City of Seattle
Gregory J. Nickels, Mayor

Seattle City Light
Jorge Carrasco, Superintendent

September 26, 2007

Helen Rueda
US EPA

Dave Peeler
Manager
Water Quality Program
Washington Department of Ecology

Deane Osterman
Director
Kalispel Tribe Natural Resources Department

Barry Burnell
Idaho Department of Environmental Quality

VIA E-MAIL AND US MAIL

Re: Pend Oreille River Temperature Draft TMDL

Dear Ms. Rueda and Messrs. Peeler, Osterman and Burnell:

Enclosed with this letter are Seattle City Light's ("SCL") preliminary comments on the Draft Pend Oreille River Total Maximum Daily Load for Temperature ("Draft TMDL"), dated August 2007. The comments have been prepared with the assistance of Dr. Tarang Khangankar, Research Leader and Manager of the Coastal and Watershed Processes Modeling Group of Battelle-PNNL's Marine Sciences Division (resume attached).

SCL very much appreciates the opportunity to be involved as the Draft TMDL is being developed. SCL's comments are intended to promote clarity and accuracy in the TMDL process so that progress can be made toward the goal of meeting water quality standards.

We understand that the underlying modeling for the Draft TMDL is currently being reviewed. As this review and the larger TMDL process continue, SCL believes it is imperative to look at some fundamental model interpretation and application issues. The purpose of our comments is to further explain these issues and urge their resolution before

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the TMDL is finalized. The TMDL team has all the tools and data necessary to address these issues, and the timeframe is sufficient to accommodate their resolution.

In order for these comments to be the most useful as the TMDL process moves forward, we have provided specific recommendations throughout. We have also included some requests for information, especially on the methodology used, that will assist us in comprehensively understanding and analyzing the TMDL and providing helpful comments on the next draft.

Thank you very much for your consideration of our comments. We look forward to continuing to work with the WAG and other stakeholders.

Sincerely,

Barbara Greene
Boundary Relicensing Project Manager

Enclosures

cc: Melissa Gildersleeve, Ecology
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Paul Pickett, Ecology
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Kody VanDyk, City of Sandpoint
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Clare Marley, Bonner County
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Seattle City Light
Comments on August 2007 Draft Pend Oreille River TMDL for Temperature
September 26, 2007

Seattle City Light provides these comments with the understanding that there will be further opportunities for comment as the TMDL process unfolds. Seattle City Light owns and operates the Boundary hydroelectric project, which may be substantially affected by this TMDL. Seattle City Light believes that these comments must be addressed in order to develop a TMDL that is consistent with state and federal laws relating to water quality, and that is not clearly erroneous, unsupported by the evidence, or arbitrary and capricious. As drafted, there is no substantial evidence as to the extent of SCL's contribution to the exceedences addressed by the TMDL.

1. Heat Load Allocation Calculations Should Account for Variability in Pend Oreille Flows

The Pend Oreille River has highly variable flows influenced by seasons as well as operation of reservoirs. The heat load allocation calculations presented in the Draft TMDL are, however, based on specific instantaneous flows that occurred at a specific river cross section in 2004. The calculations could thus misrepresent the actual effect of heat sources on temperatures in the Pend Oreille River which could be quite different during other flow conditions.

Heat Flux Model Assumes Constant Flow

The heat flux model used in the Draft TMDL[1] assumes constant flow, whereas flows are highly variable over time in some parts of the Pend Oreille, including the Boundary reach. For example in Boundary reach, due to the peaking operation, the flow fluctuates by as much as 20,000 cfs over a 24-hour period in the summer.[2] By contrast, when the heat flux model is applied in the draft TMDL, the difference between existing and allowable heat loads is simply multiplied by the one instantaneous flow of 18,811 cfs, which happened to occur at the moment of peak temperature in 2004.[3] The heat flux calculations assume that this one instantaneous flow rate occurred constantly across the entire 24-hour period (the instantaneous flow has been multiplied by 24 hours of time (86,400 seconds).

