



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
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January 20, 2011

Bo Li
Michael T. Brett
Civil and Environmental Engineering
University of Washington
Seattle, WA 98105

Re: Technical review of Spokane Regional Wastewater Phosphorus Bio-availability Study

Dear Ms. Li and Mr. Brett:

The Washington State Department of Ecology (Ecology) appreciates the opportunity to provide comments on the document *Spokane Regional Wastewater Phosphorus Bio-availability Study – Final Report* (UW Study). As a co-sponsor of this research, Ecology has a significant interest in the study findings as they pertain to wastewater treatment plant discharges in the Spokane River and the Spokane River dissolved oxygen TMDL (TMDL), approved by the U.S. Environmental Protection Agency in May 2010. Ecology appreciates the effort that was put into this study and believes it provides some very useful information that can be applied to on-going efforts to improve the Spokane River's water quality. This concerns not only the findings on biological available phosphorus (BAP), which was a major emphasis to the study, but also on the assessment of the various treatment methods on reducing total phosphorus now being examined throughout the greater study area.

The study results show encouraging results for total phosphorus removal from advanced treatment on a pilot scale. From the most representative samples such as those from the City of Spokane, total phosphorus concentrations are near or below the levels assumed or established by the TMDL before even considering the bioavailable phosphorus fraction. It appears that once implemented full scale, this level of treatment will lead to significant reductions in total phosphorus to improve the river's water quality, the intended goal of the TMDL.



Bo Li
Michael T. Brett
January 20, 2011
Page 2

Ecology also appreciates the acknowledgement of unexpected complications in evaluating some of the effluents and, as a consequence, realizes that there may still be further work yet to resolve some of these issues.

Following are general and specific comments on the technical aspects of this report, offered by the Ecology Environmental Assessment and Water Quality Programs. If you have questions on these comments, please contact David Moore, Spokane River Water Quality Lead at (509) 329-3514.

Sincerely,

A handwritten signature in black ink, appearing to read "Kelly Susewind". The signature is written in a cursive style with a large, sweeping flourish at the end.

Kelly Susewind, P.E., P.G.
Water Quality Program Manager

Enclosure

General comments

- Request that any comments on this study by other Spokane River stakeholders (dischargers, environmental groups, tribes, etc) be made available for public review.
- Some treatment process information is provided in the report but to the extent possible, all information available on the operation of the treatment process (effluent flow rates, chemical dosage rates, unusual operating conditions, etc) of the facilities should be included as well.
- Have additional split samples been collected but not sent to UW for analysis? If so, the dischargers should provide these results (including other parameters in addition to phosphorus) for inclusion into the report. This data would provide a more complete overview of the effluent quality produced by the treatment systems.

Specific comments

Page 3, second paragraph – Please explain significance of using KCl instead of K_2HPO_4 . Is this a deviation from the standard methods?

Page 6, first paragraph – Please confirm that samples were shipped to UW within established holding times.

Page 10, first paragraph – It is unclear what the significance of the sample variability divided by the square root of the number of replicates processed is. Is this a standard way of showing low analytical uncertainty?

Page 10, first paragraph – Identify which WWTP has the 17% variability.

Page 11, first paragraph – Is the high CV for the BAP samples problematic or is this just a statistical outcome? It seems that if the mean is low and the SD is also low, that's not a bad thing even if the CV is high. Should these instances be footnoted to the effect that these samples are not in fact problematic?

Page 13 – Please use the formal name of City of Spokane WWTP (Riverside Park Water Reclamation Facility (RPWRF)) to distinguish from other “Spokane WWTPs” throughout report as per page 51.

Page 13, first sentence – Please add “with current (secondary) treatment methods” at the end of the first sentence discussing RPWRF.

Page 13, second sentence – Do the pilot treatments come after the secondary clarifier? This is unclear as worded here.

Page 14, Figure 3 – Identify that the colored boxes represent where samples were taken. Please add similar, consistent diagrams for other facilities (particularly where samples are taken).

