Gonzaga University Legal Services, Environmental Law and Land Use Clinic

Please find the attached comments and attachments submitted on behalf of Gonzaga University Legal Services, Environmental Law and Land Use Clinic.

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July 24, 2020

Marla Koberstein
Department of Ecology
Preliminary Draft Variance Comments
PO Box 47696
Olympia, WA 98504-7696

SUBMITTED VIA WEBSITE (http://wq.ecology.commentinput.com/?id=3VtZr)

RE: Comments on Amendments to Chapter 173-201A WAC (variances)

Dear Ms. Koberstein:

I am writing on behalf of the Environmental Law and Land Use Clinic of Gonzaga University Legal Assistance ("Clinic") on the proposed amendments to Chapter 173-201A WAC (variances). Please include these comments into the administrative record for this matter.

As Ecology know, the issuance of a PCB variance is without any precedent. No variance has been issued in the State of Washington. No PCB variance has ever been issued in the U.S. Given the significance of this action to impact public and environmental health, the Clinic obtained the four attached reviews of this proposal by legal, technical, and policy experts for Ecology's and the public's consideration in this matter. Specifically, these comments have been prepared by:

- Water Policy Pathways LLC;
- Professor Rich Horner;
- Bricklin & Newman LLP; and
- Rey-Bear McLaughlin LLP.

If you have questions regarding these comments, do not hesitate to contact me at (509) 251-1424.

Sincerely,

Rick Eichstaedt
Director/Attorney/Adjunct Professor of Law
Environmental Law and Land Use Clinic

BRICKLIN & NEWMAN LLP
lawyers working for the environment

TO: Gonzaga Environmental Law Clinic
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FR: Bricklin & Newman, LLP
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DT: July 24, 2020

RE: Washington Department of Ecology's Preliminary Proposed Rulemaking for PCB Variances on the Spokane River—Issues Arising Under the State Environmental Policy Act and Clean Water Act

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I. INTRODUCTION AND SUMMARY OF CONCLUSIONS

The Gonzaga Environmental Law Clinic has asked our firm to evaluate the legality of the Washington Department of Ecology's preliminary proposed rulemaking for PCB variances on the Spokane River. Specifically, you asked us to assess the legality of the proposed rulemaking under Washington's State Environmental Policy Act ("SEPA"), Chapter 43.21C RCW, and the federal Clean Water Act, 33 U.S.C. § 1251 et seq. We discuss these issues below.

With respect to SEPA, this memo concludes that the Preliminary DEIS:

- Fails to properly define the no-action alternative;
- Fails to consider a reasonable range of alternatives;
- Fails to explain Ecology's rejection of other, non-variance alternatives; and
- Fails to use the proper framework for assessing environmental impacts.

With respect to the Clean Water Act, this memo concludes the proposed variances:

- May violate the Clean Water Act's prohibition on the removal or downgrading of existing uses;
- Fail to explain why PCB levels in the Spokane River "cannot be remedied," as required for a variance.
- Fail to require Inland Empire and Kaiser Aluminum to implement Best Available Technology as a necessary prerequisite to receiving a variance;

- Are based on incomplete data and analysis by the variance applicants; and
- Fail to explain why the municipal dischargers covered by the variances—*i.e.,* Liberty Lake, Spokane County, and the City of Spokane—cannot do a better job of removing PCBs from their effluent and the Spokane River.

In preparation for this memo, we reviewed Ecology's preliminary draft rule language, preliminary draft state technical support document ("TSD"), preliminary draft environmental impact statement ("Preliminary DEIS"), and preliminary draft implementation plan, all of which are available on Ecology's rulemaking website at https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC173-201A-variances. We also reviewed the variance applications submitted by the five facilities at issue in Ecology's proposed rulemaking, available at https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-standards/Updates-to-the-standards.

