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PROPOSED NATIONAL ENVIRONMENTAL STANDARD ON ECOLOGICAL FLOWS AND WATER LEVELS

SUBMISSION TO THE MINISTRY FOR THE ENVIRONMENT
29 AUGUST 2008

BACKGROUND TO IPENZ

The Institution of Professional Engineers New Zealand (IPENZ) is the lead national professional body representing the engineering profession in New Zealand. It has approximately 10,000 Members, including a cross-section from engineering students to practising engineers to senior Members in positions of responsibility in business. IPENZ is non-aligned and seeks to contribute to the community in matters of national interest giving a learned view on important issues, independent of any commercial interest.

EXECUTIVE SUMMARY

IPENZ supports the intention to establish environmental flows and water levels, and the intent of providing national guidelines; however we have are concerned that the proposed National Environmental Standard (NES) is not the appropriate way to deal with this issue.

We agree that the regional plan and resource consent processes have over allocated water in some situations. However we consider that the limited nature of the water resources is now much more widely understood, and that councils are now motivated and equipped to correct this situation. As such, IPENZ considers that further occurrences of over-allocation are unlikely, and that a national standard is not necessary to prevent over-allocation. We also note that the development of such prescriptive guidance may even detract, to the extent that national direction undermines Regional Councils' sense of responsibility and accountability.

While we consider that it is appropriate for regional councils to determine specific flows and water levels according to regional and seasonal variation in rainfall, we consider that there is scope for an NES to ensure national consistency in the methodology for assessing ecological values and measuring flows and levels.

We note that a NZ Standard is also a method for achieving this consistency and alternative mechanisms to the RMA provisions have not been considered as options to achieve the 3 objectives.

We are also concerned with the reasons given for the dismissal of the "status quo". While the discussion document provides a justification for improving the process for formulating and amending regional plans, it does not provide a valid case for bypassing these existing processes.

There is a suggestion that new and emerging methods could be incorporated in the standard, and we believe this should be done transparently and allow participation by interested parties. We are also concerned with the definition of environmental flows and note there is often confusion between the terms minimum flows, instream flows and environmental flows. We believe the flow recommendations should be a balance between environmental flows, and social and economic expectations.

We are concerned with the limited scope of the river component of the guidelines, and the technical merit of the interim flow standards and the recommended approaches. There appears to be no scientific basis for the minimum flow proportions of MALF or the distinction between stream sizes. The levels should be related to the quality of the local environment. It is also suggested that the NES will reference the Draft guidelines prepared by Beca and we believe this requires revision – for example there has been a misinterpretation of a review of instream flow methods, and we are concerned about the applicability and accuracy of habitat suitability curves.

We are also concerned about the models used for hydraulic habitat analysis. The MfE should provide guidance on the strengths and weaknesses of the various models and their recommended application.

SUBMISSION

The following are our responses to the some of the questions contained in the discussion paper.

1. Problem Statements and issues

Do you agree with the problem statements and the three key problems that were identified as benefiting from national direction?
We are concerned that problem Statements 3.1.1 and 3.1.2 have not been demonstrated to apply to a degree significant enough to warrant the enactment of the proposed NES. We do agree in principle with problem statement 3.1.3.

However we are not convinced that the proposed NES is the best regulatory option to address these problems.

2. Assessment and evaluation of alternatives

Do you consider that all available options have been covered? Do you have comments on the assessment and evaluation of alternatives?

We consider that the evaluation of the assessments is inappropriate - Other combinations of options should be considered and the assessment of alternatives would benefit from a more detailed evaluation.

We would support a combination of the status quo (s4.2) with Regional Council's developing detailed environmental flows, specific to the water resources in their region, based on sound scientific analysis complemented, if necessary, by a modified NES that only sets technical methods for assessing ecological values (s4.1.2) and for measuring flows and levels (s 4.3).

Alternatively a national directive could require Regional Councils to develop detailed environmental flows specific to the water resources in their region within a specified timeframe and also include a requirement to adopt specified technical methods.

3. The need for interim limits

Do you support the need for, and introduction of, interim limits set through a national environmental standard?

We consider that there may be a need for interim limits in some circumstances; however we are not convinced that the MfE model is appropriate (as they would be relatively arbitrary).

