Independent Multidisciplinary Science Team (IMST)

State of Oregon

Michael J. Harte
Robert M. Hughes
Victor Kaczynski
Nancy Molina
Carl Schreck
Clint Shock
J. Alan Yeakley

c/o
Oregon State University
Department of Fisheries & Wildlife
104 Nash Hall
Corvallis OR 97331-3803

July 26, 2010

Barry F. Norris, State Engineer
Oregon Water Resources Department
725 Summer St NE, Suite A
Salem, OR 97301-1266

Dear Mr. Norris,

As per your request (letter dated February 24, 2010) the Independent Multidisciplinary Science Team (IMST) has reviewed the Ecological Flows Technical Advisory Committee's (EFTAC) document *White Paper: Ecological Flows; a scientific framework for implementing Oregon HB 3369* (June 4, 2010 draft). In your letter, you asked the IMST to consider 10 questions during its review. This review provides brief answers to those questions plus some more general comments on the document. In addition, a few IMST members provided significant editorial suggestions that may be useful to the EFTAC as they revise the draft. We will send these directly to Dr. George Robison.

In general, the IMST found the document to be very well written and informative. We hope that these comments will assist the OWRD as work progresses on ecological flows.

Sincerely,

Carl Schreck
IMST Co-Chair

Nancy Molina
IMST Co-Chair

Attachment
Cc:
George Robison, OWRD
Sue Knapp, GNRO
Tom Byler, OWEB
IMST

IMST Review of Oregon Water Resources Department's *White Paper: Ecological flows; a scientific framework for implementing Oregon HB 3369* (June 4 *2010 draft*)

Released on July 26, 2010

Independent Multidisciplinary Science Team
Oregon Plan for Salmon and Watersheds
http://www.fsl.orst.edu/imst

Members:
Michael Harte
Vic Kaczynski
Carl Schreck
J. Alan Yeakley
Robert M. Hughes
Nancy Molina
Clint Shock

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Review Preparation: This review was prepared by the IMST based on an initial draft by an IMST subcommittee (Bob Hughes, Clint Shock, and Alan Yeakley with Kathy Maas-Hebner providing technical support). George Robison (Oregon Water Resources Department) briefed the IMST at its January 27, 2010 public meeting. The IMST discussed and unanimously adopted (Hughes absent) at its July 26, 2010 public meeting.

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ACRONYMS AND ABBREVIATIONS

ELOHA	ecological limits of hydrologic alteration
HB	House Bill
IMST	Independent Multidisciplinary Science Team
OWRD	Oregon Water Resources Department
USGS	US Geological Society

INTRODUCTION

The Independent Multidisciplinary Science Team (IMST) reviewed the document *titled White Paper: Ecological Flows; a scientific framework for implementing Oregon HB 3369* (June 4, 2010 draft) at the request of the Oregon Water Resources Department (OWRD; letter from Barry Norris dated February 24, 2010). In particular, OWRD asked the IMST to review the draft document in regard to 10 questions listed in the letter (and repeated below). The IMST offers the following comments with the purpose of improving the final document by increasing the clarity of information presented and by better explaining the strengths and weaknesses of the methods presented in the White Paper. This review provides brief answers to those questions plus general comments on the draft document

The IMST commends the members of the Ecological Flows Technical Advisory Committee for developing a well written, comprehensive document. IMST recognizes the scientific and technical difficulties associated with the task charged to the Advisory Committee.

<u>Regarding Ecological Flows</u>:

1. **Is the overall classification of ecological flows adequate or is there a better way to characterize them?**

   There are some uncertainties about the classification. In particular, the term "triggering flows" implies cause-and-effect, and there are cases of ecological functions that are triggered by other causes (such as life cycle changes) and changes in flow conditions may merely facilitate (rather than cause) some ecosystem functions.

2. **Are the definitions clearly delineated and do they represent mainstream thinking on this subject?**

   No, there are problems with some of the definitions. In particular, the definition of ecological flows includes stream flows defined as "flow protections" which implies management rather than naturally occurring ecosystem functions. Also, as discussed in Question 1, the term "triggering flows" does not seem appropriate.