II. SEPA ISSUES

A. Overview of SEPA

SEPA represents Washington's State's policy regarding the environmental impacts of government decisions, and the mandate that government actors timely and thoroughly consider those impacts in the decision-making process. *See, e.g., Stempel v. Dept. of Water Res.*, 82 Wn.2d 109, 118, 508 P.2d 166 (1973) (describing purposes of SEPA); *ASARCO, Inc. v. Air Quality Coal.*, 92 Wn.2d 685, 707, 601 P.2d 501 (1979) (same). In essence, SEPA is an environmental full-disclosure law. *Norway Hill Pres. & Prot. Ass'n v. King County Council*, 87 Wn.2d 267, 272, 552 P.2d 674 (1976). It requires state agencies and other government bodies to assess potential impacts of their decisions up front, and if those impacts might be significant, to undertake a thorough environmental study known as an Environmental Impact Statement ("EIS"), where those impacts must be analyzed and disclosed, and where alternatives and mitigation measures must be considered. *See generally* RCW 43.21C.030; WAC 197-11-400 to -440. By requiring government actors to evaluate environmental impacts and alternatives up front, SEPA aims to ensure that environmental consequences are adequately evaluated, disclosed, and considered during the decision-making process. In this way, SEPA represents "an attempt by the people to shape their future environment by deliberation, not default." *Stempel*, *supra*,82 Wn.2d at 118.

The Department of Ecology's SEPA regulations emphasize that "[a]n EIS shall provide impartial discussion of significant environmental impacts and shall inform decisionmakers and the public of reasonable alternatives, including mitigation measures, that would avoid or minimize adverse impacts or enhance environmental quality." WAC 1970-11-400(2). An EIS must "provide a reasonably thorough discussion of the significant aspects of the probable environmental consequences of the proposed action." *Weyerhaeuser v. Pierce County*, 124 Wn.2d 26, 37, 873 P.2d 498 (1994). A decision made based upon inadequate environmental analyses is unlawful. *Leschi Imp. Council v. Wash. State Highway Comm'n*, 84 Wn.2d 271, 284-85, 525 P.2d 774 (1974).

SEPA, like its federal counterpart (NEPA), requires agencies to take a "hard look" at environmental issues. *PUD No. 1 of Clark County v. PCHB*, 137 Wn. App. 150, 158, 151 P.3d 1067 (2007) (citing *Nat'l Audubon Soc'y v. Dep't of Navy*, 422 F.3d 174, 184 (4th Cir. 2005)). SEPA does not require every single environmental effect to be considered, but an EIS "must include a reasonably through discussion of the significant aspects of the probable environmental consequences of the agency's decision." *City of Des Moines v. Puget Sound Reg'l Council*, 98 Wn. App. 23, 35, 988 P.2d 27 (1999). *See also Weyerhaeuser v. Pierce County*, 124 Wn.2d 26, 37, 873 P.2d 498 (1994); *Gebbers v. Okanogan County PUD*, 144 Wn. App. 371, 379, 183 P.3d 324 (2008). What is "reasonably thorough" is a function of the nature of the decision at hand. SEPA requires "a level of detail commensurate with the importance of the environmental impacts and the plausibility of alternatives." *Klickitat County Citizens Against Imported Waste v. Klickitat County*, 122 Wn.2d 619, 641, 860 P.2d 390 (1993).

The "heart" of an EIS is its discussion of alternatives to the proposed action. *Oregon Natural Desert Ass'n v. Bureau of Land Mgmt.*, 531 F.3d 1114, 1121 (9th Cir. 2008) (quoting 40 C.F.R. § 1502.14). SEPA itself requires every EIS to contain a "detailed statement" regarding "alternatives to the proposed action." RCW 43.21C.030(c)(iii). "The required discussion of alternatives to a proposed project is of major importance, because it provides a basis for a reasoned decision among alternatives having differing environmental impacts." *Weyerhaeuser, supra*, 124 Wn.2d at 38. "Pursuant to WAC 197-11-440(5)(b), the reasonable alternatives which must be considered are those which could 'feasibly attain or approximate a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation." *Id*. (quoting WAC 197-11-440(5)(b). The EIS must also inform decision makers of the impacts that would be associated with alternative levels of development. The EIS must "devote sufficiently detailed analysis to each reasonable alternative to permit a comparative evaluation of the alternatives including the proposed action." WAC 197-11-440(5)(c)(v). Finally, "[t]he 'no-action' alternative shall be evaluated and compared to other alternatives." WAC 197-11-440(5)(b)(ii).