Concerns about the proposed limits include:

- Interim limits may be put in place quicker than a regional plan process can achieve - but at the cost of accuracy, for example, very conservative limits may be imposed due to a lack of information. This would result in the overall costs outweighing the benefits.

- Additionally, we are unsure how the use of interim limits would be more cost effective or expedient, given that it is the intention that over time Regional Councils will enact these limits through their Regional planning processes anyway. We consider that this can be achieved more effectively through the regional planning process on a water resource specific basis which would pre-empt the need for overly conservative interim limits via the proposed NES.

- Given that s43B(3) of the RMA states: "A rule or resource consent may not be more lenient than a national environmental standard" there needs to be clarity about the status of the interim limits i.e. would the interim limits effectively become the minimum standards?

4. The interim limits

Do you have comments on the numbers for the interim flows and water levels? Are there sufficient divisions of rivers and streams and groundwater systems?

We are concerned that the limits are arbitrary. We also note that other approaches would more effectively achieve the desired outcomes. One such approach would be a national directive requiring Regional Councils to develop detailed environmental flows specific to the water resources in their region within a specified timeframe and also including a requirement to adopt specified technical methods.

Our comments on the limits set out in the discussion document are:

- We consider that the allocation limit for shallow, coastal aquifers (predominantly sand) should be zero, unless monitoring is put in place to determine the aquaclude and ensure intrusion is controlled.

- We are unsure why the limit for all other aquifers is set at 35 per cent – we are unsure how this figure was generated and question the appropriateness of the application of this amount (we also question how authorities will manage multiple applications in dry seasons).

- We support the proposed interim limits for wetlands.

- We generally support the proposed interim limits for rivers and streams, however we question why rivers and streams with mean flows less than or equal to 5m^3/s allow a higher extraction than shallow coastal aquifers.

5. Time bound

The proposal does not set a time limit for how long the interim limits will apply. There is some concern that this will not encourage catchment-specific or regional default flows to be set. Do you think the interim flow and water levels should apply for only a limited period?

We consider that an indefinite time limit is appropriate, provided the limits are set low. We note that if a particular authority wanted to raise the limits they could provide the necessary scientific data to justify such action and set new limits.

However we also note that, if time limits are a concern, a National Directive could require regional councils to include environmental flows and levels in their Regional Plans within a specified timeframe.

6. Inclusion of existing consents within allocation limits

As currently structured, the interim allocation limits include all existing consents. Implementation of the limits will, therefore, not require claw-back of existing consents to meet the interim allocation limit. Claw-back is an option allowed when an environmental flow is set through a regional plan. How do you think the situation, where the amount of water allocated to existing consents exceeds the numeric interim limit, should be addressed?

No comment.

7. The need for an NES on the selection of technical methods

Do you support the aim to provide consistency in the selection of methods for assessing ecological values? Does consistency need to be provided in a national environmental standard or would guidance documents be sufficient?

While we consider that it is appropriate for regional councils to determine specific flows and water levels according to regional and seasonal variation in rainfall, we consider that there still needs to be national consistency in the methodology applied.

However we note that a national standard is not necessary to achieve consistency in the selection and application of methods for assessing ecological values, and that a national guideline would be more flexible and would achieve the same (or better) outcomes.

Another alternative that should be considered is the development and adoption of a New Zealand Standard (cited in a National guidance document). This would ensure that the development process follows a specified procedure (generally based on ISO/IEC Directives) which allows for the establishment of a technical committee that

embodies a broad and representative range of interests and represents a consensus approach to decision making. There is also a due process for amendments or upgrades to standards, and would provide some consistency with international practice. We note that the average time to develop a New Zealand Standard is 12 months and so time delays are not considered to be significant. However we also acknowledge that adoption would be voluntary.

8. The approach outlined in the technical document

Do you have any comments on the approach outlined in the technical document "Draft guidelines for the selection of methods to determine ecological flows and water levels"?

We are concerned that the "rule of thumb" that the NES is proposing is not based on good science. In fact, it would appear to be counter to numerous water resource consents that have gone through the hearing, environment court and Water Conservation Order process.

At the very least, the NES must be context sensitive (e.g. lowland spring fed gravel bed rivers in Canterbury differ from gravel-bed rivers with mountain catchments).