In reality, however, the heat flux through the cross section varied throughout the day just as the flow did. The total heat that passed across the section in a 24-hour period is actually the aggregate of all the many, varied heat flux sub-totals that occurred during that time.

Flow Inputs Should Reflect High Variability

The approach used in the Draft TMDL may work for a point-source situation where independent sources of heat (added flow at warmer temperatures) enter the river. In such

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[1] *See* Equation 1, Draft TMDL, p. 71.
[2] Breithaupt, S. and T. Khangaonkar. 2007. Temperature Modeling of the Pend Oreille River, Boundary Hydroelectric Project CE-QUAL-W2 Model Calibration Report. Prepared by PNNL for Seattle City Light. PNWD-3835.
[3] Draft TMDL, Table 23, p. 81.

a scenario, the heat contribution can be isolated relative to receiving water temperature, and use of the linear heat flux equation may be appropriate. In contrast, a dam is not a single point-source of heat, instead dam operations redistribute the existing heat due to changes in the natural hydraulic/hydrologic conditions. This calls for a more complex approach.

In particular, where flows are highly variable over time, as is the case here, it is critical that a *representative* daily flow be used in the heat flux equation in order to produce accurate outcomes. Arbitrarily identified flows are likely to generate inaccurate source contributions and heat load reductions. This focus on representative flows is consistent with the statutory language of the Clean Water Act, which expressly provides that TMDLs should take flow rates into account, 33 U.S.C. 1313(D),[4] as well as recent guidance from the EPA.[5]

Recommendation: If the heat load is to be expressed in Kcal/day[6], SCL recommends that a summation of heat load over a 24-hour period be conducted, to account for variation in flow and temperatures over the 24-hour period. Alternatively, a 24-hour average of flow and temperatures may be used in computing the heat load in Kcals/day.

2. Heat Load Calculations Should Take Into Account Cumulative Impacts of Upstream Actions

The load allocations and resulting proposed reductions in the Draft TMDL fail to show the cumulative effects of upstream actions and thus create the impression that the relative contributions of downstream sources are higher than they actually are. The required heat reductions set out in Tables B and 23 give an incomplete picture. They show the total reductions that would be required in each reach if the upstream projects made no changes to reduce their impacts on temperature, and, as a result, the Tables suggest that the downstream projects cause more warming than they actually do. The calculated "Reduction Needed" likewise suggests that downstream reaches have the burden of remedying the adverse effects of all upstream sources. For a complete and more representative picture, it is necessary to also show what reductions would be required in each reach assuming the upstream reaches were meeting water quality standards.

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[4] "Each State shall estimate for the waters identified in paragraph (1)(B) of this subsection the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife. Such estimates shall take into account the normal water temperatures, flow rates, seasonal variations, existing sources of heat input, and the dissipative capacity of the identified waters or parts thereof."

[5] EPA Memorandum, "Establishing TMDL 'Daily' Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in *Friends of the Earth, Inc. v. EPA, et al.,* No. 05-5015 (April 25, 2006) and Implications for NPDES Permits" (November 15, 2006), p. 2 *passim*, at http://www.epa.gov/owow/tmdl/pdf/anacostia_memo111506.pdf.

[6] Heat flux is a measure of instantaneous heat flow rate at a river cross section, measured in Kcal/s. Multiplying by a factor of 86,400 converts the value to Kcal/day assuming that heat flux remains the same.

Recommendations:

- An additional set of calculations should be run in order to determine – and present – the heat load allocations that would be required for each reach if either (a) the upstream reaches were meeting water quality standards; or (b) natural upstream conditions were assumed.
- Explanations should be provided concerning which modeling scenarios were used to determine load allocations. For example, were scenario 1 (existing) and 8 (natural) used exclusively, or were other scenarios with upstream and downstream impoundments in place or removed compared to natural conditions? This is important to help understand the relevance of cumulative impacts to each allocation.

