will enable a prediction of the BQE conditions at MEP to be made.
H. Identification of mitigation measures for GEP	As indicated on Figure 18, Measures 2 and 3 create very small areas of saltmarsh in the context of the overall water body and the extent of saltmarsh re-establishment needed to ensure ecological functioning including sustainability and continuum. These measures are therefore ruled out, meaning that GEP is defined by a combination of measures 1, 4 and 7.
G. Derivation of supporting quality element conditions for GEP	The selected combination of measures would lead to an improvement in intertidal zone structure and elevation at several locations in the water body, in turn providing a substrate suitable for the re-establishment of a significant area of saltmarsh. Measure 4 also contributes to reducing the exposure of the remaining area of existing saltmarsh along this frontage. Together the measures therefore support improvements in the affected BQEs: angiosperms (also benthic invertebrates) by enhancing the supporting habitat, and fish (by increasing the area available as a fish nursery).
F. Derivation of BQE conditions for GEP	BQE conditions for GEP cannot be derived due to lack of BQE data in this planning cycle.
Monitoring to assess whether GEP is being achieved	A national assessment monitoring for angiosperms includes a metric for the extent and quality of the salt marshes. A local monitoring programme will therefore be established to assess the effectiveness of the measures, with the current situation as a

Step	Mitigation measures approach
	baseline; the national assessment monitoring method for fish will also be applied to establish whether the measures are successfully providing habitat for fish.
Are there GEP measures that are disproportionally expensive or infeasible?	Measure 7 is ruled out on the basis of disproportionate cost (i.e. cost per unit area created)
Implement GEP measures and monitor effects on BQEs and supporting quality elements	Measures 1 and 4 will be implemented and their success monitored

Case study 4: River affected by drainage (reference approach)

Step	Reference approach
Information from earlier planning cycles (pre-step)	The river water body is heavily modified because of a straightened river course with a deepened cross section that is armoured with bank fixation. The directly neighbouring crop fields result in lack of shading. The floodplain is disconnected due to incision. These modifications lead to the following severe hydromorphological and physico-chemical alterations: • Increased flow velocity with reduced flow diversity • Reduced hydromorphological dynamics (river and floodplain) • Altered instream habitats (deepened, less diversity) • Altered substrate conditions (reduced diversity and dynamics, increased fine sediment input, colmation) • Disconnected floodplain habitats • Increased water temperature These resulted in ecological impacts such as: • Reduced abundance / loss of rheophilic species (fish, benthic invertebrates) • Increased abundance of tolerant species (fish, benthic invertebrates) • Loss of floodplain related species (fish) See Figure 19. The overall ecological status is “bad” based on benthic invertebrates and fish. With regard to physico-chemical quality elements, “temperature” is affected by the hydromorphological alterations causing the loss of shading.

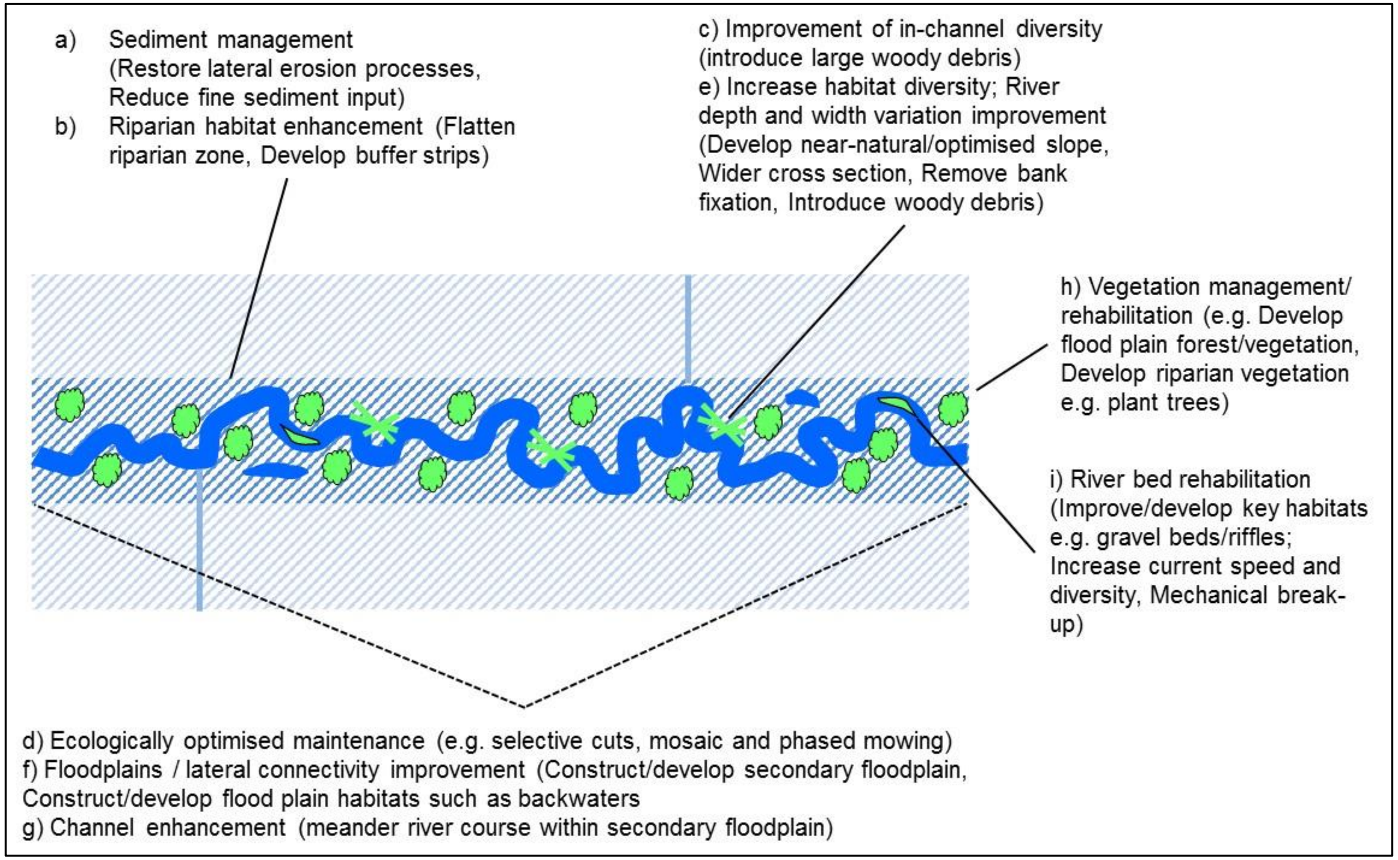
Figure 19: Drained water body with indication of impacts



Step	Reference approach
A. Identification of closest comparable water category	The original river water body remains a river water body, taking into account the hydromorphological and biological conditions.
B. Identification of mitigation measures for MEP (see Mitigation Measures Library)	Based on the hydromorphological alterations and ecological impacts, the following groups of measures might be appropriate (selection): - Sediment management - Riparian habitat enhancement - Improvement of in-channel diversity - Ecologically optimised maintenance - Increase habitat diversity; River depth and width variation improvement - Floodplains / lateral connectivity improvement - Channel enhancement - Vegetation management/rehabilitation - River bed rehabilitation
B1. Identify mitigation measures relevant to each hydromorphological alteration and ecologically effective in physical context of water body or water bodies	Based on the physical context of the water body the following measures are assumed to be relevant and ecologically effective (see Figure 20): a) Sediment management (Restore lateral erosion processes, Reduce fine sediment input) b) Riparian habitat enhancement (Flatten riparian zone, Develop buffer strips) c) Improvement of in-channel diversity (introduce large woody debris) d) Ecologically optimised maintenance (e.g. selective cuts, mosaic and phased mowing) e) Increase habitat diversity; River depth and width variation improvement (Develop near-natural/optimised slope, Wider cross section, Remove bank fixation, Introduce woody debris) f) Floodplains / lateral connectivity improvement (Construct/develop secondary floodplain, Construct/develop flood plain habitats such as backwaters) g) Channel enhancement (meander river course within secondary floodplain) h) Vegetation management/rehabilitation (e.g. Develop flood plain forest/vegetation, Develop riparian vegetation e.g. plant trees)

Step	Reference approach
	i) River bed rehabilitation (Improve/develop key habitats e.g. gravel beds/riffles; Increase current speed and diversity, Mechanical break-up) Those measures will contribute to: - Restore river hydromorphological processes and dynamic (incl. sediments) resulting in habitats for type-specific biota - Increase of flow and habitat diversity and increase of the length of the water body - Improve the hydromorphological processes and dynamics (river and floodplain) - Improve habitats for type-specific riverine species and floodplain species - Improve substrate conditions for type-specific species (e.g. gravel spawners) - Reduce fine sediment input - Reduce temperature by increased shading Raising the river bed level to connect the natural floodplain in combination with a re-meandered river course in a near-natural development corridor width would be the most effective measures to improve biological conditions, but this was not considered because: - this measures would lead to a restoration towards GES; and - it was reasoned in the HMWB designation process to mean a significant adverse effect on use (because the drainage function would be significantly impacted).

Figure 20: Drained water body with range of possible mitigation measures



Step	Reference approach
B2. Exclude mitigation measures with significant adverse effect on use or wider environment	Measure f) would have significant adverse effects on drainage, if the river bed level would get increased, but within a secondary floodplain it is possible without significant adverse effects on drainage function. The same is valid for measure g). All the other measures do not per se have significant adverse effects on the drainage use. Introducing woody debris (measure e)) is possible without significant adverse effects if the cross section is widened to ensure the flow capacity as in status quo.
B3. Select most ecologically beneficial (combination of) measures taking into account need to ensure best approximation to ecological continuum	Measures a)-i) from step B1 are relevant to the hydromorphological alterations in the water body, ecologically effective and do not adversely impact on drainage function(s). In combination, therefore, these measures contribute to MEP.
C. Derivation of hydromorphological conditions for MEP	The above measures significantly enhance habitats for river bed, riparian zone and floodplain. Based on predicted measure effects on the existing hydromorphological alterations (see pre-step) considering reference conditions of the original natural water body type, hydromorphological conditions for MEP are moderately changed compared to these. All relevant parameters have been defined based on these considerations using the existing national hydromorphological methods.
D. Derivation of physico-chemical conditions for MEP, taking into account the closest comparable water body type	Physico-chemical conditions correspond to the values for high ecological status of the original natural river type.
E. Derivation of BQE conditions for MEP	Basis for this step were the hydromorphological alterations and ecological impacts (see pre-step), the predicted effects of the relevant mitigation measures (see B1, B3) as well as the difference between hydromorphological conditions for MEP (see step C) and reference conditions of the original natural river type. In conclusion, the difference in hydromorphological conditions between MEP and reference conditions of the original natural river type have been translated to BQE conditions at MEP. Based on this, BQE conditions have been further defined based on the biological assessment system for natural water bodies. The EQR values have been reduced with the same proportion of the gradient as the difference between reference

Step	Reference approach
	conditions and MEP based on hydromorphological methods. The reduction is different between different BQEs due to different sensitivity at least to some of the relevant hydromorphological parameters (e.g. floodplain). The predicted results have been tested and amended in some aspects using a solid basis of monitoring data from comparable water bodies (same use und comparable river types) considering as much as possible the gradient of different habitat qualities from maximum to bad potential.
F. Derivation of BQE conditions for GEP - functioning aquatic ecosystem	BQE conditions for GEP resulted from the biological assessment systems that use the same principle for defining "slight changes" as for the intercalibrated method for natural water bodies. Therefore, the functioning of the aquatic ecosystem can be assumed if BQE conditions result in GEP.
G. Derivation of supporting quality element conditions for GEP - taking into account functionality of the aquatic ecosystem	Basis for this step were the BQE conditions for GEP (see step F). The hydromorphological parameters have been derived based on the difference between BQE conditions of MEP (step E) and GEP (step F) considering the hydromorphological conditions for MEP (step C). Physico-chemical conditions correspond to the values for good ecological status of the original natural river type. Functioning of the aquatic ecosystem is ensured by physico-chemical conditions as well as by the GEP conditions identified in step F.
H. Identification of mitigation measures for GEP	All measures a-i from step B3 are within the set of qualitative GEP measures. The difference between MEP and GEP is based on BQE values ("slight change"). Both classes especially differ in the quantity of measures needed (in particular the width of development corridor and meander amplitude and the conditions within the catchment (e.g. fine sediment input).
Monitoring to assess whether GEP is being achieved	The modified HMWB biological assessment systems have been used to classify ecological potential of the water body. Compared to the MEP values set for the BQEs the overall biological monitoring result show a strong deviation from the MEP values, so that the actual ecological potential is to be classified as "poor" based on benthic invertebrates and fish. Therefore,

Step	Reference approach
	hydromorphological mitigation measures (identified in step H) are necessary to improve conditions of the water body and achieve GEP.
Are there GEP measures that are disproportionally expensive or infeasible?	None of the GEP measures are disproportionally expensive or infeasible. Costs can be significantly reduced if the secondary floodplain will be developed by self-dynamic hydromorphological processes instead of construction. This is also valid according to vegetation development.
Implement GEP measures and monitor effects on BQEs and supporting quality elements	The following measures have been implemented within the next RBMP Programme of Measures: f) Construct/develop secondary floodplain, Construct/develop flood plain habitats such as backwaters g) Meander river course within secondary floodplain c) Introduce large woody debris (proved that no fixation is needed due to hydraulic conditions) d) Ecologically optimised maintenance (selective cuts) h) Develop flood plain forest/vegetation, Develop riparian vegetation (natural succession without planting to save costs) Beyond these, an improvement of the land use situation in the catchment (Improve water retention, e.g. through afforestation, restoration of rivers/floodplains, restoration of wetlands/moors,and reduce erosion of fine material from agriculture) is likely to be necessary to reach the GEP values for BQE. These measures could not be implemented yet, but can be implemented step by step within the following RBMPs. Beneath the water management, other planning sectors and instruments are relevant for implementation of these measures (e.g. agriculture, forestry, landscape planning). The quantitative design of the measures has been based on the adverse effects on use and an estimation of the need to achieve biological GEP values (see step F). Monitoring will be undertaken within the next monitoring cycle.

ANNEX II – EXAMPLE ARTIFICIAL WATER BODIES: Ditches - hydromorphological mitigation as an exception, mitigation by maintenance as a rule

Ditches in the lower parts of the Netherlands have been constructed to serve water discharge and supply. They have an estimated length of in total 300.000 km. The geometrical dimensions of these ditches have been carefully determined to suit their function: from less than half a metre wide in agricultural lands (in fact drains at the surface of the land) to several metres wide and up to a metre deep. Ditches may have a high aquatic biodiversity.