Page 18, 3rd paragraph – This section does not clearly answer the question posed as to whether TP can be used as a conservative measure of %BAP in this pilot study.

Page 19, second paragraph – What are the units in this section? Are these numbers ratios?

Page 20, Figure 6 – Why is the BAP / TRP relationship presented as a ratio in this figure and not in a regression such as in Figure 5?

Page 20, second paragraph, 3rd sentence – What is meant by a “sustainability perspective?” Depending on the expertise of the reviewing staff, sustainability perspective has been interpreted differently. One reviewer suggests checking with Prof. Dave Stensel to provide extra clarity and perspective to the statement. Alternately section 9.3 of the USEPA Nutrient Control Design Manual, August 2010 could be consulted.

Page 21, second paragraph – Please refer to appropriate figure (Figure 5?) for the statement in the first sentence. It’s unclear where this statement comes from since there is no statement that TP overestimates BAP elsewhere in the results section. Are the authors saying that TP, which is used in permitting, is assumed to be 100% bioavailable in wastewater treatment permits and that this is an overestimation? That would be a correct statement but BAP is a fraction of TP so TP is always going to be an “overestimate” of BAP.

Page 21, second paragraph – Figure 5 shows there’s some relationship between TP and BAP but this section puts those findings aside and moves on to TRP and BAP ratios without explaining why TP and BAP relationships can’t be used.

Page 22, first paragraph, last sentence – Define “protracted” as it relates to the reference cited.
Page 24 – It would be easier on the reader if you present the layout of the WWTP pilot treatment and where samples were collected first as you did for the City of Spokane samples. This section starts right off with results with no context or explanation of the treatment technology. Carry suggestion through for remaining sections.

Page 26, first paragraph – Why were some samples composited and others were grabs? Could spikes be missed or muted by either approach?

Page 29, second paragraph – It is unclear how the BAP outliers are caused by mean BAP values approaching the analytical limits for the bioassay by looking at the values in Table 4c. In short, this last sentence doesn’t make sense without further explanation. Is the quantitation limit several times the detection limit for the BAP test as it is for most wet chemistry tests?

Page 30, Figure 13 – Missing legend symbol for %BAP.

Page 30, third paragraph – Please verify whether first sentence is correct (“Prior to any treatment...”). Figure 7 shows that there is at least primary treatment prior to the treatment plant influent. Did you mean before the tertiary treatment for P removal?

Page 32 – Please highlight difference in pilot influent samples at Post Falls compared to City of Spokane and Coeur d’ Alene samples. Post Falls influent is true, raw influent and not post treatment into a pilot facility. This should be mentioned in the opening paragraphs for the Post Falls chapter.

Page 37, second sentence – Typo, strike word “that” following “one set of effluent samples (LLE)...”

Page 37, first paragraph, last sentence – Replace word “located” with “taken [?]”

Page 37, Figure 18 – Clarify whether there is any treatment prior to influent sample or, if like Post Falls, the influent sample is raw sewage and the effluent samples are following existing treatment, not pilot (small scale) treatment technology. This point needs to be made very clear for facilities where raw effluent is tested because we are essentially looking at “scaled up” existing technology BAP removal performance at these two facilities (notwithstanding the outliers and low sample size).

Page 40, third paragraph – Please describe what is meant by “quality of P in effluent.” Is this describing the composition of P species?

Page 41 – Until more information becomes available from HARSB, it doesn’t seem useful to include any further report on this facility beyond the first paragraph. Suggest deleting rest of chapter after introduction on this page.

Page 45 – Suggest preceding the term “classic algal growth bioassay” with “as determined in this study using the...” to clarify that this study in fact uses the classic growth bioassay.

Page 45, second sentence – Clarify the type of particles being described; algae, sediment, other? Always precede term “particles” with “algae” to avoid confusion in this section please.

Page 45, Figure 26 – Is the “expected” size distribution graph the typical pattern observed for other WWTPs in this study? In other words, this is an expected distribution for what? Wastewater effluent, streams, lakes, etc?