3. Volume-Weighted Maximum Temperatures Should be Used to Ensure Representativeness

As set out in a previous letter to Ecology, SCL is very concerned that the existing maximum temperature in the Washington portion of the TMDL is calculated using a single-point maximum daily temperature estimate rather than the maximum daily temperature averaged throughout the water column (i.e. a volume-weighted average).

State Law Requires Use of Representative Temperatures for TMDLs

Washington state law requires that, for the purposes of establishing a temperature TMDL, the data that is collected and analyzed must be *representative* of water quality conditions. RCW 90.48.585(1)(b). The underlying policy goal is to ensure that water quality protection measures are accurate and properly prioritize the financial resources of governments and regulated entities. RCW 90.48.570. To assure consistency with the statutory mandate, and the underlying policy goals, TMDL modeling determinations must also reflect representative temperatures. The logic that applies to data collection and analysis applies equally to the modeling process.

More specifically, Ecology is required to use "credible data" in all stages of the water quality compliance process: (a) for determining whether any water of the state is to be placed on or removed from any section 303(d) list; (b) *for establishing a TMDL for any surface water of the state*; or (c) for determining whether any surface water of the state is supporting its designated use or other classification. RCW 90.48.580(2). In order to be credible, the data must be representative of the water quality conditions:

> In *collecting and analyzing* water quality data for any purpose identified in RCW 90.48.580(2), data is considered credible data if:
>
> (a) Appropriate quality assurance and quality control procedures were followed and documented in collecting and analyzing water quality samples;
>
> (b*)* The samples or measurements are *representative of water quality conditions at the time the data was collected; …*
>
> RCW 90.48.585(1)(b) (emphasis added).

Washington's water quality regulations also indicate that temperature measurements should be collected in locations representative of the dominant aquatic habitat of a site, and this generally means that measurements should be taken from well mixed portions and should not be taken at the surface.[7] The Quality Assurance Plan for the Pend Oreille TMDL similarly emphasizes the importance of collecting representative vertical temperature data and suggests that deep locations are relevant in this regard.[8]

The rationale pertaining to temperature measurement applies equally to the standards used in modeling determinations. If representative temperatures are modeled, the resultant TMDL will be more accurate and will promote the proper prioritization of water quality resources. Moreover, the data collection, analysis, and modeling are all steps in the same process, which is designed to ensure that the waters of the State meet the water quality standards.

Vertical Temperature Gradient at Boundary is Significant for TMDL Purposes

In the Boundary reach, maximum temperatures from a single location in the water column are not representative; thus, to base the TMDL calculations on such temperatures appears inconsistent with State law and most certainly biases the assessment of existing conditions relative to water quality standards. The Draft TMDL is entirely based on surface temperatures in the Boundary reach. pp. 43, 49. This creates problems because, in key locations, and at the times of year most relevant for evaluating temperature exceedences, surface warming is significant. Specifically, during peak summer season, surface warming in the last three or four miles of the forebay can result in up to 1.79 ˚C difference between the surface and bottom temperatures (as observed on August 17, 2004).[9] Thus, when the steady state heat flux calculation is conducted (using Equation 1, p. 71), it assumes that the entire water column is at the (higher) surface temperature. This inevitably results in a higher estimate of heat flux than the actual value because the non-surface water temperatures have been disregarded.

Furthermore, the TMDL inappropriately characterizes the single-point maximum temperature approach as a margin of safety issue. p.89. The margin of safety in a TMDL is designed to address any lack of knowledge about the development of thermal water quality criteria for the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife. 33 U.S.C. 1313(d)(1)(C). Here, by contrast, the question is how existing thermal conditions should most accurately be modeled. It is not appropriate

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[7] "Temperature measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should:
(A) Be taken from well mixed portions of rivers and streams; and
(B) Not be taken from shallow stagnant backwater areas, within isolated thermal refuges, *at the surface*, or at the water's edge." WAC 173-201A-200(1)(c)(vi)(emphasis added).