Ultimately, the EIS "must indicate that the agency has taken a searching, realistic look at the potential hazards and, with reasoned thought and analysis, candidly and methodically addressed those concerns." *Conservation Nw. v. Okanogan County,* 2016 WL 3453666, *31 (June 16, 2016) (quoting *Found. on Econ. Trends v. Weinberger*, 610 F. Supp. 829, 841 (D.D.C. 1985)). "'SEPA seeks to ensure that environmental impacts are considered and that decisions to proceed, even those completed with knowledge of likely adverse environmental impacts, are 'rational and well documented.'" *Columbia Riverkeeper v. Port of Vancouver, USA*, 188 Wn.2d 80, 92, 392 P.3d 1025 (2017) (quoting 24 Wash. Practice: Environmental Law and Practice § 17.1, at 192).

In this case, Ecology's Preliminary DEIS contains a number of deficiencies under SEPA.

A. Failure to Properly Define the "No-Action" Alternative

First, the Preliminary DEIS fails to properly define the no-action alternative—*i.e.,* the alternative of not granting *any* variances for the five dischargers discussed in Ecology's proposed rulemaking. Below, we refer to these dischargers—Liberty Lake Sewer and Water District, Kaiser Aluminum,

Inland Empire Paper Company, Spokane County Regional Water Reclamation Facility, and the City of Spokane—as the "covered facilities."

In essence, the Preliminary DEIS defines the no-action alternative as simply re-issuing the covered facilities' NPDES permits under the federal Clean Water Act, with an effectively unenforceable requirement to meet the state's current PCB water quality criterion of 7 ppq.[1] *See* Preliminary DEIS at 9. We say "unenforceable" because, as Ecology explains, compliance with such a requirement would be evaluated using EPA's "Method 608.3," which "only measures down to 50,000 ppq." *Id*. In other words, while the permits themselves would require the covered facilities to meet the 7 ppq PCB limit, the facilities would effectively be allowed to discharge up to 50,000 ppq due to Ecology's view that reliably testing for lower PCB concentrations is not feasible.

However, Ecology's assessment of this issue mis-states the law. While it may be true that Method 608.3 would need to be used to evaluate compliance with any re-issued NPDES permits, it does not follow that the permits must be issued in the first place. The Clean Water Act generally forbids the issuance of any NPDES permit that would cause or contribute to a violation of water quality standards. *See, e.g.,* 40 C.F.R. § 122.4(d) ("No permit may be issued: . . . When the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States[.]"); RCW 90.48.520 ("In no event shall the discharge of toxicants be allowed that would violate any water quality standard, including toxicant standards . . . ."). In this case, Ecology has admitted that the covered facilities cannot meet the state's PCB criterion of 7 ppq. *See, e.g.,* TSD at 22 (opining that "[t]reatment technology that would reduce PCBs in the Spokane River to levels that achieve the human health criterion necessary to protect for the fish harvest and water supply uses in the river is not presently available."). Thus, a true no-action alternative would not be to re-issue permits that Ecology knows will violate water quality standards. Instead, the no-action alternative would be to allow the covered facilities' current NPDES permits to expire, without renewal.

In making this criticism of the Preliminary DEIS, we are fully aware of the Washington Supreme Court's recent decision in *Puget Soundkeeper Alliance v. State, Department of Ecology*, 191 Wn.2d 631, 424 P.3d 1173 (2018). In that case, the Supreme Court approved of Ecology's issuance of an NPDES requiring use of Method 608.3 to test for compliance with Washington's PCB criterion, notwithstanding that Method 608.3 has a much higher quantitation limit. However, notwithstanding its holding on the validity of Method 608.3 for testing, the Court also noted that testing is only one method for ensuring compliance with applicable water quality standards. Instead, "[r]requiring the permittee to implement specific water treatment practices that are designed to reach the required PCB cap is, as logic would dictate, a more effective method of preventing unlawful discharges *before* they can occur than simply to monitor a release of harmful chemicals that has already occurred." *Puget Soundkeeper*, 191 Wn.2d at 641 (emphasis in original). In short, even if Method 608.3 can lawfully be used for compliance testing, it does not

[1] "NPDES" stands for National Pollutant Discharge Elimination System, which in turn refers to the federal permitting program under Section 402 of the Clean Water Act, 33 U.S.C. § 1342. We discuss the regulatory elements and requirements for NPDES permits in Section II below.

follow that any new NPDES permits can be issued for the covered facilities unless there is some guarantee that their water treatment practices are sufficient to meet the 7 ppq PCB criterion. Here, where Ecology has admitted that no such water treatment practices exist, any re-issued NPDES would be unlawful.