The need for hydromorphological mitigation is not so obvious, since there is no natural reference condition for ditches. However, measures may be planned to improve the ecological situation in specific cases. For example, ditches may connect biodiverse natural areas as elements of an ecological network, or be part of such natural areas. In that case, adaptation of the profile of the ditch may be considered in order to promote macrophyte growth and the biota dependent thereupon. Connectivity and/or habitat for fish may also be improved with specific measures aimed at achieving stable populations.

Ditches need regular cleaning to prevent unacceptable hydraulic resistance through the build-up of vegetation biomass. Hence, maintenance activities affect aquatic biodiversity. In many cases, the method and frequency of maintenance may be optimized for biodiversity without significant effect on the hydrological function (discharge & supply). For example, aquatic vegetation can be partially removed. Ecologically optimized maintenance (i.e. selective cuts) is an effective and feasible mitigation measure.

At the absence of a reference condition, hydromorphological mitigation will be restricted to specific cases and mitigation by ecological maintenance practices could be the rule, such as in the example above, and exceptions should be motivated.

ANNEX III – GLOSSARY

Best approximation

"Best approximation" is interpreted as being as close as possible to undisturbed ecological continuum.

Ecological continuum

For explanation, refer to section 5.2.

Ecological flow

Ecological flow is considered within the context of the WFD as "a hydrological regime consistent with the achievement of the environmental objectives of the WFD in natural surface water bodies as mentioned in Article 4(1)" (from CIS Guidance Document No.31).

Environmental flow

Environmental flows describe the quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems (from Brisbane Declaration, 2007).

GEP flow

GEP (Good Ecological Potential) flow is considered within the context of the WFD as a hydrological regime consistent with the achievement of the environmental objectives of the WFD in heavily modified water bodies as mentioned in Article 4(1), considering a condition close to best approximation to ecological continuum as mentioned in Annex V 1.2.5.

Hydromorphology

The hydrological and geomorphological characteristics (including continuity) of water bodies, including the underlying processes from which they result. The hydromorphological quality elements for classification of ecological status are listed in Annex V 1.1 and are further expressed in terms of some relevant aspects, defined in Annex V 1.2 of the Water Framework Directive.

Hydromorphological alterations

Hydromorphological alterations are alterations in the hydromorphological conditions which are caused by physical modification(s).

Hydromorphological character

The distinctive hydromorphological features and processes for a water body (e.g. river channel morphology, geometry, hydrological regime, tidal regime, sediment distribution, sediment transport).

Hydromorphological processes

The hydrologic and geomorphic processes occurring in water bodies (e.g., erosion, continuity of water, sediment and wood fluxes, sediment transport, hydrological regime,), considering temporal changes and dynamics.

Hydromorphological type

A particular group of water bodies that share similar hydromorphological characteristics (e.g. a lowland sinuous river water body). To define hydromorphological types, some kind of hydromorphological categorization is used (for example, river type: medium-large calcareous lowland river, or confined bedrock stream, or unconfined fine-grained meandering, etc.).

Mitigation measures

Measures needed to restore, supplement or replace certain natural processes, or otherwise to reduce or ameliorate the effects of physical modifications, so as to enhance the ecological conditions of a heavily modified water body (e.g. fish flow, sediment by-pass, etc.) in order to improve its ecological potential.

Physical modification

Hydromorphological change (or changes) made to the surface water body by human activity (which may result in failing to meet good ecological status). Each modification (pressure) results from the current or historical "specified use" (such as straightening for navigation, or construction of flood banks for flood defence).

Reference conditions

For any surface water body type reference conditions or high ecological status is a state in the present or in the past where there are no, or only minor, changes to the values of the hydromorphological, physico-chemical, and biological quality elements which would be found in the absence of anthropogenic disturbance. Reference conditions should be represented by values of the biological quality elements in calculation of ecological quality ratios and the subsequent classification of ecological status (from REFCOND Guidance) as well by values for the hydromorphological and general physico-chemical quality elements.

Relevant and ecologically effective mitigation measures

The selection of potential mitigation measures, which are **relevant** to the hydromorphological alterations and **ecologically effective** in the context of the specific water body or water bodies should take into account the following:

- The natural hydromorphological and physicochemical characteristics of the water body.
- Other water body or water bodies characteristics relevant to the biota, e.g. is the modification within the fish zone/ outside the fish zone, fish community types, sediment (e.g. coarse, fine) and habitats (e.g. river types).

- Whether measure is appropriate for addressing the existing ecological impacts and can deliver a proven ecological benefit. In this sense, measures which are not likely to deliver an ecological benefit should not be considered.

Restoration measure

Measure needed to restore natural processes, and hence reach good ecological status, such as e.g. ecological flows. Compare mitigation measure (from WG ECOSTAT report on common understanding of using mitigation measures for reaching Good Ecological Potential for heavily modified water bodies - Part 1: Impacted by water storage).

Slight changes

CIS Guidance Document No.13 on the "Overall approach to the classification of ecological status and ecological potential" provides guidance on the interpretation of the term "slight changes" with reference to the (type-specific) conditions specified for the BQE benthic invertebrates at good status:

- There must be no more than slight changes in composition and abundance.
- There must be no more than slight changes in the ratio of disturbance sensitive taxa to insensitive taxa.
- There must be no more than slight signs of alteration to the level of diversity.

With respect to "slight changes", HMWB should follow the same principles as natural water bodies, with a functioning ecosystem being a prerequisite for a water body to be at GEP. Slight change cannot be equivalent to a complete/temporary absence or severe change of the biological quality elements relevant for the closest comparable water category and type (e.g. of fish for rivers within the fish zone). Slight changes to the biological quality elements have to be supported by corresponding conditions in the supporting quality elements (e.g. flow, habitats, continuity). With regard to ecological continuum, "slight change" means that a condition close to best approximation to ecological continuum should be ensured (instead of best approximation) .

Sustainable human development activities

For explanation, refer to section 3.

Self-sustaining populations

Self-sustaining populations refer to the type-specific animal (e.g. fish) and plant species occurring in the water body which form autochthonous stocks.

Technical Report - 2009 - 027

COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC)

Guidance Document No. 20

GUIDANCE DOCUMENT ON EXEMPTIONS TO THE ENVIRONMENTAL OBJECTIVES

EUROPEAN COMMISSION

environment

Disclaimer:
This technical document has been developed through a collaborative programme involving the European Commission, all the Member States, the Accession Countries, Norway and other stakeholders and Non-Governmental Organisations. The document should be regarded as presenting an informal consensus position on best practice agreed by all partners. However, the document does not necessarily represent the official, formal position of any of the partners. Hence, the views expressed in the document do not necessarily represent the views of the European Commission.

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Foreword

Activities to support the implementation of the Water Framework Directive are under way both in Member States and in the European Commission. The EU Member States, Norway and the European Commission have jointly developed a common strategy for supporting the implementation of the Directive 2000/60/EC, "establishing a framework for Community action in the field of water policy" (the Water Framework Directive). The main aim of this strategy is to allow a coherent and harmonious implementation of the Directive. The focus is on methodological questions related to a common understanding of the technical and scientific implications of the Water Framework Directive.

In the context of this common implementation strategy (CIS), a series of working groups and joint activities have been launched for the development and testing of non-legally binding Guidance Documents. A strategic co-ordination group oversees these working groups and reports directly to the Water Directors of the European Union and Commission that play the role of the overall decision body for the Common Implementation Strategy.

As a result of a four year discussion initiated by the Water Directors and assisted by a Drafting Group, several documents have been prepared to identify some key issues and make recommendations related to environmental objectives and exemptions.

Now this previous work is brought together in one consolidated document to give a full overview on the issue of environmental objectives and exemptions. This document compiles previously agreed interpretations on issues related to environmental objectives and exemptions and does not add any new issues. The previously agreed documents will stay available on Circa[1] as background documents for this consolidated guidance document.

[1] http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/environmental_objectives

Table of contents

1 INTRODUCTION - A GUIDANCE DOCUMENT: WHAT FOR?

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the **EU Water Framework Directive** (or even shorter the WFD) was adopted. By means of this Framework Directive, the EU provides for the management of inland surface waters, groundwater, transitional waters and coastal waters in order to prevent and reduce pollution, promote sustainable water use, protect the aquatic environment, improve the status of aquatic ecosystems and mitigate the effects of floods and droughts.

The environmental objectives are defined in Article 4 - the core article - of the Water Framework Directive (WFD). The aim is long-term sustainable water management based on a high level of protection of the aquatic environment. Article 4.1 defines the **WFD general objective** to be achieved in all surface and groundwater bodies, i.e. good status by 2015, and introduces the principle of preventing any further deterioration of status. There follow a number of **exemptions** to the general objectives that allow for less stringent objectives, extension of deadline beyond 2015, or the implementation of new projects, provided a set of conditions are fulfilled.

As for many of the challenging concepts under the WFD, the text of the directive provides the framework and gives the general orientation but there is scope for differences in understanding and application. So from the first day of the implementation it was clear that the use of exemptions needed to be explained further and the rules for application had to become clearer.

Under the Common Implementation Strategy (CIS) of the WFD several working groups for various topics have been set up[2]. The issue of exemptions was firstly addressed in the working group on economics (WATECO) where a first indication of how to deal with exemptions related to disproportionate costs is given. The WATECO guidance document, endorsed by the Water Directors, in particular started to discuss exemptions in the light of disproportionate costs.

In June 2005, the Water Directors (WD) endorsed a paper on the environmental objectives under the WFD (WFD). This document introduced key elements regarding the environmental objectives of the WFD. At the end of 2006, the Water Directors endorsed a Policy Paper on the application of Article 4.7 for new modifications. In November 2007, a third document dealing with the exemptions on extension of deadlines (4.4), the setting of less stringent objectives (4.5) and temporary deterioration (4.6) was endorsed by the Water Directors. Finally, a specific paper with conclusions on disproportionate costs was endorsed by the Water Directors in June 2008[3].

In addition to the agreed documents, information on case studies and practical examples was exchanged at various occasions. Information related to a workshop held in Berlin in 2005 and in Copenhagen in 2008 can be found at the Circa website[4].

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[2] See http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents

[3] All papers can be found at http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/environmental_objectives

[4] See http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/implementation_conventio/objectives_exemptions and http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/implementation_conventio/disproportionate

After this, all existing earlier agreed papers are brought together into one consolidated document, resulting in this guidance document. Chapter 2 recalls the requirements of the WFD related to the environmental objectives and the exemptions. Chapter 3 reflects on key issues for the interpretation of the exemptions. In paragraph 3.2, horizontal issues which are applicable to two or more exemptions are addressed. In addition to these horizontal issues, paragraph 3.3 until 3.5 included address some specific issues related to each exemption.

This guidance document intends to provide earlier agreed information in a complete way, and may be useful for water managers involved in preparing the river basin management plans, as well as to the public interested in the (draft) river basin management plans (RBMP) and the related process of objectives setting.

2 RECALL OF WFD REQUIREMENTS IN RELATION TO ENVIRONMENTAL OBJECTIVES

2.1 General introduction

The environmental objectives and the exemptions are set under Article 4 of the WFD. The subsequent paragraphs aim at describing Article 4, mainly the exemptions, in a summarised way and in the order presented in the Directive.

Article 4 WFD sets out the **"environmental objectives"** mainly in Article 4.1. The **main environmental objectives** in the Directive are manifold and include the following elements (for details see Article 4.1, (a) surface waters, (b) groundwaters and (c) protected areas):

- ***No deterioration*** of status for surface and groundwaters and the protection, enhancement and restoration of all water bodies;
- Achievement of *good status* by 2015, i.e. good ecological status (or Potential) and good chemical status for surface waters and good chemical and good quantitative status for groundwaters;
- ***Progressive reduction of pollution*** of priority substances and ***phase-out* of** priority hazardous substances in surface waters[5] and prevention and limitation of input of pollutants in groundwaters;
- ***Reversal*** of any significant, upward ***trend*** of pollutants in groundwaters;
- Achievement of Standards and objectives set for ***protected areas*** in Community legislation.

It is important to note that where more than one of the objectives relates to a given body of water, the most stringent shall apply (Art. 4.2), irrespective of the fact that all objectives must be achieved.

It is important to understand that the normative definitions for the environmental objective of "good status" are described in the Directive in great detail in Annex V. However, the development of specific numerical criteria and classification schemes including class boundaries is described only as regards the process. Taking into account the results of the intercalibration exercise Member States are obliged to set detailed values defining the status for each water body.

For **heavily modified and artificial water bodies**, Article 4.1 point (a) indent (iii) sets out "specific objectives" for these specific water bodies. In Article 4.3, strict criteria for the designation of artificial or heavily modified water bodies are described.

In order to achieve the specific objectives for heavily modified and artificial water bodies (i.e. good ecological potential and good chemical status), the provisions for designation (see Article 4.3), contain elements of comparing the consequences of achieving the 'good ecological status' to a number of aspects including economic considerations. Moreover, the assessment of "good ecological potential" is linked to the possible mitigation measures[6].

There has been a debate whether these requirements should be interpreted as "alternative objectives" or "exemptions". **It has been agreed that artificial and heavily modified water bodies do not constitute a conventional objective or exemption. They are a**

[5] Pollution of "other pollutants" than PS and PHS need to be reduced by Member States in accordance with Article 11 (3) (k) WFD.

[6] See Guidance Document No. 4 on "Identification and Designation of HMWB and AWB" for more detail. http://europa.eu.int/comm/environment/water/water-framework/guidance documents.html

specific water body category - with its own classification scheme and objectives - which is related to the other exemptions in requiring certain socio-economic conditions to be met before it comes to play.

An integral part of the environmental objectives set out in Article 4 are the so-called exemptions. Article 4.4, 4.5, 4.6 and 4.7 describe the conditions and the process in which they can be applied. These exemptions range from small-scale temporary exemptions to mid- and long term deviations from the rule "good status by 2015[7]", and include the following aspects:

- **the extension of the deadline** , in other words, good status must be achieved by 2021 or 2027 at the latest (Article 4.4) or as soon as natural conditions permit after 2027;
- the achievement of **less stringent objectives** under certain conditions (Article 4.5);
- the **temporary deterioration** of the status in case of natural causes or "force majeur" (Article 4.6);
- **new modifications** to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or failure to prevent status deterioration of a body of surface water (including from high status to good status) as a result of new sustainable human development activities (Article 4.7).

Common to all these exemptions are strict conditions to be met and a justification to be included in the River Basin Management Plan.