[8] "Vertical and lateral temperature distributions will be assessed several times during the summer to evaluate representativeness of the thermistor locations. … Spot checks of water temperature vertical profiles will be taken at the thermistor with a digital profiling thermistor … . As time allows, vertical temperature profiles will also be measured at the deepest location adjacent to the thermistor to evaluate the representativeness of the site." Pickett, Department of Ecology, "Quality Assurance Project Plan: Pend Oreille River Temperature Total Maximum Daily Load Technical Study" (September 2004), pp 18, 21.

[9] See footnote 2 on page 2.

to characterize the use of unrepresentative data or modeling as a margin of safety matter. Instead, the TMDL should be revised to produce the most accurate assessment of existing conditions relative to water quality standards.

Current Approach Exacerbates Inconsistencies between Idaho-Washington/Kalispel portions of TMDL

Modeling of single-point surface temperatures in Washington is also inconsistent with the approach being taken across the state border in Idaho and thus raises significant concerns about the internal consistency and cohesiveness of the TMDL. In the Idaho portion of the Draft TMDL, volume-weighted maximum temperatures were used for the deep pools at 10 km and 35 km downstream of the railroad bridge. pp 69, 71, 89. The Draft TMDL suggests that the single-point maximum temperature approach is used in Washington and for the Kalispel Tribe to "ensure compliance at all locations in the water column." p. 89. Yet there is no attempt to explain why the rationale is different across the state line. This inconsistency is irreconcilable with the MOA commitment to cross-border coordination and integration and one seamless temperature TMDL.[10]

Recommendation: That modeling for the Washington and Kalispel portions of the TMDL should be re-run using a volume-weighted approach.

4. Analysis Should Account for Temperature Increases Resulting From Lag Time

The TMDL analysis should account for the apparent temperature increases recorded relative to natural conditions due to the reservoir "lag effect". The "lag effect" refers to the lag or delay in the timing of peak temperatures in natural conditions versus existing conditions due to the longer travel times in existing conditions. The temperature peaks are separated by a period equal to the difference in travel time between natural conditions and existing conditions.[11] To provide a true estimate of temperature increase in existing conditions relative to natural conditions, a comparison must be made between the same or equivalent parcels of water in the two conditions. Put another way, the corresponding peaks in temperature must be compared even if they lag one another due to travel time -- as opposed to comparing temperatures at a specific time in the day.

Agencies sometimes use the concept of reach-wide absolute *maximum* temperatures to obtain a true measure of the actual temperature increase caused by impoundment (i.e. a comparison between existing condition high temperatures and *corresponding high temperatures* in the existing–unimpounded condition). To account for uncertainty in modeling results, a comparison of 95th percentile high temperatures is conducted, with

[10] Memorandum of Agreement for the Interstate EPA TMDL for the Pend Oreille River (May 2005); cover letter transmitting final signed memorandum from Michael F. Gearheard, EPA, to Washington Department of Ecology, Idaho Dept. of Environmental Quality and Kalispel Tribe, dated May 3, 2005.

[11] The presence of Boundary Reservoir results in a relatively short lag time of 1.21 days [29 hours] corresponding to August 25, 2004, and could vary between 0.5 to 1.5 days depending on river flows and reservoir operations.

and without the impoundment.[12] This approach accounts for the lag time because it is not dependant on the specific time at which the comparison is made. Conversely, if the reservoir lag effect is ignored, actual temperature differences between natural and existing conditions are exaggerated.