We recommend that the NES bring in additional expertise to build the "rules of thumb" for different river types based on the river characteristics and on the flow regime recommendations that have been developed through the hearing, environment court and WCO process.

We also consider that the approach outlined in the technical document seems complicated. It would benefit from the rigorous approach taken in the development of a New Zealand Standard - where input from a wider range of practitioners and users are involved. There is precedent for this approach - for example the recent development of the Flood Risk Management Standard and the citation of NZS 1170 as an acceptable standard for the purposes of compliance with clause B1: Structure of the NZ Building Code. It would also be consistent with government's goal of using standards to contribute towards the public good of all New Zealanders (for example - the needs of water users and human health could be considered together with ecological values and health).

9. The inclusion of new methods if they become available

How should new and emerging methods be incorporated into the process outlined in the proposed Standard?

We consider that it is desirable for new methods to be included as they become available. However, the new methods have to be subject to scrutiny and review and this should be done transparently, with the opportunity for all those interested to participate. We are concerned that if the proposed process is adopted (for example, the process for amending material incorporated by reference in a NES) then the only requirement for an amendment or replacement to have legal effect is for the Minister to publish a notice in the Gazette - there is no allowance for public input and no checks and balances. A process which allows for participation by interested and/or affected parties is preferred.

If a New Zealand Standard is developed then the updates would follow the same development process as the original standard, with the establishment of a technical committee representative of a broad range of interests and a consultation process. Reviews would be triggered by either a regular review process or as a result of emerging issues raised by participants.

We also note that the process for amending an NES is not simple – this is one reason why a national guideline (citing a New Zealand Standard) may be more appropriate.

10. NES approach to breaches

How do you think the national environmental standard should address applications for resource consents that breach the interim limits?

Applications for resource consents must be supported by an assessment of environmental effects. Following additional data collection and analysis, this will allow judgement of whether the effects are justified and also whether councils should continue to have the right and responsibility to recognise particular circumstances.

We also consider that applications for essential services such as public water supplies (particularly where they are replacement consents for continuation of a secure water supply) should be given precedence and should be exempt from the requirements of the interim limits (if they decide to implement them). In particular they should not be treated as a prohibited activity (as suggested in paragraph 2 of s5.3.2).

11. Application of the NES to existing and replacement consents

How should the national environmental standard apply to existing and replacement resource consents in each of the situations outlined in Table 2?

If a national standard is to be used, its application to the various situations as outlined in Table 2 is not unreasonable.

Public water supplies should be exempt from the provisions of the interim limits. This is not to say that there should no controls on the taking of water - provisions of the Regional Plans would still apply and each application would be subject to scrutiny and assessment of effects in accordance with best practice.

12. Benefits and costs of preferred option?

Have the range of benefits and costs of the proposed national environmental standard been identified? Are the costs and benefits identified in this document accurate? Do you have other information you would like to see included in the cost-benefit analysis that will occur after submissions are received and analysed?

A national standard is likely to result in some decisions that are less than optimum, because of its arbitrariness and inflexibility. This will result in significant costs that are not captured at all in the analysis.

We consider that a more detailed costs and benefits evaluation should have been undertaken. The evaluation concentrates on the costs and benefits associated with regulatory processes, but this does not take into account the wider costs and benefits which may show a quite different result.

We would like to be involved with any further consultation relating to the more detailed analysis (as required by Section 32 of the Resource Management Act).

13. Quantification and analysis

Do you have any comment on the assumptions used in the analysis? Do you have any comment on the partial quantification of costs outlined in this section? Do you have information that would be useful for the full analysis?

See answer to question 12.

Other comments:

- *General*

We are concerned with the insinuation in the accompanying text for Figure 4 (page 12 of the discussion document) that even when a river is below is minimum flow water will still be extracted. We consider that while human consumption and fire fighting purposes can be justified, extraction for all other purposes cannot. We are also concerned that the inclusion of such a provision for planned extraction in excess of the limit decreases the strength and credibility of the implementation of the NES.

We also note that the text accompanying Figure 5 (p13) implies that more water can be extracted. However we note that the demand for extraction is unlikely to match the period in which more water can be taken, and as such this may be misleading.