Comparing the criteria for applying the various exemptions (or "exemption tests"), there are some similarities between them. Thus, it should be discussed how and when to apply particular exemptions and whether there is a certain sequence or hierarchy when applying them together (see chapter 3 for more details).

Finally, paragraphs 8 and 9 of Article 4 introduce two principles applicable to all exemptions,

- first, exemptions for one water body must not permanently exclude or compromise achievement of the environmental objectives in other water bodies
- second, at least the same level of protection must be achieved as provided for by existing Community law (including those elements to be repealed).

2.2 Scope of article 4.4 and 4.5

Under certain conditions, the WFD permits the assignment of a less stringent objective or the extension of the timescales for achieving a particular objective:

Art 4.4
The deadlines established under paragraph 1 may be extended for the purposes of phased achievement of the objectives for bodies of water, provided that no further deterioration occurs in the status of the affected body of water when all of the following conditions are met:

(a) Member States determine that all necessary improvements in the status of bodies of water cannot reasonably be achieved within the timescales set out in that paragraph for at least one of the following reasons:

(i) the scale of improvements required can only be achieved in phases exceeding the timescale, for reasons of technical feasibility;
(ii) completing the improvements within the timescale would be disproportionately expensive;
(iii) natural conditions do not allow timely improvement in the status of the body of water.

[7] or "good ecological potential by 2015 " for HMWB and AWB.

(b) Extension of the deadline, and the reasons for it, are specifically set out and explained in the river basin management plan required under Article 13.

(c) Extensions shall be limited to a maximum of two further updates of the river basin management plan except in cases where the natural conditions are such that the objectives cannot be achieved within this period.

(d) A summary of the measures required under Article 11 which are envisaged as necessary to bring the bodies of water progressively to the required status by the extended deadline, the reasons for any significant delay in making these measures operational, and the expected timetable for their implementation are set out in the river basin management plan. A review of the implementation of these measures and a summary of any additional measures shall be included in updates of the river basin management plan.

Art 4.5
Member States may aim to achieve less stringent environmental objectives than those required under paragraph 1 for specific bodies of water when they are so affected by human activity, as determined in accordance with Article 5(1), or their natural condition is such that the achievement of these objectives would be infeasible or disproportionately expensive, and all the following conditions are met:

(a) the environmental and socioeconomic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs;

(b) Member States ensure,
— for surface water, the highest ecological and chemical status possible is achieved, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution,
— for groundwater, the least possible changes to good groundwater status, given impacts that could not reasonably have been avoided due to the nature of the human activity or pollution;

(c) no further deterioration occurs in the status of the affected body of water;

(d) the establishment of less stringent environmental objectives, and the reasons for it, are specifically mentioned in the river basin management plan required under Article 13 and those objectives are reviewed every six years.

2.3 Scope of article 4.6

Article 4.6 differs from articles 4.4 and 4.5 in that it relates to events which "could not reasonably have been foreseen".

Art 4.6.
Temporary deterioration in the status of bodies of water shall not be in breach of the requirements of this Directive if this is the result of circumstances of natural cause or force majeure which are exceptional or could not reasonably have been foreseen, in particular extreme floods and prolonged droughts, or the result of circumstances due to accidents which could not reasonably have been foreseen, when all of the following conditions have been met:

(a) all practicable steps are taken to prevent further deterioration in status and in order not to compromise the achievement of the objectives of this Directive in other bodies of water not affected by those circumstances;

(b) the conditions under which circumstances that are exceptional or that could not reasonably have been foreseen may be declared, including the adoption of the appropriate indicators, are stated in the river basin management plan;

(c) the measures to be taken under such exceptional circumstances are included in the programme of measures and will not compromise the recovery of the quality of the body of water once the circumstances are over;

(d) the effects of the circumstances that are exceptional or that could not reasonably have been foreseen are reviewed annually and, subject to the reasons set out in paragraph 4 (a), all practicable measures are taken with the aim of restoring the body of water to its status prior to the effects of those circumstances as soon as reasonably practicable, and

(e) a summary of the effects of the circumstances and of such measures taken or to be taken in accordance with paragraphs (a) and (d) are included in the next update of the river basin management plan.

Hence it is not used for setting alternative objectives during the improvement planning process - rather it is used after the event, as a "defence" to justify why an objective which was set in a river basin management plan has not been met. This justification must be provided in the following (update of the) river basin management plan. Details are discussed in section 3.4.

2.4 Scope of article 4.7

Article 4.7 sets out circumstances in which failure to achieve certain of the WFD objectives are permitted.

Art 4.7. Member States will not be in breach of this Directive when: - failure to achieve good groundwater status, good ecological status or, where relevant, good ecological potential or to prevent deterioration in the status of a body of surface water or groundwater is the result of new modifications to the physical characteristics of a surface water body or alterations to the level of bodies of groundwater, or - failure to prevent deterioration from high status to good status of a body of surface water is the result of new sustainable human development activities and all the following conditions are met: (a) all practicable steps are taken to mitigate the adverse impact on the status of the body of water; (b) the reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years; (c) the reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the objectives set out in paragraph 1 are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and (d) the beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

Note that Article 4.7 does not provide an exemption if deterioration caused by inputs of pollutants from point or diffuse sources drives the water body to a status below good.

If the resulting development is not causing a deterioration of status on the water body scale, art. 4.7 does not have to be used (for example if replacing one activity by another).

Details on how Art 4.7 can be applied are provided in section 3.5.

3 KEY ISSUES IN THE PROCESS OF JUSTIFYING EXEMPTIONS

3.1 General Introduction

When discussing exemptions it should be taken into account that the WFD is an environmental directive and exempting from its objectives should not be the rule but exceptional. It is important that before considering the application of exemptions for a certain water body, all relevant requirements from existing EU legislation for the protection of water have to be fulfilled. Nevertheless "exemptions" are an integral part of the environmental objectives set out in Article 4 and the planning process.

Member States are encouraged to keep the analysis for applying exemptions as simple as possible, but as detailed as necessary. The level of information should be determined by the complexity of the decision and the possible consequences of taking the wrong decision.

When consensus is reached between all relevant stakeholders in an early stage of the decision-making process, the efforts for data gathering may be reduced. Thus, early consensus may help to reduce analytical efforts but does not replace an economic analysis.

In the following section the key issues to use exemptions are outlined in more detail. First, some horizontal issues related to the exemptions in general are set out (in paragraph 3.2), followed by specific issues for Article 4.4 and 4.5 (in paragraph 3.3), Article 4.6 (in paragraph 3.4) and Article 4.7 (paragraph 3.5).

3.2 Horizontal issues

3.2.1 Scale

Member States have to set objectives for individual water bodies. As reflected in the 2010 reporting sheets, Member States are asked to report each water body for which the objective will not be good status by 2015; the alternative objective related to the affected quality element, and the reasons for this.

It is however recognised that different scales (national, basin, sub-basin, water body) may be appropriate for different assessments or different aspects of the same assessment. For example, transboundary issues have to be assessed on a transboundary scale. However, the choice of the scale should be justified by the provisions of the WFD and if the information used to justify an exemption is gathered at a more aggregated level it needs to be clear that the aggregated information is relevant for the concerned water body or group of water bodies.

Furthermore, Article 4.8 specifies that when applying an exemption to a water body, "a Member State shall ensure that the application does not permanently exclude or compromise the achievement of the objectives of this Directive in other bodies of water within the same river basin district and is consistent with the implementation of other Community environmental legislation." Regarding the link between water bodies, it is clear that there cannot be an automatic mechanism for justifying exemptions in an adjacent water body on the basis of an assessment carried out for another water body. This does not necessarily imply that the reasons (e.g. water uses or significant pressures) for justifying an exemption must always be located within the water body for which the exemption is sought for.

3.2.2 Protected areas

It is generally understood that the exemptions in Article 4.4 and 4.5 and 4.6 are applicable to all environmental objectives in Article 4.1, thus also to Article 4.1(c), which describes the objectives for protected areas. But Article 4.9 is clear in its obligation that when applying the exemptions of Article 4, the same level of protection should be given as in existing Community legislation. This means that exemptions from the WFD environmental objectives cannot be used to deviate from objectives and obligations set by other pieces of EU legislation.

For example, a new development is proposed that would cause deterioration of status and a failure to achieve the objectives for a Natura 2000 site. In such a case, in order to fulfil both the WFD and the Habitats Directive:

- The relevant conditions set out in Article 4.7 of the WFD for allowing deterioration of status would have to be met to the extent that it is a water body; and
- The conditions set out in Article 6 of the Habitats Directive (92/43/EEC) for allowing a failure to achieve a Natura 2000 site's objective would have to be met.

3.2.3 Management of uncertainties

Uncertainty is an inevitable feature of objective setting in general, and will therefore be a feature of the first set of river basin plans[8]. Uncertainties should be taken into account in deciding the appropriate action. This action may include further investigation, monitoring and assessment to reduce uncertainties and this could contribute to the justification for the phasing of measures across cycles. Uncertainty will reduce over the medium to long term but will always be present. There can be uncertainty about:

- Whether, and to what extent, a water body is adversely impacted and what and/or who causes the impact;
- The impact of policies already in place or planned and various trends and developments, including innovation and technical change;
- The effectiveness of measures in addressing an adverse impact on a water body (note that this will have an effect on the certainty of the benefits as well);
- The assessment of the achievement of good status[9];
- The costs associated with measures;
- The benefits resulting from improvements to the status of water bodies, particularly the calculation of the non-marketable benefits.

These uncertainties will also relate to the analysis for applying exemptions, and will have substantial impact on cost and benefit estimates. There are a number of things which can be done, and should be done, to reduce uncertainties or to deal with them in the decision-making process. For example:

- Choose reversible measures, measures that can be easily adapted, measures that can be carried out iteratively or measures with low risk and costs, and high return[10]. Where

[8] See also Guidance nr 13 on Classification of Ecological Status on: http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents

[9] A number of uncertainties are addressed by the Directive's requirements to apply the 'one out - all out' principle and to set physico-chemical Standards characterising the good Status and to use hydro-morphological parameters to define the high Status. The pressure - Status - impact relations are well researched and understood for most of those non-biological parameters. Furthermore, uncertainties associated with the assessment of water body Status are addressed in the CIS ECOSTAT work programme 2007-2009.

[10] These measures are often referred to as 'no-regret measures'.

there is significant uncertainty, the risk of incurring disproportionate costs can be reduced by choosing measures that can be readily and iteratively added to, or adapted, in the future on the basis of information on their effects and the associated benefits. However, these kinds of measures are not necessarily the ones that are most acceptable to stakeholders.

- Estimating and recording the level of uncertainty is needed to take into account uncertainty in objective setting.
- Weigh the benefits in such a way that the additional uncertainty of benefits relative to costs is taken into account. The same logic should apply where costs are more uncertain than benefits, though this is likely to be less common in practice.
- Actions need to be taken to reduce uncertainty (e.g. by research programmes), although these actions need to be proportional. The findings of the Article 5 reports are an important basis for addressing knowledge gaps and identifying follow-up actions.
- Efforts to reduce uncertainty should be proportional to the difficulty of the decision at hand and the implications of making a wrong decision. However, there is no point attempting to reduce uncertainty if doing so does not clarify the decision at hand. It may be better to act on the basis of principle, for example the precautionary principle and/or the polluter pays principle and/or, where possible, on the basis of consensus.
- There needs to be a balance between the risk of failing to meet objectives and the risk of failing to use the most cost-effective means of achieving those objectives, with priority being given to minimising the risks of the first.

For example, the effectiveness of diffuse pollution measures may be more uncertain than the effectiveness of point source pollution measures. Conversely, the costs of diffuse pollution measures may be less than the costs of point source pollution measures.

3.2.4 Technical infeasibility

In principle, only issues of a technical nature should be taken into account in applying the technical infeasibility test - as referred to in Article 4.4 and 4.7 - and not cost issues. Although cost savings may be associated with extending the deadline for achieving good status, such savings are not relevant in deciding whether making the improvements by the deadline would be technically infeasible.

Technical infeasibility is justified if:

- No technical solution is available;
- It takes longer to fix the problem than there is time available;
- There is no information on the cause of the problem; hence a solution cannot be identified.

In practice, the greater the effort expended in trying to overcome practical issues of a technical nature, the greater the likelihood that technically feasible ways of making the improvements will be found. This means that consideration of the costs and benefits will need to be considered alongside technical feasibility. Where the benefits resulting from an improvement would be substantial, a much higher degree of effort to find a technically feasible option is likely to be appropriate than where the benefits of an improvement are expected to be low.

Further guidance can be provided by the term 'best available technique (BAT)' which is defined in the IPPC-directive (96/61/EC)[11], although in the cases where going beyond BAT might be technically feasible, these options should be explored.

Article 4.5 refers to the term 'infeasible', which includes technical infeasibility, but which could also refer to situations where addressing a problem is out of the control of a Member State.

3.2.5 Disproportionate costs

The term disproportionate costs (or disproportionately expensive) is used in Article 4.4, 4.5 and 4.7 of the WFD. Below, some principal issues related to these terms are addressed.

3.2.5.1 General introduction of the terms 'disproportionate costs'

'Disproportionality', as referred to in Article 4.4 and 4.5, is a political judgement informed by economic information, and an analysis of the costs and benefits of measures is necessary to enable a judgement to be made on exemptions. It was already concluded in the WATECO guidance that, given the uncertainty around estimates of costs and benefits one should bear in mind that,

- Disproportionality should not begin at the point where measured costs simply exceed quantifiable benefits;
- The assessment of costs and benefits will have to include qualitative costs and benefits as well as quantitative;
- The margin by which costs exceed benefits should be appreciable and have a high level of confidence;
- In the context of disproportionality the decision-maker may also want to take into consideration the ability to pay of those affected by the measures and some information on this may be required.

From the logic of the WFD is becomes clear that an assessment of disproportionate costs only makes sense after a combination of the most cost-effective solutions has been identified. Most importantly, for all cases where an exemption is applied, all measures that can be taken without involving disproportionate costs should still be taken to reach the best status possible.

In cases where exemptions are considered the consequences of non-action (i.e. foregone benefits) need to be weighed against the specific costs of the measures.

3.2.5.2 Costs of measures required under other Community legislation

The costs of measures required under existing Community legislation already agreed at the time of the adoption of the Directive cannot be considered when deciding on disproportionate costs. Without prejudice to the transitional arrangements in the Accession Treaties, this also applies to Member States which joined the EU in 2004 and 2007.