The Willamette TMDL provides an EPA-sanctioned precedent for taking travel time into account.[13] Specifically, the approach adopted in the Willamette TMDL includes the following two progressive features:

- Use of 95th percentile values – The TMDL is based on point of maximum impact (Albany, OR) where the differences between the existing and natural conditions are the highest. However, rather than using a specific day with the highest recorded difference (extreme value), a 95th percentile value of the predicted differences is used.
- Use of seasonwide predictions in calculation of 95th percentiles – The percentile differences in high temperatures are based on daily values from a period of June 15 through September 15 of 2001. This implies that high temperatures in existing conditions were ranked irrespective of when they occurred for comparison with high temperatures under natural conditions, implicitly accounting for lag times.

Recommendation: The TMDL impact analysis should be revised to take the reservoir lag effect into account.

5. Analysis Should Acknowledge Absence of Modeling of Seven Mile Dam Reservoir Operations

The Draft TMDL states that the Washington section of the model was developed from Box Canyon Dam to the International Border; however, the model does not currently reflect the impact of the Seven Mile Dam backwater downstream of Boundary Dam. This reach is affected by the operation of Seven Mile Dam located at RM 6.0. Seven Mile Dam creates a backwater effect that may contribute thermal load but has not been accounted for in the modeling.

In particular, because the operational conditions of Seven Mile Dam were not known, the model's downstream boundary was assumed to be the same as the measured water surface elevation in the Boundary Dam tailrace.[14] The calculations could therefore be overestimating the effect of upstream sources, when in fact some of the contribution could be from Seven Mile Dam operations.

Recommendation: The TMDL should acknowledge that the upstream impacts of Seven Mile Dam reservoir operations are not captured by the model, and allocations should take that into account.

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[12] Oregon Department of Environmental Quality, Willamette Basin TMDL: Chapter 4: Temperature-Mainstem TMDL and Subbasin Summary (September 2006).
[13] EPA approved the Willamette TMDL in September 2006.
[14] See Footnote 2 on page 2.

6. Water Quality Standards and "Allowable Temperatures" Should be Consistent

There appears to be a significant discrepancy between the regulatory water quality standards and the "allowable temperatures" set out in the Draft TMDL. It is entirely unclear how the 19.97 and 19.99 ºC allowable temperatures were calculated for Washington and how the 12.85 ºC allowable temperature was calculated for the Kalispel portion of the river relative to the numeric criteria of 20 ºC and 20.5 ºC, respectively (Table B and elsewhere). How do the "allowable temperatures" for Washington and the Kalispel relate to the numeric criteria described in Table 9 and p. 68? It is also difficult to understand how the allowable temperature in Boundary Reservoir can be lower than that in Box Canyon, when Boundary Reservoir is downstream of Box Canyon Reservoir.

"Allowable temperatures" should reflect the water quality standards, and thus would be 20.3 ºC or higher for all of the Washington reaches using the natural condition provision. Any lower allowable temperatures need to be fully explained and justified. If the natural conditions provision is used to determine the water quality standard and TDML allocations, an explicit presentation of the modeled natural temperatures should be included in the TMDL document.

Recommendations:

- Revisit allowable temperatures to ensure accuracy.
- Provide full explanation as to how they were arrived at, including how and why they differ from numeric criteria.
- Provide detailed explanatory and supporting information if natural conditions provisions are used.
- Include figures that use real temperatures values as modeled to show load capacity, existing and natural conditions. (The figures in the Draft TMDL focus on the difference between existing and natural temperatures and therefore load capacity is defined graphically in a manner that cannot be related to reality.)

7A. The TMDL Should Require Idaho Compliance with Downstream Standards at the State Border

The State Border Compliance Point is Arbitrarily and Unfairly Ignored

The TMDL expressly states that Idaho must comply with Washington standards at the State border. p. 67. It also identifies the Washington State Line as one of three water quality compliance points that should be considered when developing Idaho allocations (Idaho Cross Section; Idaho Bottom 35 km; Washington State Line). p. 70. However, it ultimately ignores two of those compliance points – including the State Line. The TMDL prioritizes the three compliance points, determining that the Cross-Section is the first priority; the Bottom target is the 2nd priority, and, the State Line target is the 3rd priority. p. 70. It goes on to develop a Load Allocation for only the Cross-Section target and determines to simply monitor temperatures at the other two compliance points (including non-compliance at the WA state border) to determine if further controls are needed. p. 79.