3. **Do the definitions give enough information to allow policy makers to understand some of the different ways they are determined?**

   No, the definitions do not address methods of how these flows are determined, and hence on their own do not give policy makers enough information to make that determination.

<u>Regarding Methods</u>:

4. **Are the methods and techniques described in the White Paper representative of the range of options that are available or are there some missing approaches?**

   To our knowledge and without extensive literature review, it appears that the range of options provided in the White Paper is representative of what may be currently available.

5. **Are methods or approaches emphasized that are considered as fringe methods while more commonly used methods were not adequately covered?**

   The methods covered appear to be ones that are commonly used, and not "fringe".

6. **Does the description of methods naturally lead into the more applied parts of the report that follows, or is better exposition needed?**

   The description of the methods is only done in a summary way, and nearly all the details are missing. The report requires the reader to obtain the cited references and learn about the methods on his/her own. The report provides Table 1 and Appendix B, but this is only a set of outcomes without describing how these outcomes were reached. An additional appendix that details the methods described, including providing steps and examples of applications, would help the reader greatly.

7. **Are the limitations and advantages of the various methods for each type of ecological flow adequate to provide the reader an understanding of inferences made in the later sections of the report?**

   The limitations are discussed somewhat, but not in great detail. We feel the reader will have to conduct a non-trivial amount of trial and error to determine the limitations of the methods listed.

<u>Regarding Applications/Recommendations/Conclusions</u>:

8. **The paper includes various determination methods and techniques that relate to the narrow situations needing full detailed analysis. Do the related inferences and recommendations regarding their application flow logically from the information in methods, or are more background information and linkages necessary?**

   The background provided is reasonable. The problem is that the lack of details about the actual methods renders the document to appear more implicit than explicit. Actual methods could be provided in additional appendices.

9. **Do any of the recommendations or conclusions seem to be introduced awkwardly without the logical linkage back to the definitions and methods? If so, what information needs to be added or how does the recommendation need to be altered to better correlate with information given in previous sections?**

   The recommendations appear to jump ahead somewhat of what was actually presented in the methods. It would be preferable to present a conclusion composed of a breakdown of methods, including their pros and cons and areas of specific application. Instead the conclusions seem to focus on policy considerations.

<u>Overall</u>:

10. **Is there information that you feel should be added to strengthen the report or any information that needs clarification?**

    As mentioned above, there appear to be several gaps in terms of actually applying the methods reviewed. The reader who may be trying to implement these methods would be greatly aided if more detailed steps including explicit examples were added.

SPECIFIC COMMENTS

Page ii, 1st paragraph – A definition of how stream and river reaches are used in the document is lacking.

Page ii, 2nd paragraph – The term "*flow protection*" seems management oriented. Here it would be more appropriate to base descriptions of flow on ecology and/or hydrology based

Page ii, 3rd paragraph, item 1 – The use of "*abate and dilute pollutants such as chemicals or stream heating*" is vague and could be to be more specific as some "*chemicals*" are naturally occurring and beneficial, and it´s not clear what "*abate*" means here

Page ii, 3rd paragraph, item 2 – As discussed above, "*triggering flows*" implies causality. In other words, for this to be appropriate, all such flows would necessarily "*trigger*" or "*cause*" the ecological functions desired. Clearly some high flows just happen to be synchronous with ecological functions, and other triggering mechanisms are actually happening, including endogenous biological (e.g. life cycle) causes. In fact the text on the bottom of page 8 states as much, describing streamflow as only one of many causes. Consider changing this term to something more appropriate to cover both causal and non-causal (but synchronous and still important) higher flow conditions so that the definition is more comprehensive. Perhaps consider "*biological facilitating flows*" or some such variation in place of "*biological triggering flows*". Or define both types of flows and use them accordingly.