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[11] 'best available techniques' shall mean the most effective and advanced stage in the development of activities and their methods of Operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole. For further details, see http://ec.europa.eu/environment/air/legis.htnrfstationary

3.2.5.3 Affordability issues

Affordability (or ability to pay for a certain measure) can be one element for justifying the decision on a time extension (i.e. application of Article 4.4), if based on a clear explanation:

- of the non-availability of relevant alternative financing mechanisms which would not result in affordability issues,
- of the consequences of non-action in deciding on an extension of the deadline,
- of steps to resolve the affordability issues in the future.

Non-action by one player does not automatically lead to non-action by other players within the same sector.

Furthermore, Member States may phase the implementation of measures to spread the costs of the implementation, but there is the need for clear and demonstrable action in the first cycle.

When affordability arguments are used to extend the deadline, the possibility to use relevant **alternative financing mechanisms** should be fully considered. The alternative financing mechanisms could include distribution of costs among polluters and users, use of the public budget (at different levels), private investment, EU and international funds, etc. These relevant alternative financing mechanisms should be considered at the appropriate scale.

On the role of affordability in setting less stringent objectives, no guidance can be provided at this stage. For some Water Directors affordability could play a role in setting less stringent objectives, as both Article 4(4) and 4(5) use the same terminology 'disproportionately expensive'. They indicated that in practice affordability arguments may be used less frequently in Article 4(5) than in Article 4(4). Some other Water Directors argued that affordability can not be used as an argument for setting less stringent objectives as the context of 'disproportionate expenses' is different in 4(5) from the context in Article 4(4) as it concerns setting lower objectives permanently (subject to revision every 6-years). These Water Directors consider that application of this provision requires it to be set out clearly that the costs outweigh the benefits of achieving the targets.

On the role of constraints of the public budget as a reason for extending the deadline, no guidance can be provided at this stage either. Most Water Directors indicated that constraints of the public budget may be used as a reason for extending the deadline as there are limits to the available budget for water management. The Commission indicated that in its views the adoption of the WFD by the Council and the European Parliament entails obligations for Member States to make available the necessary means for its implementation.

3.2.5.4 Prioritisation approaches in the context of disproportionate costs

The Water Directors agreed that a proportionate selection of the different analyses (cost-benefit analysis, benefits assessment, assessment of the consequences of non-action, distribution of costs, social and sectoral impacts, affordability, cost-effectiveness etc) is useful to inform decision making.

It was also agreed by the Water Directors that prioritisation approaches for ranking measures that are considered technically feasible can be the first operational steps in the assessment of cost disproportionality, but that a justification of an extension of the deadline following these approaches should respect the relevant provisions of the WFD. The results of prioritisation have to be developed on or transformed to the water body level when relevant.

It was emphasised that prioritisation takes place on different geographic / administrative levels (e.g. MS, River Basin, Region, sub unit, water body) and should consider the different basic conditions in the area. The prioritisation process should take into account a set of relevant criteria, for example:

- synergies with other directives, e.g. habitat directive, flood risk management directive
- cost-efficiency / benefits of measures
- consequences of non-action
- certainty / uncertainty (“no regret measures”)
- measures which could be implemented short term
- urgency of problem to be solved(severe consequences/high cost of non action: e.g. protection of drinking water supplies)
- existence of available financing mechanisms
- acceptance by the public

Prioritisation criteria and results should be transparent and should be disclosed to the public. The prioritisation approach should also give information on the further timescale to reach the environmental objectives.

3.2.6 Alternative means

In both Article 4.5 and Article 4.7, the necessity is mentioned to assess 'alternative means'. In Article 4.5 this refers to alternatives to serve the environmental and socioeconomic needs served by a certain human activity, which are a significantly better environmental option not entailing disproportionate costs. In Article 4.7 it is indicated that it is necessary to demonstrate that the beneficial objectives served by the modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

Those means or alternatives solutions could involve alternative locations, different scales or designs of development, or alternative processes. Alternatives should be assessed in the early stages of development and at the appropriate geographical level (EU, national, RBD) against a clear view of the beneficial objectives provided by the modification.

For projects under its scope, the use of the requirements of the EIA Directive can help to assess the different possible alternatives.

3.2.7 Transboundary context

In international river basin districts within the EU, exemptions need to be coordinated. This obligation to coordinate the requirements for the achievement of the environmental objectives is indicated in Article 3.4 and 3.5.

Exemptions can be applied in cases where a certain Member State cannot resolve the reasons for not achieving the environmental objectives because they lay outside the competence and jurisdiction of the Member State. In these cases, a country causing the problem should be obliged to provide enough information for justification of the application of exemptions for the affected Member State.

Frequent information exchange between Member States, and between an EU Member State and a country outside the EU, is crucial when applying exemptions in a transboundary context. This includes information on intermediate objectives and the expected evolution for the water bodies where exemptions are applied. This enables affected Member States to adapt their own planning process.

In cases where the reasons for not achieving good status cannot be resolved by a Member State since they are outside the competence and jurisdiction of the Member State, the WFD includes the provision of Article 12 on the involvement of the Commission to solve the issue.

The key issue in both applying the exemption and invoking Article 12 is the demonstration of evidence that Member States have taken all reasonable actions to fulfil the legal obligations.

More information on the transboundary context is included in Annex II: Exemptions in a transboundary context

3.2.8 Public participation and transparency

Active participation at an early stage should be encouraged not only because of legal requirements, but it can also be used to get a better insight in factors influencing the application of exemptions (such as costs and benefits and technical feasibility). Further, it might also give an early indication of acceptability and create a basis of understanding of a certain decision on objective setting. However, public information and consultation do not guarantee acceptance of a range of (feasible) measures.

As a minimum, the public should be given insight in the reasons for applying exemptions (eg. as mentioned in Article 4(a) i, ii and iii) per water body for which an exemption is applied.

Public information and consultation is not only an obligation of WFD Article 14 and other legislation, also Article 4(4) and 4(5) and the related recitals require that the following information should be provided in the river basin management plans[12]:

- the reasons for an extension of the deadline should be specifically set out
- the reasons for the establishment of less stringent environmental objectives should be specifically mentioned;
- a summary of the measures to bring the bodies of water *progressively* to the required status;
- the reasons for any significant delay in making the measures operational;
- the expected timetable for the implementation of the measures (that are delayed);
- the appropriate, evident and transparent criteria used for applying exemptions

It is agreed that:

- there is the need for clear and demonstrable action in the first cycle;
- when applying the 'disproportionality justification', the reasons, underlying data and assessments should be made public;
- if affordability arguments are used, an explanation that there are no relevant alternative financing mechanisms available;
- an explanation of how consequences of non-action are taken into account and what action will be taken to address these reasons, so that in the future a time extension is no longer needed.

[12] See 4.4(b):'Extension of the deadline, and the reasons for it, are specifically set out and explained in the river basin management plan required under Article 13' and 4.4(d):' A summary of measures required under Article 11 which are envisaged as necessary to bring the bodies of water progressively to the required status by the extended deadline, the reasons for any significant delay in making these measures operational, and the expected timetable for their implementation are set out in the river basin management plan.' and 4.5(d):' the establishment of less stringent environmental objectives and the reasons for it, are specifically mentioned in the river basin management plan required under Article 13 and those objectives are reviewed every six years', including reasons why 'the environmental and socioeconomic needs served by such human activity cannot be achieved by other means, which are a significantly better environmental option not entailing disproportionate costs' (4.5(a)).

3.2.9 Link with Strategic Environmental Assessment and Environmental Impact Assessment

Both in applying Article 4.4/4.5 and in applying Article 4.7, the question may arise regarding how a link to the Environmental Impact Assessment (EIA)[13] and/or Strategic Environmental Assessment (SEA)[14] can be best made.

Some measures to improve status may fall within the scope of the EIA Directive and hence require an EIA (see Figure below). Furthermore, the EIA Directive gives a list of some of the environmental factors to consider in assessment of environmental costs and benefits which should be a starting point.

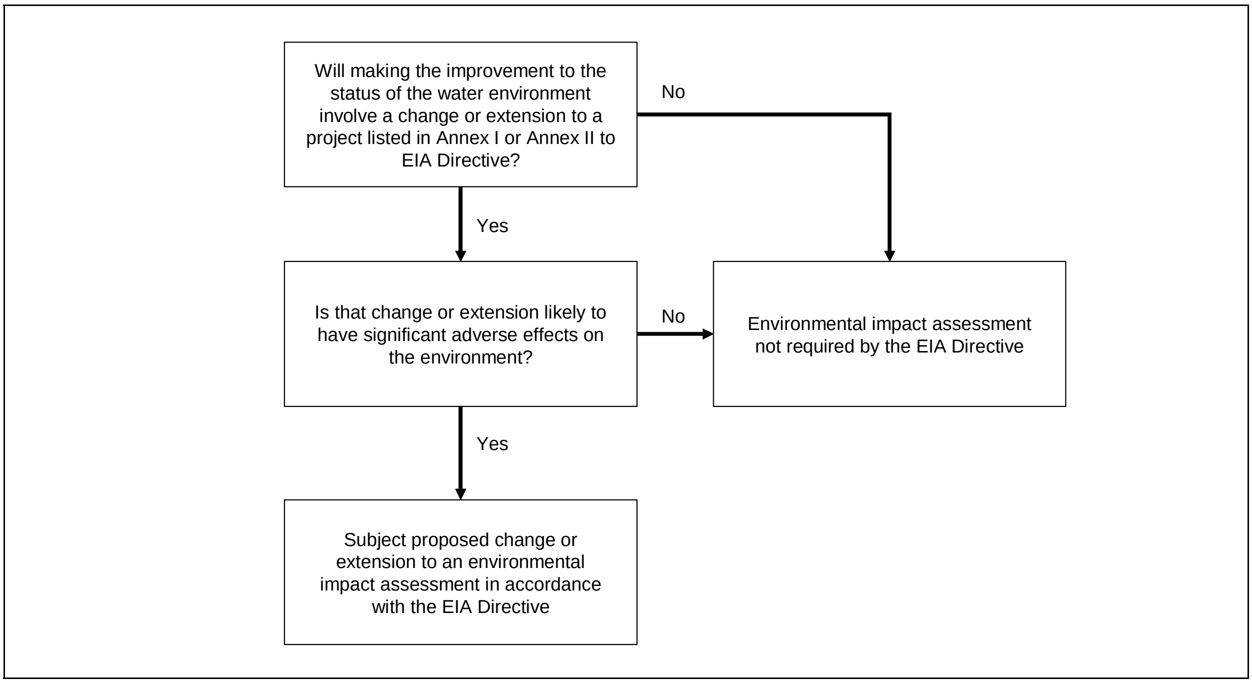

Figure 0: Link between EIA and measures under the WFD

Information from an already carried out SEA or EIA should be used as much as possible in exemptions tests. However, a formerly carried out EIA is not a blank cheque for application of the WFD exemptions.

The assessment of whether the criteria and conditions set out in **Article 4.7** are met needs to be carried out in the planning stage. Thus, it makes sense to incorporate such an evaluation into the environmental impact assessment which has to be done for most of these types of projects. However, even if certain projects are not covered by the EIA Directive, article 4.7 may apply. For plans and programmes affecting the environmental objectives of the WFD, the evaluation in accordance to 4.7 should be incorporated into the SEA[15].

In summary, the planning of "new modifications" requires the carrying out of an assessment of the environmental impacts which demonstrates, at least, that the criteria and conditions of Article 4.7, but also 4.8 and 4.9, are met.

[13] Directive 85/337/EEC

[14] Directive 2001/42/EC

[15] See guidance document on the implementation of the SEA Directive, available at http://europa.eu.int/comm/environment/eia/sea-support.htm

3.3 Key issues for Article 4.4 and 4.5

3.3.1 Relationship between Article 4.4 and 4.5

The relationship between Article 4.4 and Article 4.5 is not a hierarchy in the sense that Member States must prove that one is ruled out before considering another. Member States are free to apply either exemption, provided the relevant exemption tests are met. However, the conditions for setting less stringent objectives require more information and in-depth assessment of alternatives than those for extending the deadline. For this reason, there should be a stepwise thinking process for considering what sort of exemption may be most appropriate (see Figure 1).

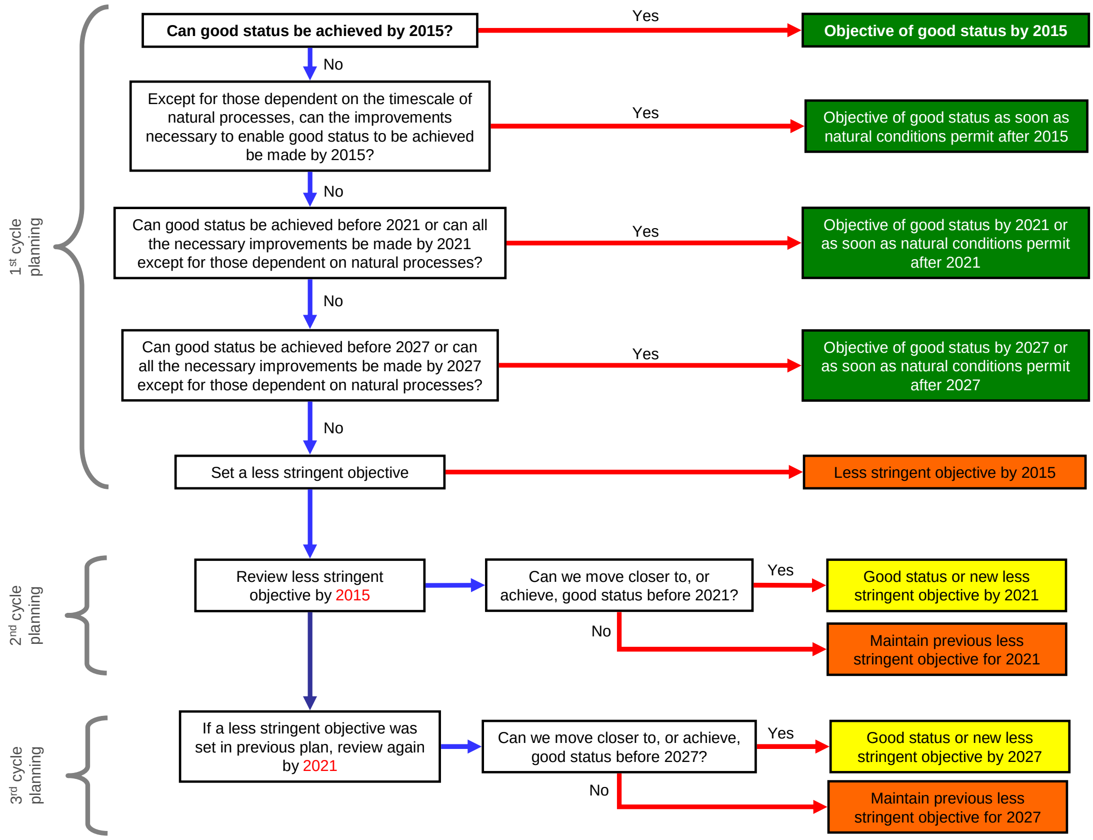

Figure 1: Stepwise thinking process for the considerations of exemptions from good status. The orange boxes refer to Art 4.5, the green except the first box to Art 4.4. For water bodies designated as heavily modified or artificial, references in the Figure to 'good status' should be taken to mean 'good ecological potential and good surface water chemical status[16]. Note, if the objective of "good status" is aimed for (green boxes), the achievement of "good status" needs to be confirmed by monitoring data.