This approach appears arbitrary. There is no sound explanation as to why the State Line (and Bottom) compliance point(s) should be ignored and thus why Idaho will not be required to comply with Washington standards at the State border, despite an express acknowledgement that it should. The TMDL explains its third ranking on the basis that "it is based on numeric criteria rather than the attainment of beneficial uses." *Id.* This reasoning is fatally flawed: numeric criteria are specifically designed to ensure attainment of beneficial uses. Compliance with numeric criteria should therefore be the first-order focus, not a basis for avoiding compliance efforts.

In addition, the selective treatment of Idaho compliance points also raises fundamental questions about TMDL equity and coherence. Specifically, no such selective compliance is allowed in the Washington or Kalispel portions of the TMDL. It is entirely unclear why such a liberal approach makes sense in part of the Pend Oreille but not in others.

State Line Non-Compliance inconsistent with CWA Policy and Prior Practice

In failing to address non-compliance at the state border, the TMDL also disregards the apparent established position that, in an inter-state TMDL, upstream states must comply with downstream water quality standards. The Clean Water Act has an underlying policy of upstream compliance with downstream water quality standards. For example, States' water quality standards must ensure "attainment and maintenance" of downstream WQS. 40 C.F.R. § 131.10(b) (1994). In addition, there is a prohibition on NPDES permits "when the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States." 40 C.F.R. 122.4(d); *Arkansas v. Oklahoma,* 503 U.S. 91, 112 S. Ct. 1046 (1992).

The notion that Idaho must comply with Washington standards at the State border is also consistent with Idaho's prior practice in the Idaho-Oregon Snake River/Hells Canyon TMDL.[15] That TMDL explained the approach as follows:

> The purpose of TMDL development is to meet applicable water quality standards. The SR-HC TMDL is a bi-state effort; therefore the most stringent of each state's water quality standards have been identified as targets for this TMDL. In this way the attainment of these targets will ensure that the water quality requirements of both states will be met.

EPA has also taken the position that TMDLs should ensure achievement of more stringent downstream WQS:

> EPA is concerned that developing a TMDL targeted at the less stringent temperature standards for a particular reach would not assure achievement of the more stringent standards also applicable to the reach, because it appears that temperature loadings delivered at the border by the state with the less stringent

[15] Oregon Dept of Environmental Quality and Idaho Dept of Environmental Quality, Snake River/Hells Canyon TMDL (June 2004) at 353.

> standards – i.e., the "background" loadings – would make it difficult, if not impossible, for the neighboring state to achieve its temperature water quality standards. …
> Moreover, as a legal matter, EPA is authorized to consider downstream water quality standards (including those in other states), when establishing or approving a TMDL (citing Arkansas v. Oklahoma). … The application of state water quality standards in the interstate context is wholly consistent with the Act's broad purpose 'to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.' 33 U.S. C. § 1251(a). [16]

Calculations Inappropriately Based on Different Time Frames

To ensure that Idaho in fact complies with Washington water quality standards at the border, Idaho calculations must be based on the same target dates as those in Washington. Currently, the target date used for Idaho compliance at the Washington State Line is May 1. By contrast, Washington TMDL calculations were based on August 25, 2004. Compliance and temperature reductions by Idaho in the cooler month of May are irrelevant if Washington load allocations are based on August. For consistent calculations, the incoming water from Idaho must be in compliance with the allowable temperature standards in Washington ***on August 25***. This would ensure load allocations in Washington correspond to impairment induced by sources in Washington. Moreover, it is highly questionable whether Washington waters could actually achieve water quality standards if the discharge from Idaho was already significantly impaired relative to Washington standards.