- *Consideration of costs*

In section 6.3, Effects on existing and potential resource consent holders, some significant costs are not considered. For example in relation to public water supply these include:

1. Reduced ability to obtain water to meet essential public health needs
2. Increased (and as yet unplanned for) capital cost to provide alternative water supplies, with the increased risk that these new alternative supplies (eg: dams/reservoir storage) will no longer be feasible because of the proposed minimum flow and allocation limits.
3. Drawn out proceedings with a significant burden of proof on public water supply utilities to demonstrate no more than minor ecological effects due to the overly conservative NES limits which will become a de facto benchmark, even though sound science demonstrates that effects are not significant.

Also a reduced ability to influence the selection and application of technical assessment methods, particularly any amendments to the methods, for the reasons outlined in the response to question 9 in this submission.

There needs to be a better weighing of the other costs and benefits, particularly as they relate to human health and well-being. This is in line with the IPENZ comments in Engineering Dimension about the 2008 Budget - "what was missing was additional funding for wastewater and water for local government
- needed by a number of under-resourced councils and communities." There is concern that the proposed NES will add even further to this cost burden.

- *Scope and definition: what are environmental flows?*

We consider that definition of “Environmental flow” used in the NES is arbitrary and may be too narrow.

We note that Beca 2008 (summarised on p 53 of the NES) state: '*Ecological flows are defined here as "the flows and water levels required in a water body to provide for the ecological integrity of the flora and fauna present within the waterbodies and their margins."* However on page 1 of the NES states: "*The term 'environmental flow' is used (as an alternative to 'minimum flow') because of the recognised ecological and cultural importance of flow variability*."

We note that "Minimum flow" and "environmental flow" are quite different in meaning. In New Zealand and elsewhere there is often confusion between the terms "minimum flow," "instream flow" and "environmental flow." Also, there is little appreciation of what an environmental flow regime must consider.

This issue has been discussed by various authors, including Hudson (2002)[1] and Dyer et al[2], and the following conclusions reached:

- Minimum flows are often a subjectively determined water level or flow, retained for the purpose of survival of a particular fish species. Instream flows are an objective balance of the flow regime needs of in-channel uses (e.g. fish and water sports) and off-channel uses (e.g. irrigation). Environmental flows provide a flow regime for the river corridor (i.e. the channel itself as well as the floodplain, and the transitional upland fringe) and receiving waters (e.g. lake, coastal zone), for the purpose of maintaining ecosystem structure (e.g. wetlands, oxbow lakes) and processes (e.g. nutrient cycling; sediment flux) in their own right.
- In the river corridor flow regimes are required to maintain lateral (riverine-riparian-floodplain), longitudinal (headwater-riverine-estuary) and vertical (riverine-groundwater) processes (e.g. nutrient dynamics and energy flow)[3]. In this regard, Hill et al. (1991), argue that multiple flow regimes are needed to maintain biotic and abiotic resources: (1) floodflows that form floodplain and valley features; (2) overbank flows that maintain surrounding riparian habitats, adjacent upland habitats, water tables, and soil saturation zones; (3) in-channel flows that keep immediate streambanks and channels functioning; and (4) in-channel flows that meet critical fish requirements. Hill et al. (1991) add there is a need to determine how altered streamflows affect channels, transport sediments, and influence vegetation.
- Downstream effects must be explicitly considered. For example, flow manipulations can modify water quality in deltas, estuaries and adjacent wetlands (e.g. salt wedge position, California Water Plan 1994[4]), and can limit fish passage (e.g. river mouth closure[5]), and habitat availability[6]; and can significantly modify productivity[7], morphology and hydrodynamics of the coastal zone[8].

As such, we consider that the flow recommendations under the RMA should be a balance between the environmental flow needs (as described above), with social and economic expectations. This would encompass the Key Concepts in section 2 of the NES.

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[1] Hudson, H.R. 2002. *Linking the physical form and processes of rivers with ecological response* (keynote paper)
[2] Dyer, F.J. Thoms, M.C, Olly, J.M. (editors), The Structure, function and management implications of fluvial sedimentary systems, IAHS Publication 276 (Pages 121-142)
[3] Vannote et al., 1980; Junk et al., 1989; Ward & Stanford, 1989; 1995
[4] Abam, 2001
[5] McDowall, 1992
[6] Oyebande, 2001
[7] Yin et al., 1997
[8] Kirk, 1991, and Abam, 2001

- *Technical merit of the interim flow standards*

The proposed interim limits on the alterations to flows and/or water levels for rivers have little scientific basis. The fundamental premise, that the existing or natural flow regime is an appropriate target flow regime, is flawed.