"No action" means allowing the current permits to lapse. It does not mean issuing new, illegal permits that cannot guarantee compliance with the applicable criterion.

B. Failure to Include a Reasonable Range of Alternatives

Second, the Preliminary DEIS fails to include a discussion of a reasonable range of alternatives, in addition to the no-action alternative. In general, the Preliminary DEIS describes the range of alternatives as being effectively binary—either Ecology denies the variances, and re-issues the NPDES permits which will not meet applicable water quality standards; or, alternatively, Ecology can grant the variance requests and issue the specific variances described the agency's draft rulemaking. *See* Preliminary DEIS at 10 (description of Alternative 2). However, this binary approach fails to address many issues relevant to determining a reasonable range of alternatives.

First, the Preliminary DEIS and proposed rulemaking would establish the variances for 20 years (10 years in the case of Kaiser Aluminum). This is an exceedingly long time, and the Preliminary DEIS fails to analyze any alternatives to the proposed duration of the variances. This failure is especially problematic since, under Washington law, a variance may only be granted "for the minimum time estimated to meet the underlying standard(s)." WAC 173-201A-420(5)(a). There is no discussion in the Preliminary DEIS of how long that period might be, or if a shorter period would be more appropriate.

Second, under the Clean Water Act, variances may take a number of forms. Specifically, pursuant to 40 C.F.R. §131.14, they may be expressed as the "highest attainable interim criterion" or as the "interim effluent condition that reflects the greatest pollutant reduction achievable." 40 C.F.R. § 131.14(b)(1)(ii)(A)(1–3). In turn, this second option can be expressed in a number of ways, including as a numeric effluent condition or as a percent reduction of pollutants in the applicant's effluent. *See* 80 Fed. Reg. 51048, 51037 (Aug. 21, 2015). In this case, all five proposed variances would be expressed as percent reductions in PCB discharges, under the "greatest reduction achievable" options at 40 C.F.R. § 131.14. However, it appears that for at least two facilities (Liberty Lake and City of Spokane), this way of expressing the variance was selected due to a lack of data. *See* TSD at 49. For all facilities, the Preliminary DEIS should assess all available options for expressing the proposed variances and, if data is missing, should comply with the requirements of WAC 197-11-080—*i.e.,* Ecology should assess the costs of obtaining the missing data and, if the costs are exorbitant, assess the relative costs and benefits of moving forward at this time. Ecology should also consider the risks and benefits of proceeding at the current time, rather than waiting until later after the covered facilities provide more data. *See also* WAC 197-11-440(c)(vi) (EIS must "[d]iscuss the benefits and disadvantages of reserving for some future time the implementation of the proposal, as compared with possible approval at this time").

Relatedly, the TSD explains that other methods of expressing the variance were rejected due to reliability issues with EPA testing method 1668. *See* TSD at 49. But notwithstanding those issues, Ecology reports that method 1668 will be used under the variances for source investigation, identification, and determining the effectiveness of actions taken under the proposed "pollution minimization plans" or "PMPs." *Id*. at 58. The TSD also reports that method 1668 is effective at measuring PCBs at low concentrations in ambient water. *Id.* at 15. The Preliminary DEIS should analyze whether the variance might be expressed as an interim ambient water quality criterion, as measured using method 1668.

Third, the pollution minimization plans associated with the proposed variances contain many terms and conditions aimed at ensuring that the covered facilities make reasonable progress toward eventually meeting Washington's 7 ppq PCB water quality criterion. But even there, the Preliminary DEIS is entirely silent on whether alternatives exist for the PMPs, or if the current terms of the PMPs could be strengthened to better ensure eventual compliance with the PCB criterion.