[16] All information needed for the decision on exemptions should be on the desk before starting the stepwise process, especially the economic data and assessments, as these make it possible to test the proportionality of costs, which is one assumption for the achievement of good status

3.3.2 Internal logic of Article 4.4

Figure 2 summarises the principal tests involved in deciding whether the application of an extended deadline is appropriate. Other tests also need to be considered before applying an extended deadline. These include meeting the conditions specified in paragraphs 8 and 9 of Article 4 of the Directive.

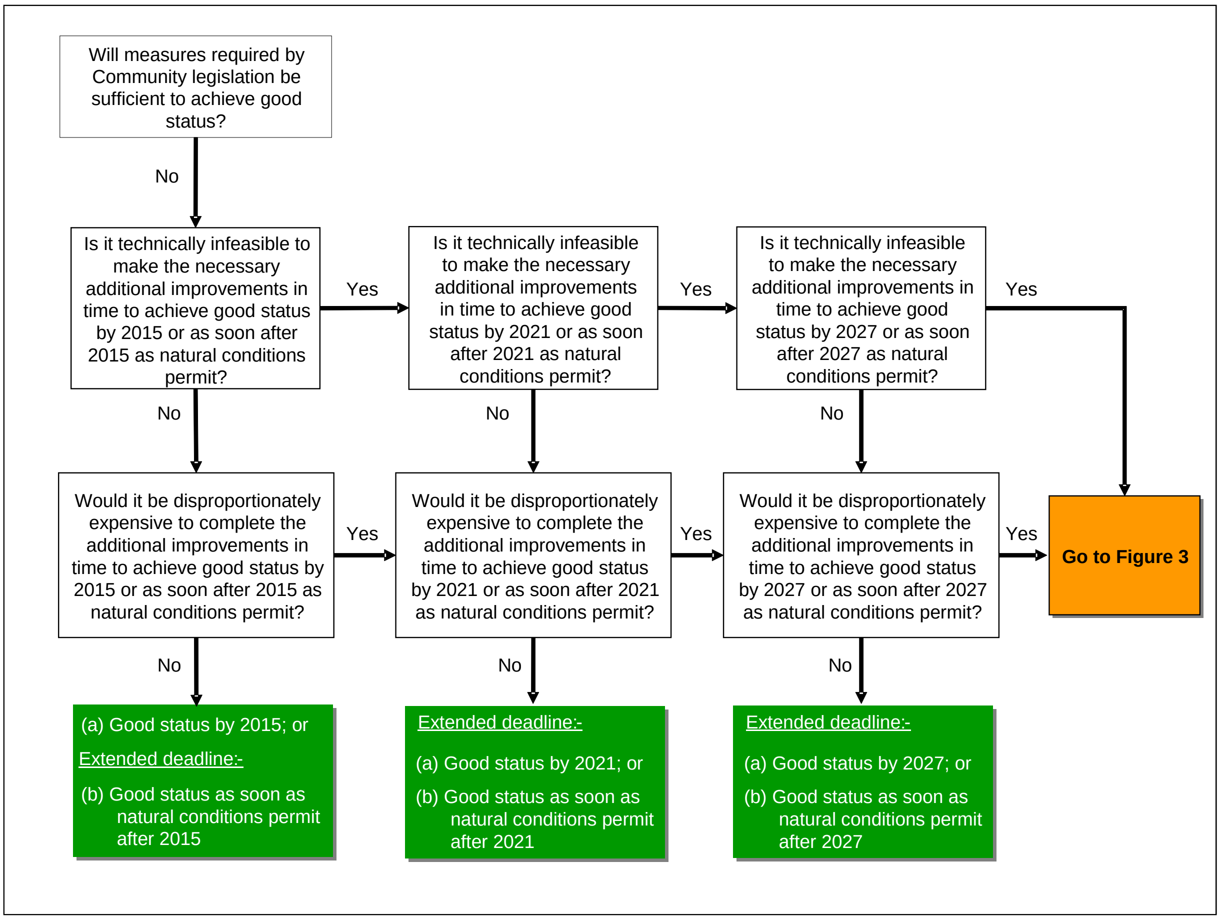

Figure 2: Internal logic of Article 4.4 - References in the Figure to good status should be interpreted as references to good ecological potential and good chemical status when dealing with heavily modified or artificial water bodies.

The Figure represents the internal logic of Article 4.4 as a step-wise linear process. However, in practice Member States may apply the process in a more iterative manner. For example, where it is technically infeasible to achieve good status by 2015 because there is no known technique for doing so (see above), consideration of the other tests illustrated in Figure 2 will not be relevant. Instead, the application of a less stringent objective (see Figure 3 below) could be considered. In contrast, if achieving good status by 2015 is technically infeasible because of technical constraints on the timing of making the measure operational, consideration of whether the measure could be implemented in time to achieve good status by 2021 or 2027 would be relevant in order to decide if an extended deadline might be applicable.

The tests should not be applied in relation to any improvements to the status of water bodies that are required by other Community legislation (see above). Exemptions may only be applied in relation to the additional improvements that would be necessary to achieve good status once compliance with relevant Community legislation has been achieved.

Where an exemption for an extended deadline is applied, a summary of the measures envisaged as necessary to achieve good status by the extended deadline and the expected timetable for their implementation must be set out in the RBMP. A review of the implementation of these measures and a summary of any additional measures must be included in updates of the RBMP. In the second and third planning cycle, Figure 2 should be used by leaving out the first column boxes referring to 2015.

The tests require consideration of the measures needed to address the pressures on the water body and so create the conditions necessary for the achievement of good status. It should be borne in mind that the rate of recovery of the water body to good status once such conditions have been established may be delayed because of natural conditions. Where natural conditions are preventing the timely achievement of good status by 2015, Article 4.4 provides that the deadline may be extended until such time as the water body recovers to good status.

Some changes of the institutional framework for putting alternative financing mechanisms in place, or addressing other administrative or legal constraints, may need time. In some cases, pursuing these changes within the first management cycle may lead to disproportionate costs. In cases where certain procedural requirements need to be fulfilled to take measures, the deadline for achieving the environmental objectives may need to be extended. In all cases where administrative or legal constraints occur, a description of the constraints has to be given in the RBMP as well as an explanation of how these constraints will be addressed in the future.

3.3.3 Internal logic of Article 4.5

Figure 3 is intended to illustrate the process of checking whether a less stringent objective is applicable and, if so, the process for identifying what the less stringent objective should be.

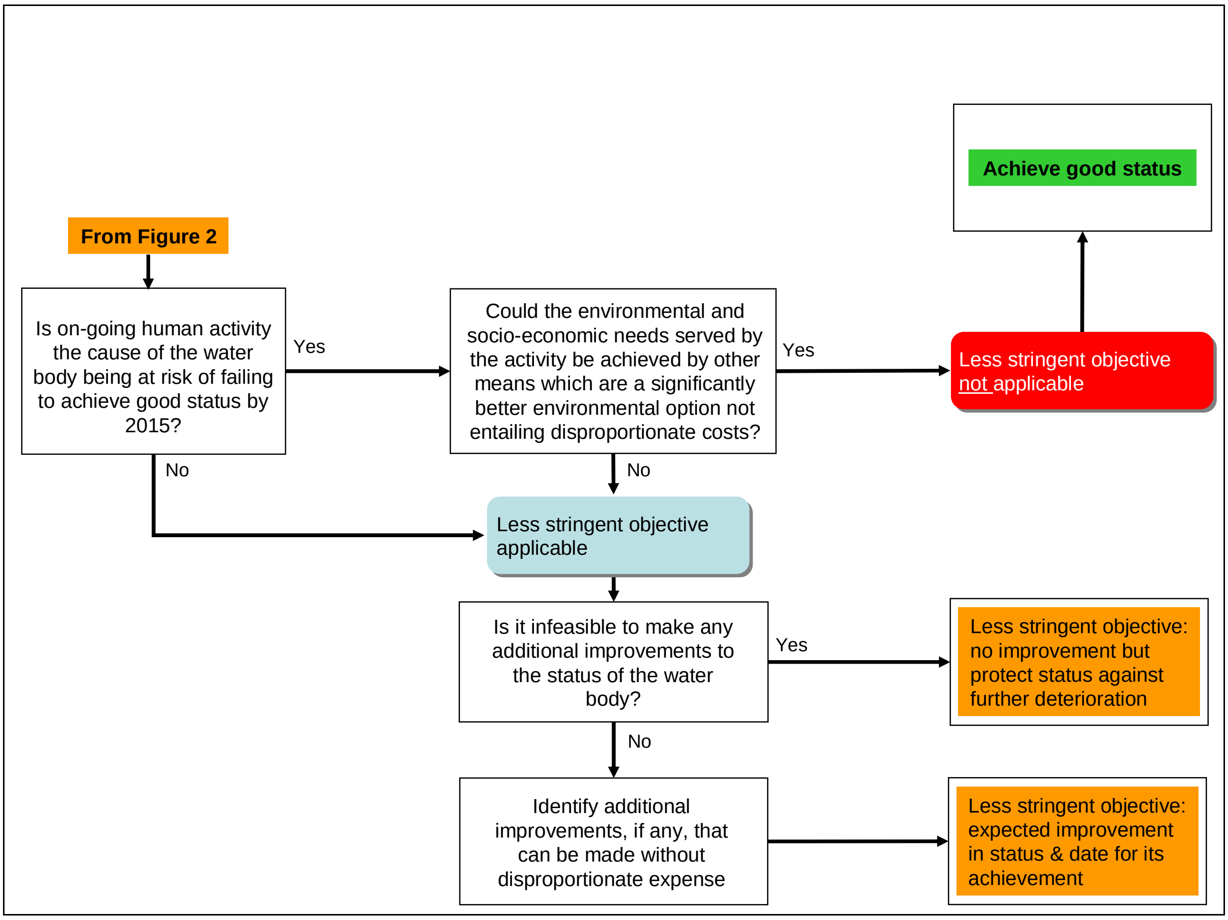

Figure 3: Internal logic of Article 4.5 - References to status should be interpreted as references to ecological potential and chemical status when dealing with heavily modified or artificial water bodies.

Figure 3 should be read in conjunction with Figure 2. According to the step-wise approach, it assumes that the tests indicated in Figure 2 have already been applied.

The Figure illustrates the process for the first cycle. The application of any less stringent objective must be reviewed in each subsequent planning cycle. When reviewing a less stringent objective, the internal logic illustrated in Figure 3 still applies. However, references in the Figure to 2015 should be treated as references to the deadline relevant to the planning cycle concerned (e.g. 2021; 2027; etc).

Before setting a less stringent objective, Member States must decide whether the environmental and socio-economic needs served by any activity that is preventing the achievement of good status could instead be provided by other means which are a significantly better environmental option not entailing disproportionate costs. Where the achievement of good status is being prevented by impacts resulting from human activities which have now ceased (e.g. historically contaminated land or sediment), this test will not be relevant.

If the test for other means is failed (i.e. if an 'other means' exists), an exemption cannot be applied and the objective for the water body will remain to aim to achieve good status. Member States are free to choose how they then achieve good status. They are not obliged to implement the identified other means of providing the benefits served by the activity as part of those measures.

In principle, a less stringent objective should represent the condition expected in the water body once all measures that are feasible and not disproportionately expensive have been taken. For example, this could mean that a less stringent objective is for the majority of the quality elements to be protected at, or restored to, values consistent with good status even though the overall status may be worse than good because of remaining impacts on other quality elements. A 'less stringent objective' does therefore not mean that (a) the other quality elements are permitted to deteriorate to the status dictated by the worst affected quality element or (b) the potential for improvement in the condition of other quality elements can be ignored.

In some cases it may be technically infeasible or disproportionately expensive to make any improvements in the status of a water body within the period covered by the relevant river basin management plan or update. In such cases, Member States must nevertheless prevent further deterioration of status, subject to the application of paragraphs 6 or 7 of Article 4 of the Directive. It should be noted that the term "infeasible" used in Article 4 (5) is broader than the term "technical feasibility" used in Article 4 (4).

The achievement of a so called "less stringent objective" may require the implementation of measures that are as stringent, if not more so, than the measures that are required for water bodies for which the objective is good status.

3.3.4 Application of new exemptions in subsequent planning cycles

On the basis of new knowledge gathered in the subsequent planning cycle, it may be necessary and appropriate in some cases to apply a new exemption under article 4.4 or 4.5 in the next update of the river basin management plan. For example, suppose a Member State finds that a water body will not achieve the objective set for it because the measures the Member State implemented are proving less effective than expected. If bringing the achievement of the objective back on track would be infeasible or disproportionately expensive, an extended deadline up to 2027 or a less stringent objective may be applied, as appropriate. Along the same lines, it is possible to apply a less stringent objective in a subsequent planning cycle for a water body for which an extension of the deadline was applied in an earlier planning cycle or it could be concluded that an exemption is not necessary anymore for the second or the third planning cycle.

The internal logic of Article 4.4 and 4.5 illustrated in Figures 2 and 3 above applies equally where the application of new exemptions is being considered in subsequent planning cycles. However, references in the figures to the deadlines for achieving objectives will change accordingly.

3.3.5 Natural conditions

The term 'natural conditions' is used both in Article 4.4 and 4.5 and refers to the conditions which dictate the rate of natural recovery. It recognises that it may take time for the conditions necessary to support good ecological status to be restored and for the plants and animals to recolonise and become established. It also recognises that due to varying natural hydrogeological conditions, groundwater bodies may take time to reach good chemical status. Climate change can also change the natural conditions over time.

3.4 Key issues for Art 4.6

Article 4.6 provides, under certain conditions, an exemption for temporary deterioration of the status of bodies of water in certain circumstances, which are exceptional or could not reasonably have been foreseen. In order to apply Art 4.6 a common understanding of the different terms below is needed, as well as a common understanding of the terms extreme floods and prolonged droughts.