7B. Even if Idaho is Non-Compliant at the Border, Washington & Kalispel Sources Should Not be Required to Compensate

In the alternative, if the TMDL does not seek to achieve Washington water quality standards at the State Line, Washington and Kalispel calculations and allocations should take that into account. It would be fundamentally inequitable for load allocations in Washington to reflect Idaho-sourced impairment. Washington and Kalispel sources should only be required to address temperature impairment induced downstream of the state border.

Recommendations:

- The TMDL should include load allocations for the State Line compliance target.
- Load allocations for Idaho sources should be designed to ensure compliance with Washington water quality standards at the border.

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[16] Preliminary Draft Columbia/Snake Rivers Temperature TMDL, September 13, 2002, pages 10-11; *see also*, EPA, TMDL to Limit Discharges of 2,3,7,8-TCDD (Dioxin) to the Columbia River Basin (1991) at A-1 ("Because the purpose of this TMDL is to provide a framework for attaining all applicable water quality standards for dioxin, this multi-state TMDL must be protective of the waters with the most stringent of those standards.")

- Alternatively, even if Idaho does not achieve Washington water quality standards at the border, the Washington and Kalispel load allocations should reflect that situation. Washington and Kalispel load allocations should only address temperature impairment induced downstream of the state border.

8. Unreasonable Shade Enhancement Obligations

The TMDL acknowledges that there is "no obvious relationship" between shade and temperature on the mainstem. Pg. 84 and Table 27. Despite this, the TMDL unreasonably suggests that significant shade enhancement should be undertaken on the mainstem in Washington. *Id.*

Recommendation: Load allocations for mainstem vegetation should be revisited to assess their reasonableness given the non-existent relationship between shade and mainstem temperature.

9. Implementation and Monitoring

In general, there is duplication of information and a general lack of clarity about Washington, Idaho, and Kalispel Tribe/EPA requirements, processes, and responsible parties throughout the Implementation section of the TMDL. Section 5.6.

Recommendation:
- Once the body of the TMDL has been revisited and revised, the Implementation section should be rewritten to provide meaningful guidance to regulated entities.
- Alternatively, the implementation section should be deleted and all implementation issues should be addressed in a separate implementation plan.

<u>Detailed and Courtesy Comments</u>

In comparison with the comments above that are designed to address more fundamental policy and modeling questions, the following comments address what appear to be more specific points or apparent errors:

- It would be helpful if some context for the compliance assessment was provided. Specifically, for all jurisdictions, an introduction could provide a characterization of conditions in the river as generally meeting water quality standards during all or parts of the year. It should be clear that the TMDL focuses on times of non-attainment. Illustrations of the percentage of critical season with exceedances versus percentage of the entire year that water quality standards are exceeded may be useful.

- Figure 21 implies that on August 25, for almost 20 river miles, existing conditions were at least 2 ºC above the allowable load. Without explanation of how this was derived anywhere in the document, it gives a false representation of the actual conditions in the river the majority of the time and at varying depths.

- Table 31 in the Temperature TMDL indicates that Seattle City Light is the "responsible party" for ongoing water quality monitoring described as follows: "Stimson Lumber Temperature and Sediment Monitoring in LeClerc Creek Watershed and Tri-State Water Quality Council Nutrient and Metal Monitoring at Newport." SCL is not conducting this monitoring.

- Page 69, paragraph 4, references 2003 and 2004 data, though 2004 and 2005 data are the years used for the TMDL. This is confusing and perhaps inaccurate.

- Figures 25 and 26. Y-axis label is misleading: “temperature impairment” implies exceedance of load capacity. Just because a source has a temperature contribution, it does not necessarily equate to a temperature impairment as the label implies. There are many instances on this graph where the temperature contribution of sources is below the load capacity.