- There is no sound reason to assume that fish (or other aquatic organisms) are best adapted to natural flows everywhere they occur (Bovee 1982)
- Any flow regime, be it natural or modified, is a compromise between competing uses
- A balance is sought between competing instream needs between species and life stages; & between instream flow needs & competing out of channel water uses
- Flows can be manipulated to improve habitat for target species because different species & life stages usually have different, often contradictory, flow preferences.

The one day mean annual low (MALF) is an appropriate benchmark flow (e.g. Hutt River, Jowett 1993; Manawatu River, Hay & Hayes 2005; Rangitikei River, Hay & Hayes 2004). As noted by Hay (2007b) "The crux of the rationale being that the amount of habitat available at the MALF is thought to act as a bottle neck for trout, and potentially other annual spawning fishes, because it is indicative of the average annual minimum living space." The MALF as defined in the NES is for a seven day duration. The NES Appendix 1 definition is not helpful. MALF needs to be appropriately defined.

There is no scientific basis for the proposed minimum flows of 90% of MALF for streams with mean flows of less than 5 cms and 80% for streams with mean flows of more than 5 cms.

- The distinction between stream sizes is arbitrary. A median flow would be more appropriate than the mean as a basis to describe rivers.
- The habitat retention levels should be related to the quality of the environment and its significance. Jowett & Hayes (2004) provide some guidance in this respect.

Suggested significance ranking of critical values and levels of habitat retention[9]

Critical value	Fishery quality	Significance ranking	% habitat retention
Large adult trout – perennial fishery	High	1	90
Diadromous galaxiid	High	1	90
Non-diadromous galaxiid	-	2	80
Trout spawning/juvenile rearing	High	3	70
Large adult trout – perennial fishery	Low	3	70
Diadromous galaxiid	Low	3	70
Trout spawning/juvenile rearing	Low	5	60
Redfin/common bully	-	5	60
Ranking: 1 highest; 5 lowest			

[9] Jowett & Hayes 2004

It is recognised that the habitat retention levels recommended above are conservative. Jowett & Hayes (2004) noted "The suggested levels of habitat retention are conservative, in that we believe that they are unlikely to be proportional to a population response. Theoretically, a change in available habitat will only result in a population change when all available habitat is in use (Orth 1987). In most cases, we believe that because flows are varying all the time, population densities are at less than maximum levels. That being the case, a habitat retention level of, say 90%, would maintain existing population levels, whereas retention levels of 50% might result in some effect on populations, especially where densities were high."

There is no scientific basis to limit water allocation to a proportion of MALF. For example, flow allocations in Canterbury vary from about one quarter of MALF to more than ten times MALF (Canterbury Strategic Water Allocation Study, Lincoln Environmental 2002). A critical assessment of these allocations is probably required, but in any case, there appropriate flow allocations will vary (e.g. a lowland sourced river will differ from a mountain sourced river).

The proposed standard appears to be counter to numerous water resource consents that have gone through the hearing, environment court and Water Conservation Order process. If a national standard "rule of thumb" on allocation is to be proposed, it must be context sensitive (i.e. based on different types of stream and rivers) and based on flow regimes that have been established through rigorous analysis.

- *Technical merit of the recommended approaches*

It is intended that the Draft guidelines for the selection of methods to determine ecological flows and water levels (Beca 2008) will be referenced in the national environmental standard and form the basis for the selection and application of methods to determine ecological flows and water levels.