Page ii, 4th paragraph, 5th line – Why was a 1.5 year peak flow chosen? Presumably these are the mean recurrence intervals of bank full flows that do most of the work on stream channel morphology. But this is not well justified in the document or here in the Executive Summary. As written, it appears to assumes that the reader is a hydrologist or familiar with hydrology.

Page iii, bullet 2 – Why is 50% exceedence for baseflows used? What is the justification here? Obviously this number will vary depending on topographic, groundwater and climate conditions.

Page iii, bullet 3 – The definition for "*year return flow*" here and elsewhere is misleading. The definition would be enhanced by replacing "occurs" with "is exceeded" here and elsewhere throughout the document. Generally, it is not easy to understand what this item is saying, particularly the 2nd and 3rd lines. Also, could "bank-full flows" be used instead of "year peak flows"?

Page iii, 3rd paragraph, item 4 – What does "*effects of and condition a proposed storage project to protect ecological stream flow*s" mean, exactly? Please clarify. IMST is concerned about

the effects of construction of new dams and reservoirs on salmonids that are already limited by such migration barriers.

Page 3, 2nd paragraph – Does the federal Clean Water Act also apply here for pollution dilution flows?

Page 3, 3rd paragraph – Same comment as in Executive Summary regarding "flow protections"

Page 4, 1st paragraph – As discussed above, "biological triggering flows" has causal implications and does not cover cases where flows do not cause but rather just facilitate ecosystem functions.

Page 5, Figure 2 – The depiction of baseflow seems inaccurate or at least not comprehensive. This figure depicts streamflow at a significantly higher elevation than near-stream water table levels. This may occur in some cases, but a more general case would have the water table elevation near the stream at the same elevation and then increasing in elevation moving away from the stream. Isn't the primary difference between subsistence flow and baseflow relate to the depth of the water table (here they are shown at the same level but it would seem that in subsistence flow it should be generally lower than at baseflow) and to the longitudinal character of the stream/groundwater interface (rather than at a specific cross-section)?

Page 5, 1st paragraph, footnotes 24-25 – Based on their titles, these papers appear to suggest synchrony rather than cause-effect relationships, is that correct?

Page 5, bulleted list – Providing specific examples, maybe a paragraph per bullet, would help illustrate the importance of higher flows that facilitate (or in some cases cause) ecological functions.

Page 6, item 3 under Habitat Maintenance flows – Off-channel habitat creation and maintenance are also critical to healthy streams and healthy streams populations.

Page 6, 2nd paragraph, 1st line – This observation seems accurate, and it makes one wonder how such high flow events can actually be managed or what policy could effectively be applied to govern them? Such events are rare and hard to predict.

Page 7, 2nd paragraph – Consider replacing "almost always less then" with "by definition less than or equal to".

Page 7, item 1 – This item suggests that such methods are no longer relevant. Please clarify.

Page 7, item 2 – Is a single site based method actually useful? It seems that this would provide only very limited information and perhaps be either not comprehensive enough or even misleading. Somewhere there needs to be clarification as to which of these methods are useful.

Page 8, item 4 – This section could be summarized with the conclusions reached by Fausch *et al.* (1988), i.e., that predictive models are site specific and not general.

Page 8, bottom paragraph –This first sentence argues that high flows are only one of many "triggering" or causal factors. Again, the use of the term "triggering" is misleading and not very comprehensive. It could be possible for someone to show that for some given ecological function the flow is not actually "triggering" or causal and therefore should be ignored in a proposed management activity. As mentioned earlier, using a different term

such as “facilitating” or some variation that does not require causality may be more relevant.

Page 9, 3rd paragraph, 4th line – The phrase “*have more capacity to transport sediment than sediment supply*” is not clear. Please clarify.

Downstream and upstream effects are both important. Consider work by Pringle (1997) and Pringle *et al.* (2000). This is especially important regarding the import of nutrients to ogliotrophic streams by spawning salmon.