Information Requests

In order to comprehensively understand and assess the TMDL analysis, and to provide the most helpful comments on the next draft of the TMDL, we request copies of the following documents:

- The load allocation guidance that regulators used to develop the allocations. In the absence of guidance, a detailed written explanation of the methodology used to develop allocations is necessary.
- A copy of the Detailed Implementation Plan for the Pend Oreille River.
- The Quality Assurance policy/plan for the modeling scenario and analysis.
- Appendix A to the TMDL.
- Reports that explain how Ecology used the model to determine impairment.

Tarang Khangaonkar

Dr. Khangaonkar is a Research Leader and Manager of the Coastal and Watershed Processes Modeling Group of Battelle-PNNL's Marine Sciences Division. He provides senior leadership to Battelle's activities in numerical modeling studies related to water quality, hydrodynamics, sediment transport, and fate and transport analysis. He has 18 years of experience with various types of models capable of hydrodynamics, circulation, toxics fate and transport, and water quality kinetics. He has been involved in a number of mixing zone and dilution ratio studies providing modeling of near-field and far-field mixing processes, calculating dissolved oxygen (DO) depletion and sediment deposition, evaluating long-term effluent flushing and pH buffering, and performing diffuser design optimization. He has developed modeling based waste load allocations (WLAs) and water quality based permit limits for a number of facilities. He is currently managing the developments of Watershed/TMDL models for the Lower Deschutes River and the Clackamas Rivers related to temperature, DO, and phytoplankton issues. Through an R&D project, Dr. Khangaonkar also developed an instrument to conduct in situ sediment oxygen demand (SOD) measurements. He is currently supporting several FERC relicensing projects for hydropower facilities providing hydrodynamic and water quality modeling support in connection with fish passage and CWA Section 401 Water Quality Certification.

Dr. Khangaonkar is a recognized expert in modeling based water quality management studies. He currently serves as an expert consultant for the Northwest Pulp and Paper Association, refineries, and several aluminum smelters, in connection with temperature TMDL in the Columbia River, and National Pollutant Discharge Elimination System (NPDES) issues in the Puget Sound. Dr. Khangaonkar and his team are currently engaged in a number of restoration projects where he is managing the development and application high resolution 3-D finite element hydrodynamics and transport models for feasibility assessment and design of alternatives for restoring natural estuarine functions to coastal marshlands.

Research Interests

- Hydrodynamics, Hydraulics, Coastal Circulation and Waterwave Propagation
- Water Quality Kinetics and Fate and Transport of Pollutants
- Sediment Transport and Sediment Deposition Analysis
- Coastal and Shoreline Habitat and Fish Passage Restoration
- Mixing Zone Sizing/Design and Impact Evaluations
- Statistical Data Analysis and Water Quality Based Permitting
- Ocean/Coastal Engineering

Education and Credentials

- Postdoctoral Associate. Coastal and Oceanographic Engineering Department, Univ. of Florida, 1990 - 1991
- Ph.D., Applied Marine Physics/Ocean Engineering, University of Miami, 1990
- M.S., Ocean Engineering, University of Miami, 1988
- B.S. Naval Architecture, Indian Institute of Technology, 1986

Affiliations and Professional Service

- American Geophysical Union
- American Society of Civil Engineers

Selected Publications

2007

- Vavrinec J, III, WH Pearson, NP Kohn, JR Skalski, C Lee, KD Hall, BA Romano, MC Miller, and TP Khangaonkar. 2007. Laboratory Assessment of Potential Impacts to Dungeness Crabs from Disposal of Dredged Material from the Columbia River. PNNL-16482, Pacific Northwest National Laboratory, Richland, WA.
- Frick WE, TP Khangaonkar, AC Sigleo, and Z Yang. 2007. "Estuarine-ocean exchange in a North Pacific estuary: comparison of steady state and dynamic model." Estuarine, Coastal and Shelf Science 74(1-2):1-11. doi:10.1016/j.ecss.2007.02.019

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