For example, each of the PMPs require the permit holder to "[s]ubmit a proposed schedule for performing and completing PMP actions." Why could this schedule not be developed now, as part of the rulemaking itself? The Preliminary DEIS does not explain why this schedule cannot be developed before the variances are granted, not after. The public would also be far more capable of commenting on the adequacy of the PMPs if they knew how long it would take to complete them.

Similarly, several of the PMPs require the covered facilities to undertake such tasks as "[e]valuate infiltration and inflow (I/I) to collection systems," "[i]mplement measures to optimize operation and maintenance and to reduce PCBs discharged in final effluent," "[e]valuate and optimize the solids dewatering and storage processes," "[i]ncorporate adaptive management to identify and reduce sources of PCBs through active participation in the Spokane River regional toxics task force (SRRTTF)," and "[i]nvestigate Technical, Legal and Policy Solutions through the federal Toxics Substance Control Act (TSCA)." *See* Preliminary Draft Rule Language at 13–20. For these and similar provisions, the Preliminary DEIS fails to discuss whether (a) specific timelines and milestones can be established for the various PMP elements, and included in the final rule, to ensure they are completed in a timely manner, and (b) whether the details of any of these elements can be clarified, delineated, or shortened before the variances are granted.[2] Ecology should not be giving the covered facilities any more time than necessary to take all steps toward complying with the variances and underlying PCB criterion.

[2] The proposed variance rule does note that more information about the PMPs may be found in "Ecology Publication 20-10-020." However, the proposed variances do not identify what this document is. Nor were we able to find it online. Regardless, if there are any additional details relating to the PMPs that Ecology proposes to treat as binding, they should be identified and disclosed in the draft rule language, so that the public can meaningfully comment and the covered facilities may be held accountable to them as such.

At the very least, Ecology should explain why it believes no greater detail can be provided at this time regarding the specifics of each PMP component, or why these details should not be included in the proposed rule language. Ecology should also explain why none of the steps can be performed now, or why no binding milestones can be established now to judge the reasonableness of progress made by the covered facilities over the terms of the variances.[3]

C. Failure to Explain Rejection of Other, Non-Variance Alternatives—TMDL and Compliance Schedule

At pages 8 to 9 of the Preliminary DEIS, Ecology rejects two alternatives suggested during the DEIS scoping phase—the first is to address PCBs in the Spokane River through a Total Maximum Daily Load ("TMDL"), the second is to issue compliance schedules to the covered facilities rather than variances. The Preliminary DEIS rejects the TMDL alternative because TMDLs are "not self-implementing and therefore would not meet the objective of issuing the NPDES permits by fall 2021." The Preliminary DEIS rejects the compliance schedule option because "[a] compliance schedule can only be used when it is shown that a discharger can meet effluent limits at the end of the compliance schedule period," whereas here, "it was clear [to Ecology] that all dischargers could not meet the final end of pipe effluent limit of 7 ppq within the timeframe of a compliance schedule due to technology limitations." Preliminary DEIS at 9.

Regarding Ecology's rejection of the TMDL alternative, we agree that TMDLs are, in a sense, "not self-implementing." In general, a TMDL sets a pollution budget for the affected waterbody, and then distributes that budget among various point and nonpoint sources of pollution. *See generally* 33 U.S.C. § 1313(d); 40 C.F.R. § 130.7. Once the pollution budget is established, however, the TMDL does not technically force Ecology or any other state, municipal, or private actors to implement the pollution budget as it applies to nonpoint sources of pollution, such as forestry and agriculture. In this sense, TMDLs are not self-implementing; but they certainly still have value to the extent that the state actually cares of about reducing nonpoint sources of pollution. *See, e.g., Pronsolino v. Nastri*, 291 F.3d 1123, 1129 (9th Cir. 2002) ("TMDLs are primarily informational tools that allow the states to proceed from the identification of waters requiring additional planning to the required plans. As such, TMDLs serve as a link in an implementation chain that includes federally-regulated point source controls, state or local plans for point and nonpoint source pollution reduction, and assessment of the impact of such measures