- *Temporary deterioration:* The length of a temporary deterioration (Article 4.6) is linked to the length of the circumstances of natural cause, which are exceptional or could not reasonably have been foreseen and the practicability[17] of the measures that can be taken to restore the status of the water bodies.
- *Natural cause:* 'Natural cause' refers to events like floods and droughts which give rise to situations which cause us to make use of the water environment in ways that results in its deterioration of status (e.g. by taking emergency action to save life and property during floods; by supplying the public with drinking water during prolonged drought; by having pollutants to be washed into the water environment by floods). It is essential for proper river basin management planning and the application of Article 4(6) to make a distinction between the natural cause itself and the effects of management practices. WFD Article 4.6 deals with circumstances of natural cause which are exceptional or could not reasonably have been foreseen.

3.4.1 Extreme floods

The term 'extreme floods' recognises that, whilst it is possible to have some knowledge of the quantitative range of numerical flows and levels that might occur and the possible frequency of flood events, it will not be possible to foresee all flood events or to extrapolate all of their consequences in terms of environmental and other impacts.

The new Flood Risk Management Directive[18] introduces a EU-wide *"framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences for human health, the environment, cultural heritage and economic activity".* This includes the setting up of preventive measures which can contribute to the prevention of deterioration of status as provided for by the WFD. Thus, a closely coordinated and coherent implementation of both Directives will maximise synergies in the achievement of their objectives.

Despite all required preventive measures, however, some flood events will lead to "temporary deterioration" for which it is justified to apply the exemption set out by Article 4.6 WFD[19]. The identification of such an event can finally only take place after its occurrence. However, Member States should have assessment strategies in place in which they make use, to the maximum possible extent, of the implementation of the Floods Directive.

For example, the Floods Directive introduces three categories in Article 6.3 for the purposes of mapping floods:

a) floods with a low probability, or extreme events scenarios;
b) floods with a medium probability (likely return period > 100 years);
c) floods with a high probability, where appropriate.

It is most likely that "extreme flood" events falling under category (a) will require the application of a "temporary deterioration". However, floods with a higher probability of

[17] Practicable is related to 'technical feasible, not disproportionately expensive and without natural conditions preventing the improvements' (Article 4.4(a)).

[18] Directive 2007/60/EC of 23 October 2007 of the European Parliament and of the Council on the assessment and management of flood risks.

[19] This does not, however, include those cases of coastal flooding where deterioration, as a result of coastal erosion, may be permanent.

occurrence may also be regarded as "extreme floods" in circumstances where the impacts of such floods are equally exceptional or reasonably unforeseen.

In no way does the application of exemptions under the WFD give a Member State a possibility to make an exemption from the obligation of implementing all aspects of the Directive on the assessment and management of flood risks.

3.4.2 Prolonged droughts

A drought - contrary to water scarcity- is a natural unpredictable phenomenon. The appearance of a drought is not generated by human activities. However, the impacts of a drought episode may be exacerbated by mismanagement practices. Mitigation and prevention measures can be taken in order to reduce, and potentially avoid, the consequences of a drought when it occurs, but no measures can avoid a drought.

Although not always easy in practice, Member States will have to differentiate between the effects of prolonged droughts, which are purely natural phenomena, and the effects of human activities.

'Prolonged' droughts should be clearly distinguished from non-prolonged droughts. The conditions of a prolonged drought, i.e. the circumstances that are exceptional or that could not reasonably have been foreseen, should be demonstrated, as normal dry hydrological conditions should be addressed in the reference conditions. Relevant indicators identified at EU level are necessary to facilitate the common understanding of a 'prolonged drought', similar to criteria to define 'extreme floods'. More information is provided in Annex III.

3.5 Key issues for Art 4.7

Under Art 4.7 exemptions can be applied for **new modifications** and **new sustainable human development activities.** Before explaining the main principles of applying Art 4.7 some common definitions are provided:

- New modifications: Article 4.7 has a considerable impact on new developments and modifications. Modifications to the physical characteristics of water bodies mean modifications to their hydro-morphological characteristics. The impacts may result directly from the modification or alteration or may result from changes in the quality of water brought about by the modification or alteration. For example, hydropower plants, flood protection schemes and future navigation projects are covered by this provision. Also the hydro-morphological characteristics of impoundment created for hydropower and water supply can dictate the oxygen and temperature conditions resulting in a deterioration of ecological status in the impounded water and in the downstream river. These may be different from those in a natural water body.

  The impacts of those modifications and alterations may be limited to the water bodies in which modification works are undertaken; or extend to water bodies beyond those in which the modification works are undertaken. For example, the abstraction of water from a body of groundwater may cause adverse impacts in an associated surface water body.

- New sustainable human development activities: The Directive does not give a definition of those activities. In general, such activities cannot be defined per se through a set of criteria or policies but are framed by the relevant decision making process requirements within an open ended and iterative procedure. The exact definition for an activity falling under sustainable development will thus depend on the time, scale, involved stakeholders and information available. Relevant process requirements are provided in the WFD itself, the Strategic Environment Assessment, Environmental Impact Assessment and "Aarhus" Directives and should be guided by the principles of the EC Treaty, being the *"polluter pays principle, the precautionary principle and preventive action, and the principle of rectification of pollution at source"'.* Guiding principles on sustainable development can be found in the Renewed EU Sustainable Development Strategy (EU SDS), which was adopted by the Council in June 2006[20]. Furthermore, the decision making process should follow the principles of "good governance", including policy coherence, social inclusion and transparency and make best use of the availability of alternatives. A generic approach for small business developments affecting the same water body may be considered when applying the second point of 4.7.

- Deterioration of status or potential: The ecological status (or the potential) of a water body is expressed in terms of “classes” (e.g. high, good, moderate, poor or bad). Ecological status and potential classes are established on the basis of specific criteria and boundaries in accordance with the annex V of the WFD. In the context of Article 4.7, the objectives of preventing deterioration of ecological status (or the potential) refer to changes between classes rather than within classes. Member States do not, therefore, need to use article 4.7 for negative changes within a class.

- Temporary effects: Fluctuations in the condition of water bodies can sometimes occur as a result of short-duration human activities, such as construction or maintenance works. If the condition of each affected water body is adversely affected for only a short period of time and recovers within a short period of time[21] without the need for any restoration measures, such fluctuations will not constitute deterioration of status. The application of Article 4.7 will not be required.

  For example, temporary impacts due to the establishment of the modification during the building phase are not required to be addressed if no deterioration of status or potential could be expected thereafter in the water body or parts of the water body.

  Article 4.6 provides, under certain conditions, an exemption for temporary deterioration of the status of bodies of water in certain circumstances, which are exceptional or could not reasonably have been foreseen. An exemption under Article 4.7 will be unnecessary in those cases in which an Article 4.6 exemption is applicable.

- Small size projects: The size of the project is not the relevant criteria to trigger article 4.7. The relevant approach is to assess if a given project, whatever its importance is, will result in deterioration of the status of a body of surface water or groundwater or prevent the achievement of good ecological status, good ecological potential or good groundwater status or from high status to good status of a body of surface water. Thus, projects of any size may fall under article 4.7. However, for small projects not falling within the scope of the EIA Directive (85/337/EEC) a generic approach can be used in order to reduce the assessment burden.

In addition to the explanations above, the conditions under which Article 4.7 can be applied are presented in the figure below in a stepwise approach. This flow chart aims to be a practical tool when considering application of Article 4.7.

In comparison to the exact text of the Directive (art 4.7) c), the order of Box 3 and 4 have been changed. This is done for two reasons. Firstly, the considerations in Box 2 and 3 may result in adaptations of the project. This is not the case for the considerations from Box 4 onwards.

[20] Available at: http://register.consilium.europa.eu/pdf/en/06/stlO/stl0117.en06.pdf

[21] No definition will be given of 'short period of time'. However, the frequencies mentioned for the monitoring programmes (Annex V 1.3.4 and 2.2.3) can serve as an indication.

Secondly, Box 3 refers to the process of looking for alternatives, which should be done at an early stage of drafting the project, when better alternatives are available.

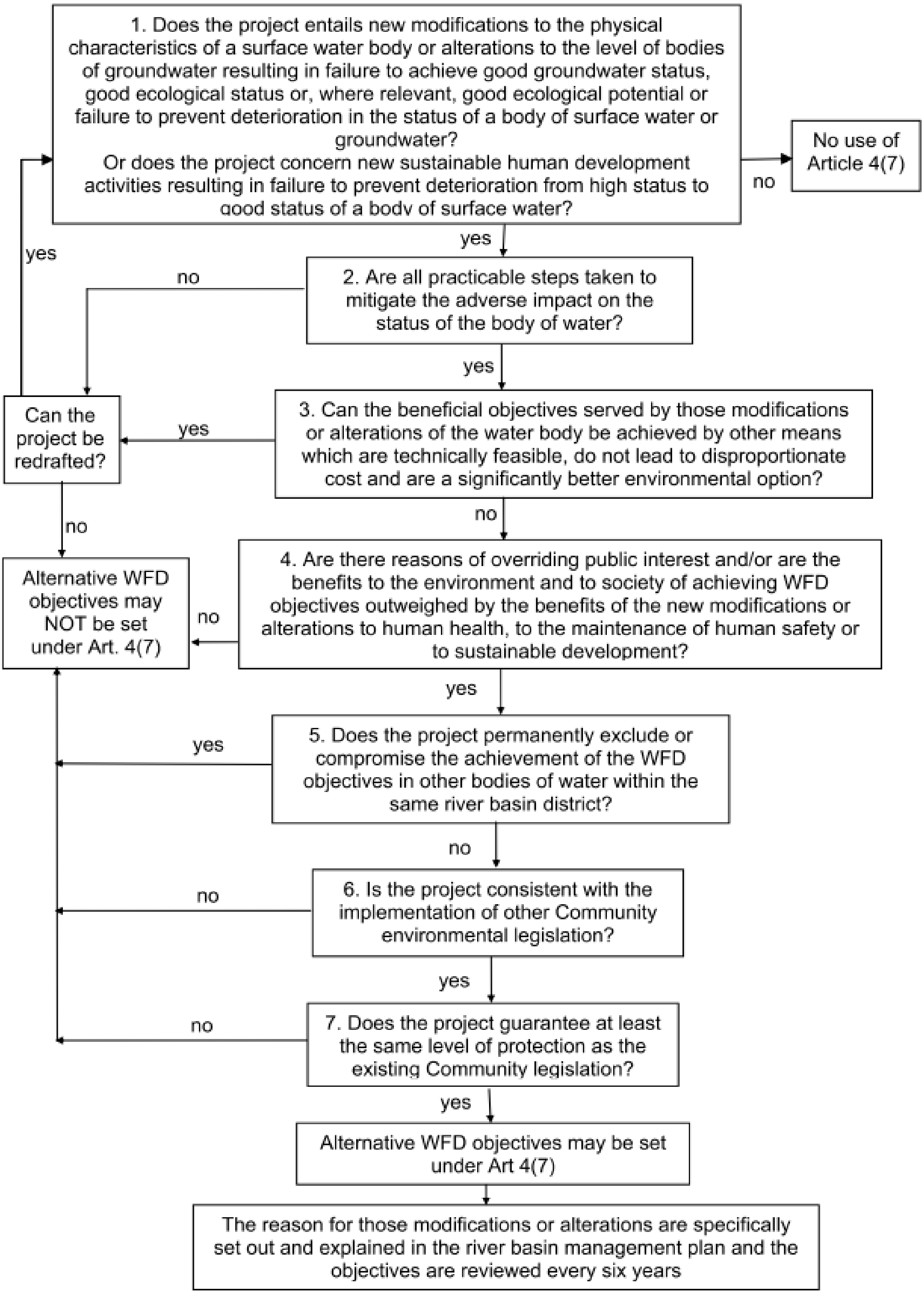

Figure 4: Example for an iterative approach, which should allow the re-assessment of the potential identification of a sustainable development activity done at the beginning.

Like all WFD exemptions, article 4.7 does not apply when the provisions of articles 4.8 and 4.9 are not fulfilled. In other words, use of the exemptions is allowed when they guarantee at least the same level of protection as existing Community legislation and provided that they do not permanently exclude or compromise the achievement of the wider objectives of the WFD under Article l in other bodies of water within the same river basin district.

In the following paragraphs, the different conditions of the Article 4.7 assessment are explained in more detail.

3.5.1 Practicable steps to mitigate adverse impacts

As indicated in box 2 in figure 5, all practicable steps have to be taken to mitigate the adverse impact on the status of the water body. As article 4.7 requires only mitigation, it is at first important to make a clear distinction between:

- Mitigation measures, which aim to minimise or even cancel the adverse impact on the status of the body of water, and
- Compensatory measures, which aim is to compensate in another body of water the "net negative effects" of a project and its associated mitigation measures.

Article 4.7 does not require compensatory measures.

The notion of "steps" addresses potentially a wide range of measures in all phases of development, including maintenance and operation conditions, facilities' design, restoration and creation of habitats.

The wording "all practicable steps", in analogy with the term "practicable" used in other legislation, suggests those mitigation measures should be technically feasible; do not lead to disproportionate costs; and are compatible with the new modification or sustainable human development activity.

3.5.2 Overriding public interest

As indicated in box 4, when applying Article 4.7, the reasons for those modifications or alterations are of overriding public interest. This concept is also used in the Habitats Directive (92/43/EEC) and other EC law. Though there is no case law from the European Court of Justice on the application of this concept to the Habitats Directive, the European Commission's "Methodological guidance on the provisions of Article 6.3 and 6.4 of the Habitats Directive 92/43/EEC: Assessment of plans and projects significantly affecting Natura 2000 sites"[22], may bring some clarification. It is reasonable to consider that the reasons of overriding public interest[23] refer to situations where plans or projects envisaged prove to be indispensable within the framework of:

- Actions or policies aiming to protect fundamental value for citizen's lives (health, safety, environment);
- Fundamental policies for the state and the society;
- Carrying out activities of an economic or social nature, fulfilling specific obligations of public services.

[22] Some consideration to defining "Overriding public interest" can be found at http://europa.eu.int/comm/environment/nature/nature_conservation/eu_nature_legislation/specific_articles/art6/index_en.htm

[23] Note that the consideration of "overriding public interest" only applies to the first part of Article 4.7 c, not to the second part.

Furthermore, public participation will contribute considerably in determining overriding public interest[24].