Page 46, first paragraph – This paragraph needs a heading to reflect the conjecturing into low BAP from IEP being presented. Suggest “Potential Causes of Low BAP” as the heading or something similar.

Page 46, second paragraph, second sentence – add “pilot” between “advance” and “tertiary.”

Page 46, second paragraph – Ecology agrees that IEP’s installation of a pilot plant is a “proactive commitment” but why is this term missing for the other treatment plants that have also installed tertiary pilot systems in advance of the TMDL?

Page 46, second paragraph – It would be helpful to have a treatment diagram for IEPs treatment system as the report has for the other treatment systems.

Page 47, second paragraph – What are the potential shortcomings of only having one influent sample? One sample doesn’t seem to be enough to characterize the quality.

Page 47, third paragraph – Last sentence is awkwardly worded. Please revise to something like “Our initial results suggest this effluent may be a poor substrate for...”

Page 48, first sentence – Same comment as regarding the one influent sample. It really needs to be highlighted that there is only one influent sample to consider; more so than just saying “if one merely considers the result for the one influent sample...” The report makes much of the fact that there are few samples for the other facilities but make little of the same situation for the influent at IEP.

Page 49, third paragraph – Typo, replace “like” with “likely.”

Page 49, third paragraph – Same comment as for Page 46, last paragraph; this section needs a heading to clearly show authors speculation, discussion and conclusions as to what the likely causes of low BAP are in IEP effluent.

Page 51 – Please provide intro sentence as to why samples were collected from the river and lake; what was the objective for this part of the study (take from the QAPP)? In general, the report should have a consistent organization in all chapters, i.e., intro, sampling, results, conclusions.

Page 51, first paragraph – The correct term for the City of Spokane WWTP is introduced here but needs to be introduced at the beginning of the report and use the same term throughout the rest of the report.

Page 51, first paragraph – Please provide exact locations of where Spokane River samples were taken. From which bridge, outfall, etc.

Page 51, last sentence – From where did the “upstream” concerns come from? What were the concerns (DO, algae, other)? How is upstream defined? Why was stateline chosen and not some other upstream location from Lake Spokane and the RPWRF (there are three other discharges between stateline and RPWRF)? Stateline was not a location from the QAPP. This needs to be clearly defined as to what the concern was, why this location was chosen and why it was sampled.

Page 52, first paragraph – Could there be another explanation for the high BAP in winter other than cessation of alum from the RPWRF? What about lake turnover or other seasonal factors that affect nutrient cycling? This should at least be acknowledged and discussed.

Page 52, second paragraph – Regarding the statement “the algae bioassays indicated that most of the phosphorus was unavailable to algae,” an alternative explanation is that the most readily bioavailable phosphorus was already used by algae and macrophytes in the river.

With the possible exception of the pools behind upstream dams, the water in the Spokane River is shallow enough that the entire water column is euphotic. Trying to determine what percentage of phosphorus *still in the water column* is bioavailable is uncertain under the best of conditions. In lake Spokane, taking composite samples from the euphotic zone, the interflow zone and the hypolimnion give SRP/TP ratios of 16%, 82% and 86% respectively. This is not due to actual differences in the bio-availability of the phosphorus, rather the fact that a portion of the available phosphorus has already been taken up by algae or macrophytes.

Page 53, third paragraph – There should be a discussion about the fact that at the stateline, the river is a losing reach to groundwater and you also have Post Falls dam upstream, which can act as a sink for algae and phosphorus before it hits stateline. These factors should be considered in the evaluation of this one sample. The report should also mention that Ecology has a long data record for this and numerous other sites throughout the river, which provide a much better characterization of water quality than this one sample.

Page 54, first paragraph – Please define “raw sample.” Is this unfiltered river water?

Page 56 – Typo, “Executive” Summary. This should be at the beginning of the report.

Page 57, first paragraph, last sentence – Replace “very hard” with “impossible.”