Page 9, 4th paragraph, 2nd line – In reference to the statement about the Metolius River, explain better how some streams do “*not experience peak flows*”? Clearly there will be some elevated flows following rain or rain-on-snow events for any stream, even those that are spring fed.

Page 10, item 1, 2nd line – Consider replacing “occurs” with “is exceeded”.

Page 10, item 1– Why was 5% chosen? This percentage needs in-depth discussion that relates both to ecological function and to general hydrologic science. Why was 5% used in California and why would it be relevant in Oregon?

Page 11, item 3 – This item could be expanded to include more on direct monitoring. As written, this item implies that direct monitoring is just model calibration, and that is not accurate or comprehensive

Page 11, paragraph beneath item 3 – Ignoring the importance of wood in rivers is a serious oversight. Consider work by Sedell &Froggatt (1984) and Gregory et al. (2003). Additionally, high flows are also needed to limit the invasion and spread of non-native fish species (see Meffee 1984; Hughes *et al.* 2005).

Page 13, 1st paragraph, 5th line – “*This equation*” needs to be explicitly presented. In general, all equations and calculations need to be presented somewhere in this document (either in the appendix or in the text) to be useful to the reader.

Page 13, 3rd paragraph, 3rd line –As discussed above, these “year event” definitions are not accurately described at various places in the report, such as here.

Page 13, 3rd paragraph – A process based rationale for 5% is missing.

Page 14, ELOHA – The summary does not present the information well as described by Poff *et al.* (2010). Perhaps a figure from Poff *et al.* would be helpful.

Page 14, bulleted list – Reference back to Figure 2 would be helpful.

Page 14, 3rd paragraph, following last sentence – But then what happens? With no flow levels prescribed, this approach (Texas) seems rather “toothless”.

Page 15, last paragraph – The cost in dollars would be more informative if it was tagged to a specific year. Also using other metrics (such as person-hours, field time and data requirements) would provide a more fundamental way to evaluate costs

Page 16, 2nd paragraph – It would be helpful if specific details (either here or in an appendix) on these methods were presented so that the reader could implement them.

Page 16, last paragraph, 4th line – This is misleading as Texas only varies in terms of rainfall (which is admittedly highly variable in the state); snow storage and melt and rain-on-snow are negligible there.

Page 17, 1st paragraph – This paragraph is not clear, yet it appears to be a key piece of the discussion. A figure may help the reader to understand the text. Also, as written, the current screen for determining water availability does not appear protective of aquatic species. Is this correct?

Page 17, 2nd paragraph – What is the cumulative effect of multiple small projects? And how do the methods take cumulative effects into consideration?

Page 17, last paragraph – Can the California rules also reject proposed projects with in-depth and short-term studies?

Page 18, second item 2 – "*However, since we have greater certainty on instream flow values this may not be necessary*." This statement assumes that knowledge of past flow is an accurate predictor of future flows. Climate change will likely change this, especially rain-on-snow event frequency and increased droughts in semi-arid areas. How will increased urbanization-driven runoff and demands on ground water affect the ability to predict future flows?

Page 20, Table 1–The table would be more usable and understandable if the text were to describe how the information in the columns was determined, same goes for Appendix B. Also, rather than just referring to Appendix B and Table 1, it would greatly aid the reader if the details on how the designations in these tables were made, were presented as explicit descriptions in the text. It is not readily apparent how the values listed in Table 1 were derived from Appendix B. In the footnote, what exactly does "*ISWR stands for using the instream water right for baseflow bypass*" mean?

Page 21, 2nd paragraph, line 1 – How is "high impact" determined for a given project?

Page 24, item 7. Consider USGS (2003) on hydrogeomorphological classifications and a potential statewide classification.

Appendix B – It is very difficult to decipher the tables in the Appendix. Clearly defining abbreviations and acronyms would greatly assist the reader. Units are also missing. Additionally, providing an example describing how the calculations were made and why the specific variables were subtracted from the flows would increase the clarity of the results.

Endnotes 53, 54, 55 are identical with Endnotes 24, 25, 26

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