This report requires revision. For example, there is one major critical review of instream flow methods in New Zealand, and this has been misinterpreted. Beca (2008 p 19) state that the biggest concerns relate to habitat preferences. In fact, Hudson et al. (2003) did express concerns about the applicability and accuracy of habitat suitability curves; but they elaborated on internationally recognised inadequacies in instream flow methods using New Zealand examples. They agree with Bovee et al. (1998) that "IFIM … is widely misconstrued, misinterpreted, and in some cases misused." Further, they concurred with Castleberry et al. (1996): "That those who use PHABSIM, or some modification of it, must take into account the following:

> 1) Sampling & measurement problems associated with representing a river reach with selected transects & with the hydraulic & substrate data collected at the transects
> 2) Sampling & measurement problems associated with developing the suitability curves
> 3) Problems with assigning biological meaning to weighted usable area (WUA)…"

The Castleberry et al. quote is a consensual statement. Appendix 3 is misleading in this regard "A recent multi-authored review concluded with divergent opinions regarding the scientific defensibility of PHABSIM (Castleberry et al. 1996)."[10]

- *Modelling issues for hydraulic habitat analysis*

[10] The correct citation is Hudson, H.R.; Byrom, A.E.; Chadderton, W.L. 2003: A critique of IFIM—instream habitat simulation in the New Zealand context. Science for Conservation 231. 69 p

Beca (2008) refers to 1D and 2D models for hydraulic habitat analysis. They do not provide a comprehensive evaluation of the strengths and weaknesses of the models. The recommendations for using 1D models in less complex rivers appears reasonable, but use of 2D models should not be excluded. They in fact may provide for more information on patterns of habitat availability in single channel reaches with features such as large boulders and pocket waters that typically can not be modelled in 1D.

There is no evaluation of the strengths of the 2D models used in New Zealand (e.g. Hydro2de in the Rangitata River, Duncan & Hicks 2001, and Waitaki River, Hicks et al 2003; and River2d in the Wairau River, Hudson et al. 2005). Hydro2de is a square grid model, whereas River2d is a flexible mesh model.

There are compelling reasons to recommend a flexible mesh 2D model (river2d) over a fixed grid model (Hydro2de). Major reasons include the ability to:

- Explicitly map and model substrate (e.g. Wairau vs. Rangitata or Waitaki)
- Map and model channel features such as chutes through bars
- Map and model abrupt changes (e.g. steep banks, bar faces…).

Hydro2de does not appear to be able to accept maps of substrate, which is one third of the habitat assessment in typical weighted usable area (WUA) calculations. Therefore, Hydro2de must estimate substrate variability, or not include substrate in calculating habitat. The consequence of omitting substrate ranges from unimportant for some species and life stages which are generalist substrate users, to extremely important (Hudson, HR. 2007- Bed material (substrate) in hydraulic-habitat modelling - 6th International Symposium on Ecohydraulics). One could not recommend using Hydro2de without explicitly mapped substrate unless it was shown that substrate variability was not important.

With a fixed grid 2D model, even with extremely detailed surveying, transitions would not be handled well. Discrepancies from reality are expected as an artefact of using a fixed grid approach and would be largely associated with the inability of a fixed grid model to describe abrupt channel changes (e.g. a steep bank and scour pool could average to zero depth!). With appropriate surveying, these transitions are handled well by a flexible mesh model, and there is little difference between surveyed and modelled transects. River2D and Hydro2de can map fish passage limitations, but Hydro2de is likely to be more conservative because it does not model transitions such as chutes which provide passage over shallow bars.

If 2d modelling is recommended for complex channels, the nod must be given to River2D rather than Hydro2de. River2D has been adopted by the developers of IFIM (Waddle et al 2001).

The limitations of the bioenergetic model under development at Cawthron (Hayes et al 2003; Kelly et al. 2005) are not well stated. The model, based on Eliot 1995, is limited to examining drifting feeding of adult trout in simple straight channels. As well, the authors themselves considered the model to be promising but not proven. In contrast, there are other more comprehensive bioenergetic models such as SALMOD. The developers of IFIM use SALMOD (Bartholow et al. 1993, 1995) which considers all life stages of trout & salmon. This is used quite frequently in US hydro relicensing over the last decade. It is constantly being refined. If bioenergetic models are to be recommended, then a proven model, such as SALMOD, should be recommended as a supplement to other investigations.

The MfE should provide guidance on the strengths and weaknesses of the various models and their recommended application. Dr. Henry R Hudson of Environmental

Management Associates Limited in Christchurch is able to provide further information on these modeling issues if required.

CONCLUSION

IPENZ appreciates the opportunity to make this submission and is able to provide further clarification if required.