3.5.3 Benefits of the new modification versus benefits to the environment

In Box 4, it is asked whether the benefits to the environment and to society of achieving the objectives set out in paragraph 4.1 (of the Directive) are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development. The benefits of achieving the environmental objectives of Article 4 include:

- In case of deterioration of status, those benefits and opportunities foregone as a result of the deterioration of status (e.g. loss of biodiversity); and
- In case of failure of reaching good status or potential, those benefits that would be provided if the achievement of good status or good ecological status were not prevented (e.g. drinking water supply is not longer possible).

The "water costs" (negative benefits) have to be put in balance with the potential benefits and other costs (increased use of other natural resource, including global impacts) of the new modifications and alterations to human health, to the maintenance of human safety or to sustainable development. Thus, other categories of possible benefits and costs will have to be considered and -if possible- calculated.

In conclusion, an analysis of the costs and the benefits of the project adapted to the needs of the Directive is necessary to enable a judgement to be made on whether the benefits to the environment and to society of preventing deterioration of status or restoring a water body to good status are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development.

This does not mean that it will be necessary to monetise or even quantify all costs and benefits to make such a judgement. The appropriate mix of qualitative, quantitative and, in some cases, monetised information should depend on what is necessary to reach a judgement and what is proportional and feasible to collect.

3.5.4 Article 4.7 and the designation of heavily modified water bodies (HMWB)

After a new hydro-morphological alteration has occurred, it may be that the water body qualifies for designation as a heavily modified water body in accordance with Article 4.3 in the next planning cycle. There is no requirement that the designation has to wait until the publication of the next River Basin Management Plan. However, **water bodies cannot be designated as HMWBs before the new modification has taken place** because of the anticipation of the significant hydro-morphological alteration.

After the application of article 4.7 and in case of designation of new HMWBs, the step by step approach developed within the HMWB guidance document should be applied without the "provisional identification-step".

[24] See Guidance Document No 8: Public Participation in relation to the Water Framework Directive on http://forum.europa.eu.int/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents

3.5.5 Reporting article 4.7 in the RBMP and public consultation

Annex VII of the WFD describes the information that should be included in the RBMP. Under point A.4, the current status of the water bodies must be assessed as a result of the monitoring programmes. Under point A.5, the environmental objectives established for surface waters and groundwaters must be listed, including identification of the use of the exemptions and the associated information required under Article 4.

The risk of deterioration of status occurring should be assessed at the time a new modification or alteration is being considered. The assessment of risk should be based on the best information available on the status of those water bodies whose status is likely to be affected by the proposed project. Such information should include the latest information from the monitoring programmes required under Article 8 and information obtained from any environmental impact assessment undertaken for the project.

Further, under article 4.7 (b), there is a general provision that "the reasons for those modifications and alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years". This is a reporting obligation and does not mean that Member States must wait until the publication of the River Basin Management Plan before allowing a new physical modification or new sustainable development activity to proceed. In many cases projects will be developed within the RBMP six-year cycle.

For modifications and alterations within the scope of the Environmental Impact Assessment Directive, Member States must ensure that the public concerned is given the opportunity to express an opinion before the project is initiated.

Even if timing of a project is such that consultation on the RBMPs will not provide the opportunity for interested parties to express their views in advance of those decisions, Article 14 requires Member States to encourage the active involvement of all interested parties in the implementation of the Directive. It is recommended that Member States ensure that such opportunities are provided in relation to projects that are outside the scope of the Environmental Impact Assessment Directive but likely to result in deterioration of status or to prevent the achievement of good ecological Status, good ecological potential or good groundwater status.

The information provided through such consultations will help Member States in reaching a judgement on whether the exemption conditions are met and will reduce the likelihood that interested parties will challenge the subsequent decision.

If a modification or alteration goes ahead in the middle of a river basin planning cycle, the reason for that modification or alteration must be set out in the subsequent (update of the) RBMPs.

4 Conclusions

The work on environmental objectives and exemptions has started in 2005 and has progressed significantly over the past years. It has become evident that Article 4 of the WFD is the heart of this legislation and the crucial element to achieve a high level of protection of our waters as part of a sustainable water management, which also takes account of the social and economic needs and realities. This document brings together the fruitful work under the WFD Common Implementation Strategy on exemptions.

In the mean time, Member States are gaining practical experience with the application of Article 4 and are preparing for the necessary discussions as part of the public consultation. Whilst it is recognised that starting points, strategies and approaches differ across Europe, it is important to make transparent the underlying reasons and data for decision-making and to not use the exemptions as a blanket excuse. In many cases it may be more effective to discuss in a proactive way what measures can be taken to improve the current situation, rather than what arguments and administrative effort can be made to avoid taking any measures.

Thus, where "good status" may not be achieved or "deterioration of the current status" is possible, no action is not an option! This document aims at contributing towards this positive and proactive attitude when implementing the WFD and thereby contributing to sustainable water management.

The process of objective setting does not stop after the first planning cycle but is dynamic and iterative which means that it should be further developed and improved on the basis of experiences in the first RBMP. It is likely that the number of water bodies for which exemptions are applied will be decreasing within the second and third planning cycle but the application will have to be adapted each time.

It may be necessary to continue the work on exemptions in the next years, focusing on practical experiences and cases from the first planning cycle.

ANNEXES

Annex I: Costs & Benefits

An analysis of the costs and the benefits of measures to achieve the objectives of the WFD may be necessary to support the judgement to be made on exemptions from these objectives. Reasonable efforts should be made to collect information on different types of costs and benefits, including the appropriate mix of qualitative, quantitative and monetised information. In addition, available information, for example from the cost-effectiveness assessment, should be used. In all cases, the data should be used in a transparent way showing how the assessments and calculations have been carried out.

Below, more specific information is given on benefits and costs in the framework of the WFD. Useful guidance on types of costs and benefits and how to assess them was also made in the **WATECO guidance**. Please see Section 2 and 3 and Annex D of this guidance document[25].

In addition to the WATECO guidance, **the study on Costs and Benefits associated with the implementation of the Water Framework Directive of** 2007[26] provides useful information on types of costs and benefits and methodology for Cost-Benefit Analyses (CBAs) (mainly Chapter 3). Currently used methodologies for estimating the total costs and benefits of the implementation of the WFD were studied, and recommendations were made on which costs and benefits to include and how to evaluate them. Issues relating to comparison and aggregation of costs and benefits were also outlined.

I.1 Benefits

The environmental objectives set in the WFD shall ensure the long-term protection and the sustainable use of the water resources and prevent further deterioration. The achievements of these objectives will have numerous benefits and socio-economic gains for this and coming generations. When examining the proportionality of costs required for achieving the objectives, these benefits can and should be taken into account. Some examples of such benefits are listed below:

- Protection and enhancement of health and biodiversity of the aquatic ecosystem (in particular since good ecological status requires good quality of the structure and the functioning of this ecosystem).
- Protection of human health through water-related exposure (e.g. through drinking, drinks and food production, bathing and consumption of fish, shellfish and seafood).
- Lower costs for water uses, e.g. water supply or fisheries and more cost effectively achieved improvements by reducing treatment and remediation costs (e.g. drinking water supply, Sediment pollution).
- Improvement of efficiency and effectiveness of water policy based on the "polluters-pays principle" (in particular by adequate water pricing policies and cost-effectiveness assessment of measures, example: reduction of amount of water use per capita).
- Increased cost-effectiveness of water management, in particular of measures to implement and apply, for example the Nitrates, Urban Wastewater Treatment and IPPC Directives.

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25 http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents/guidancesnos1seconomicss/_EN_1.0_&a=d

26 http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/thematic_documents/economic_issues/benefits_implementation/report_septl2pdf/_EN_1.0_&a=d

- Integrated river basin management - as introduced by the WFD – should help authorities to maximise the economic and social benefits derived from water resources in an equitable manner instead of repeating the mistaken and fragmented approaches of the past, which dealt with problems in a local, and usually temporary, basis. This should translate, *inter alia,* in designing more cost-effective measures to meet the environmental objectives of other EU legislation (see above). Especially for new Member States, the cost-saving potential is great the lessons from the experiences in EU15 are learnt[27].
- Improvement of the quality of life by increasing the amenity value of surface waters (e.g. for visitors, tourists, water-sports users, conservationist) and by increasing its non-use value and all non-market benefits associated.
- Mitigation of impacts from **climate change and security of water supplies** (e.g. by forward planning in river basin management, water demand and supply management and mitigation of flood and drought events)
- Mechanisms to address **conflicts and regional disadvantages** by balancing interests of different water users and creating a level playing field for water users across the EU[28] (in particular by addressing and managing all demands on water resources from drinking water supply, agricultural and industrial uses, navigation, hydropower, etc. in a consistent and comparable way).
- Promotion of sustainable uses thereby **creation of new jobs** (e.g. in ecotourism, fisheries, environmental technologies and nature conservation sector).

Some of these benefits are financial like e.g. the saving of costs for water supply (economic benefits) and therefore can be expressed in monetary terms, or, if the acquisition of the corresponding data requires a disproportionate effort, can at least be estimated. However, on the basis of existing methodologies, it is difficult to attribute a monetary value to many types of environmental and social benefits. The existing Information Sheet on "Environmental and Resource Costs" clarifies many concepts and outlines a few examples of how to measure them in monetary terms. Another useful tool is the "Millennium Ecosystem Assessment Report"[29] which includes substantial information on freshwater ecosystem values as well as more recent study on The Economics of Ecosystems and Biodiversity (TEEB)[30] which quantified the costs of in-action for many ecosystem services. Member States need to make an effort to value or assess social and environmental benefits/costs more appropriately than in the past. Without this, it is likely that many assessments of disproportionate costs, taking place as part of the WFD implementation, will be incorrect.

However, it will not always be necessary to place a monetary value on all costs and benefits. Member States will need to collect sufficient information on costs and benefits to support good decision making, taking into account the costs associated with the collection of the relevant information. There is a need for pragmatic approaches in order to be able to take benefits into account if this monetary information is incomplete or not fully available. Some of these benefits may be assessed by using qualitative information. In other cases, an appropriate alternative may be the application of the "precautionary principle" or it might be possible to make a qualitative assessment of the benefits and to weigh them up against the costs.

More work is required to achieve full assessment of benefits (monetary or not) derived from the implementation of measures under the WFD. It is expected that, e.g. the ongoing

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[27] See e.g. EEA report on "Effectiveness of urban wastewater treatment policies in selected countries: an EEA pilot study". Final draft of 19 April 2005.

[28] and with non-EU countries sharing a river basin with the EU.

[29] http://www.maweb.org//en/index.asp

[30] http://ec.europa.eu/environment/nature/biodiversity/economics/index_en.htm

work on environmental costs (both within the WFD implementation as well as in a wider context) will improve this situation.

I.2 Costs

While recognising the considerable benefits, achieving the environmental objectives may have additional costs on those water uses or "driving forces" which have a negative impact on the aquatic environment or beneficiaries from improvements and which have not - up until now - contributed to address such impacts (e.g. not paying for the water use). At the moment, these potential costs are not known for various reasons. First, it is impossible to determine the costs before criteria for the environmental objectives are available. The water quality has to be monitored in accordance with the Directive. Only when comparing the monitoring results with the environmental standards (as defined through Annex V WFD) will it be possible to assess the "distance to target" and thereby the required investments. Second, the costs are largely dependent on the choices of instruments and combination of measures that Member States will use. Third, application and enforcement of other water protection legislation, in particular the Urban Waste Water Directive, the Nitrates Directive and the Drinking Water Directive, are inadequate in a number of countries and, thus, costs related to implementing those are easily, but wrongly, added to the costs of implementing the WFD. In the end, it is not always possible to distinguish between the water management costs incurred due to the implementation of the WFD, and the costs which would have been incurred in the absence of the WFD. However, this distinction is crucial for performing the different analysis of costs. The costs of basic measures according to existing EC water related directives (UWWD, IPPC, Nitrate etc.) can not be included in the analysis for justification of exemptions.

Independent of the lack of concrete cost-estimates, the WFD incorporates mechanisms that the socio-economic impacts are properly addressed in the decision-making and that the least cost option is selected. The way that such considerations are addressed in the directive is mainly through the above-mentioned exemptions and the development of the programme of measures as an integral part of the planning process.

If there is sufficient evidence that costs seem to be disproportionate, careful assessment and balanced decision-making on benefits and costs is an integral part of the WFD, in particular through the "exemptions" tests.

Further to the considerations in the objectives, the socio-economic aspects and, in particular the **cost-effectiveness,** is a central part in the development for the Programme of Measures. The Member States should attempt to ensure that the combination of measures for achieving the environmental objectives is resulting in the least cost option after giving sufficient attention and consideration to environmental and resource costs. Such approaches, which should be applied on national or river basin, sub-basin or water body level, leave enough flexibility in order to address issues of concern.

Furthermore, the proposed options including the use of certain exemptions and the proposed programme of measures must be subject to **public participation** in which all interested stakeholders are encouraged to be involved.

The WFD provides for environmental objectives which should be achieved by the most cost-effective combination of measures. Cost-effectiveness assessment and public participation of proposed choices are the key instruments in this process.

Annex II: Exemptions in a transboundary context

II.1 Principles for applying exemptions in a transboundary context

Exemptions may be applied in cases where a certain Member State cannot resolve the reasons for not achieving the environmental objectives because they lay outside the competence and jurisdiction of the Member State. When applying such an exemption, the following principles should be taken account of.

The coordination mechanisms as mentioned in WFD Article 3.4 or Article 3.5 or covered by other pieces of legislation (e.g. air quality) should be in place and have been exploited to the fullest extent to resolve the problem. In this context, the Member States concerned should coordinate their efforts to apply the most cost effective solution to solve the environmental issue for which an exemption may be required. - Furthermore, the Member State has to take all measures on its own territory that will contribute to achieving good status, and that are not disproportionate expensive or technically infeasible.

Finally, the Member State has to demonstrate that the reasons for not achieving the environmental objectives are outside its jurisdiction and its competence. This could for example be done by information provided by the other Member State, and/or by information provided by a monitoring point at the border between the Member States concerned or by other means.

II.2 Reasons for applying exemptions in a transboundary context

Exemptions in a transboundary context could relate to transboundary pollution, but also to hydro-morphological alterations or other transboundary ecological impacts or in the case of extreme events.

Transboundary pollution was specifically discussed in the context of the negotiations of the Commission proposal on environmental quality Standards (EQS) for priority substances[31], in particular for the following issues:

- where EQS are exceeded because the pollution load which is transported from an upstream country (whether this country is a EU Member State or not) through transboundary rivers;
- where EQS are exceeded because long-range transboundary air pollution transports high loads of pollutants (in particular heavy metals and PAHs) into the Member State concerned[32];

In both cases, the exceedance of the EQS *"cannot be resolved by that Member State"* since the sources of pollution are outside the competence and jurisdiction of the Member State. So it appears most likely that in these cases of transboundary pollution, the exemptions (Article 4.4, 4.5 and 4.6) would be applicable. Countries receiving transboundary pollution via marine currents or by atmospheric deposition are also considered downstream (or affected) countries in the context of Section 3.2.7 and this Annex.

[31] COM(2006) 397 final of 17.7.2006; 2006/0129 (COD)

[32] It should be noted that other EU or international legislation or agreements might be applicable to this issue, for example the protocols under the UNECE Convention on Long-range Transboundary Air Pollution.

II.3 Conditions of the exemptions in transboundary context

Similar to applying exemptions in a national context, it needs to be demonstrated if the conditions of Article 4.4 and 4.5 are met. Subparagraph 4.5(a) needs special attention in this case: the application of sub-paragraph (a) is clear in cases where human activities are carried out within a Member State and where an assessment of the environmental and socio-economic needs of the human activities and its alternatives is carried out. In case of transboundary effects, there is no human activity within the Member States' competence that can be compared with another. The human activity causing the pollution or the ecological impacts is outside the jurisdiction of the Member State. Thus, this condition does not apply in case of transboundary pollution or transboundary ecological impacts.

WFD Article 3

WFD Article 3.4 requires Member States to ensure coordination of the requirements for the achievement of the environmental objectives for international river basin districts within the territory of the EU. For international river basin districts partly outside the territory of the EU, the requirement is to 'endeavour to establish appropriate coordination'. It is obvious that this includes the coordination of the application of exemptions. It is of particular relevance that the coordination ensures that all relevant information and data are being exchanged between the Member States and/or other countries. For example, if the upstream Member State intends to apply an exemption on its territory, the downstream country should be informed as soon as possible and access to all information should be guaranteed. The international river conventions and other relevant international agreements play an important role in fostering and improving this information exchange.

WFD Article 12

In case the reasons for not achieving good status cannot be resolved by a Member State since they are outside the competence and jurisdiction of the Member State, the WFD includes the Provision of Article 12 ***"Issues which cannot be dealt with at a Member State level".*** Article 12 provides for:

"1. Where a Member State identifies an issue which has an impact on the management of its water but cannot be resolved by that Member State, it may report the issue to the Commission and any other Member State concerned and may make recommendations for the resolution of it.

2. The Commission shall respond to any report or recommendations from Member States within a period of six months."

Article 12 might be invoked for various situations related to exemptions. It might for example be applied in cases where no information on exemptions is provided, or it might be applied to solve the issue for which an exemptions needs to be applied by a neighbouring Member State. Article 12 could be invoked at the same time when applying the exemption in the drafting phase of the river basin management plan.

The possible reaction by the Commission will vary depending on the issue.

Demonstration of evidence

The key issue in both applying the exemption and invoking Article 12 is the **demonstration of evidence** that Member States have taken all reasonable actions to fulfil the legal obligations.

When applying exemptions, the reasons for this need to be mentioned in the river basin management plan. Furthermore, it is important to inform neighbouring countries as soon as possible on intermediate Steps related to the evidence, the intermediate objectives and the expected evolution, in order to enable the neighbouring country to adapt their own river basin management.

When a Member State is reporting to the Commission under Article 12, it will have to provide information which support their argument and allow the Commission to verify that the non-achievement of an objective is clearly linked to the transboundary pollution or other transboundary effects. In general, such demonstration of evidence can be achieved through an appropriate and targeted monitoring strategy or a comprehensive risk analysis in accordance with Article 5 and Annex II WFD.

Annex III: Background information on prolonged droughts

The 'Drought Management Plan Report, including Agriculture, Drought Indicators and Climate Change' (also DMP report) of the Water Scarcity and Drought Expert Network notes that there are various types of droughts. For the application of exemptions according to WFD Article 4(6), the term to be used is "prolonged droughts". Whilst it will be difficult to find an all encompassing definition for what a "prolonged drought" is, it would be beneficial to enhance the common understanding for the application of the term in the context of the WFD exemptions.

As the WFD indicates in Article 4.6, the Member State may declare a "temporary deterioration" to achieving the objectives of Article 4.1 on the basis of the following conditions:

- It is a result of natural causes or *force majeure* which are exceptional or which could not reasonably be foreseen and which are reviewed periodically (e.g. through a follow up of the Programme of Measures (PoM) and/or Drought Management Plan);
- All practicable Steps are taken to avoid further deterioration (Article 4.6(a));
- Measures taken during the prolonged drought do not compromise the recovery of the water body after the prolonged drought and are included in the PoM (Article 4.6(c));
- Measures to restore the water body are taken as soon as reasonably practicable and are included in the next update of the River Basin Management Plan; (Article 4.6(c) and 4.6(d))
- A summary of effects of the prolonged droughts is included within the RBMP (Article 4.6(e)).

Section 10 of the Paper "Exemptions to the Environmental Objectives under the Water Framework Directive, Article 4(4), 4(5), and 4(6)" already highlights a few issues regarding the exemption under 4(6).

First, 'prolonged droughts' are one of the natural causes for which the exemptions under Article 4(6) may be applied. It is highlighted again that a **drought - contrary to water scarcity - is a natural and unpredictable phenomenon[33].** The appearance of a drought is not generated by human activities. However, the impacts of a drought episode depend on the degree of use of the resource in a particular river basin and may be exacerbated by mismanagement practices (i.e. water resource management that is not sustainable). Some mitigation and prevention measures can be taken in order to (partially) reduce the effects of a drought when it occurs, but no measures can avoid a drought.

Secondly, it is already recognised that Member States will have to differentiate between the effects of prolonged droughts, which are purely natural phenomena, and the effects of human activities, although not always easy in practice. It is essential for proper river basin management planning and the application of Article 4.6 to make a distinction between the natural cause itself and the effects of management practices.

Thirdly, the Exemptions Paper indicates that for the distinction between a "non prolonged drought" and a "prolonged drought", the conditions of a prolonged drought, i.e. the circumstances of natural causes or "force majeure" which are exceptional or could not reasonably have been foreseen should be demonstrated in order to qualify as "prolonged". Normal dry hydrological conditions should be addressed in the ecological reference conditions set by the WFD. The river basin management plans should be able to

[33] See also the Communication 'Addressing the challenge of water scarcity and droughts in the European Union' (COM(2007) 414)

cope with non prolonged droughts without resorting to the exemption in article 4(6). Relevant criteria are necessary to facilitate the common understanding of a 'prolonged drought' through an agreed set of indicators (see below), similar to criteria to define 'extreme floods'.

III.1 Identification of a "prolonged drought"

Characteristics of droughts can vary significantly from country to country and between regions and therefore it is not possible to agree on common values of indicators that can be used in all cases.

As the circumstances to declare prolonged drought relate to a natural cause, indicators for prolonged droughts should relate to natural parameters (see 4.6(b)). Although there might be a time lag between the lack of precipitation and decreased water levels, e.g. due to retention effects of soil and vegetation and inertial effects on aquifers, the main parameter to define prolonged drought should be related to lack of precipitation (minus evapotranspiration) during a particular period with respect to average, and should take into account aspects like intensity and duration. It is necessary to distinguish between the drought itself and the effects of water use and management practices.

The drought events that are part of the normal dry hydrological conditions cannot be considered a "prolonged drought" since they are not "circumstances of natural cause *or force majeure* which are exceptional or could not reasonably have been foreseen". Any indicator used to define a prolonged drought and hence to allow triggering the exemption in article 4(6) should be based on a statistical analysis of the deviation of precipitation from the average situation (including intensity and duration), to prove that the circumstances are those of a prolonged drought.

III.2 Management of a prolonged drought

The reason for invoking an exemption under Article 4.6 is that a prolonged drought may affect the status of a water body considerably and during a significant period of time, so that a temporary deterioration may be inevitable even with the application of the best water management practices.

In the case of a prolonged drought, it may be necessary to take exceptional measures, but they must not compromise the recovery of the quality of the water body when the prolonged drought is over. These measures need to be included in the programmes of measures and/or the Drought Management Plan. They also do not exempt from taking all practicable steps to prevent further deterioration in status of the water body (see 4.6 paragraphs (a) and (c)).

Furthermore, during the prolonged drought and afterwards, all measures have to be taken with the aim of restoring the water body to its prior status as soon as reasonably practicable. In this context, practicable measures are those that are technically feasible and not disproportionately expensive. Restrictions on water use by different sectors might be an example of measures that have to be taken.

Managing prolonged droughts implies making decisions on the allocation of reduced resources to both environmental and human activity needs. Unlike in non prolonged droughts, during which the environmental needs should be respected at all times so that the WFD environmental objectives are met, during a prolonged drought, and provided the conditions on article 4.6 are respected, priority needs related to human activity (e.g. drinking water supply) can be temporarily met at the expense of the environmental needs, i.e.

allowing a temporary non- achievement of the environmental objectives. Such decisions have to carefully consider the environmental and socioeconomic aspects in accordance with the conditions in paragraphs 4.6 (a) to (d).

Besides the potential impacts on drinking water, prolonged droughts may cause significant impacts on all water uses, in particular irrigation, hydropower generation, supply of cooling water and other industrial uses, navigation and domestic uses other than drinking water (such as garden sprinkling). Thus, a clear prioritisation of main uses should be established[34] in advance where use restrictions are imposed step-by-step with increased duration, intensity and impact of the drought event. Essential drinking water supplies will be considered a high priority during periods of prolonged droughts, and this should be combined with high priority for an ecological minimum flow.

All drought situations other than a prolonged drought need to be managed without the use of article 4.6, i.e. for water bodies where non-prolonged droughts occur, the environmental objectives should be achieved and no deterioration must take place. Hence the water uses need to be brought in balance with the water availability under these dry hydrological conditions. The impacts of non prolonged droughts need to be taken into account in the definition of the environmental objectives of the RBMP and need to be addressed in the programme of measures and/or the Drought Management Plan. The iterative process of the WFD includes a periodical review of these objectives and associated measures in order to take into account the evolving impacts of these events in time.

In case of water bodies where the extent of human activity is such as to produce a permanent imbalance between available resources and demands, and if the achievement of environmental objectives would be infeasible or disproportionately expensive, the possibility to apply an exemption in article 4.4 or 4.5 might be explored, provided the conditions set out in these articles are fulfilled

III.3 Drought impacts on ecology and other water uses

For management of droughts and for determining if a temporary deterioration occurs in case of a prolonged drought, the impacts of this extreme phenomenon need to be investigated, both on ecology and on different human water uses.

Some examples for impacts on the ecology at a low water level and high water temperature are, in particular:

- changes in fish development and larger numbers of deaths than normal. Some periods of the year are highly critical for fish, such as the reproduction and migration periods.
- increased algae development due to the lack of water in rivers and lakes due to the drought. However, this parameter may be difficult to distinguish from the excess of nutrient releases that cause eutrophication.

The effects of a drought could greatly vary depending on the existing scenarios: basins with storage aquifers directly linked to the water body system, and/or regulating infrastructures (e.g. reservoirs) could be less vulnerable to impacts, while basins without storage capacity could be more rapidly affected. Other factors will undoubtedly influence drought impacts, such as demands and uses of the area. Thus, the different potential impacts caused by droughts should be assessed or, at least estimated, in advance, preferably as part of a drought management plan. Such assessment should consider economic, social and

[34] See also the Communication 'Addressing the challenge of water scarcity and droughts in the European Union' (COM(2007) 414)

environmental impacts in order to inform the necessary decision-making. Such an assessment should also take into account transboundary impacts, disparities between different Member States and distortions of competition between them which may stem from restricting or stopping certain uses.

III.4 Indicators

Three types of indicators can be identified in relation to droughts:

1. Indicators to identify and demonstrate the occurrence of a prolonged drought: natural indicators based on precipitation as the main parameter (where relevant including evapotranspiration, and with statistical series) indicate that it is a 'natural cause *or force majeure',* and that the circumstances are exceptional or could have not reasonably been foreseen.
2. Indicators to prove that the prolonged drought has resulted in a temporary deterioration of one (or several) water body(-ies) as an integral part of the monitoring programmes established under Article 8 and Annex V WFD (these are indicators related to environmental impacts).
3. Indicators to illustrate the socio-economic impacts of the prolonged droughts (drinking water supply, agriculture, industry, etc).

The first and second types of indicators should be used to prove the occurrence of a prolonged droughts and the associated temporary deterioration of water bodies. The second and third types of indicators should be used:

- to take the appropriate measures in order to mitigate the impacts of the prolonged droughts
  and recover the quality of the water bodies, according to 4.6 (c) and (d),
- to draft the annual review of the effects of the prolonged droughts (4.6(d))
- to draft the summary of the effects (4.6(e))

All indicators should be used to inform the water users and the public about the occurrence of droughts, their effects and the management results.

Chapter 3 of the DMP report provides an overview of national indicators related to droughts. The development of such indicators to be used on EU level and the specification on which indicators are consistent for the purpose of applying the exemption related to "prolonged droughts" will be subject of further work carried out by the European Commission, the European Environment Agency and Member States. In all cases, it is a requirement that when applying an exemption and the related indicators that they are to be submitted to a transparent and open process through the public participation (cf. Article 14 WFD).

III.5 Measures to address "prolonged droughts"

When a prolonged drought occurs, measures need to be taken to avoid further deterioration and to restore the water body as soon as reasonably practicable. Examples of such measures could be the following:

- develop early warning System and public Information
- implement preventive measures
- promote water savings
- take all practicable measures to prevent further deterioration
- implement specific mitigation and adaptation measures of article 11 (basic and supplementary) in water management sector as well as in other water

dependant sectors (agriculture, energy, tourism, transport, urban development, industry)

- propose additional measures after the annual review of the effects of circumstances
that are exceptional or could not have reasonably been foreseen (Article 4.6(d))

When, and where necessary, these measures can be presented in advance as part of a drought management plan (complementing the river basin management plan). Acting on a prolonged drought, requires a rapid adoption of measures, for which the course of action should also be reflected in the RBMP or directly within the specific DMP.

Measures to be taken in case of prolonged droughts as mentioned in 4.6(c) cannot adversely affect other water bodies (see Article 4.8 WFD) and must ensure that the objectives set by other Community legislation are not compromised (see Article 4.9 WFD).

Additional information on the types of measures and possible implementation strategies are described in detail in Chapter 5 of the DMP report.

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