[3] It also bears note that, at page vi of the Preliminary DEIS, Ecology describes the proposed variance rulemaking as a "non-project" action under SEPA. In general, the phrase "non-project" refers to "actions which are different or broader than a single site specific project, such as plans, policies, and programs." WAC 197-11-774. However, it is unclear why that term would apply here, since the purpose of the proposed rulemaking would be to set individual effluent requirements for five specific facilities. Moreover, even if this were a non-project action, that would not reduce the agency's duty to provide a full analysis under SEPA. *See, e.g.,* Washington Department of Ecology, State Environmental Policy Handbook, 2018 Updates, *available at* https://ecology.wa.gov/DOE/files/4c/4c9fec2b-5e6f-44b5-bf13-b253e72a4ea1.pdf (explaining that "[t]he procedural requirements of SEPA for review of a nonproject proposal are basically the same as a project proposal.").

on water quality, all to the end of attaining water quality goals for the nation's waters.") (internal citation omitted).

The situation is different, however, for point sources of pollution governed by the Clean Water Act's NPDES permit program. For those sources, they may only discharge pollutants n accordance with a valid NPDES permit issued under Section 402 of the Clean Water Act. *See* 33 U.S.C. §1311(a). And every NPDES permit must be consistent with the pollution budget allocated by a TMDL covering the same waterbody, if any. *See* 40 C.F.R. § 122.44(d)(1)(vii)(B); 40 C.F.R. § 130.2(h). In this sense, a TMDL may not be "self-implementing," but it would certainly have regulatory effect and would be helpful when issuing any new or revised permits to the covered facilities, to ensure they collectively meet the 7 ppq PCB criterion.

Further, even if a TMDL could not be a stand-alone alternative to the proposed variances, it is unclear why the covered facilities cannot or should not be required to fund the creation of a PCB TMDL to help aid future pollution reduction work in the Spokane River, as a required element of the variance. Such a requirement would clearly be of the same spirit as many other requirements of the proposed PMPs, such as working with the Spokane River Regional Toxics Task Force to find and reduce PCBs in the Spokane River. Funding a TMDL could be a very important part of that work. In other words, while the Preliminary DEIS rejects the creation of a TMDL as a stand-alone alternative *to* the proposed variances, it does not consider requiring a TMDL as a required component *of* the proposed variances.

As for the Preliminary DEIS's rejection of the compliance schedule alternative, Ecology's stated rationale would appear to apply equally to the proposed variances. It is true, as Ecology observes, that a compliance schedule cannot be granted unless there is some guarantee that the facility will be capable of complying with applicable water quality standards at the end of the schedule period. *See* WAC 1730-201A-510(4)(b) ("Schedules of compliance shall be developed to ensure final compliance with all water quality-based effluent limits and the water quality standards as soon as possible."). But the same rule also applies to variances. *See* WAC 173-201A-420(5)(a) ("A variance is a time-limited designated use and criterion. . . . Each variance will be granted for the *minimum time estimated to meet the underlying standard(s)* or, if during the period of the variance it is determined that a designated use cannot be attained, then a use attainability analysis . . . will be initiated.") (emphasis added).

Ultimately, if it is true that the covered facilities cannot be expected to come into compliance with Washington's PCB criterion over any reasonable period of time, then not only should the compliance schedule alternative be rejected, so should the variance alternative. The Preliminary DEIS fails to explain why one of these alternatives is available, but not the other, when both require assurances that water quality standards will be achieved at the end of the timeline.

Finally, the Preliminary DEIS contains no discussion of other options for reducing PCB discharges such as beneficial reuse and land application of the covered facilities' effluent. These alternatives are discussed briefly in Ecology's TSD. But they should be given a full evaluation under SEPA based on up-to-date information. Inland Empire also should be required to evaluate the option of ending its use of recycled paper, which appears to be the source of the PCBs at that facility. In

Inland Empire's variance application, it opines that "preservation of recycling provides enormous environmental benefits." *See* Inland Application at 6. But it is unclear whether such benefits would actually outweigh the environmental harm of continued PCB discharges to the Spokane River. This issue should be analyzed by Ecology under SEPA.

D. Failure to Consider Environmental Impacts of the Alternatives

Finally, throughout the Preliminary DEIS, the variance alternative is presented as having no adverse environmental impacts whatsoever, and as having only positive environmental impacts. In large part, this appears to be due to Ecology's artificial comparison of the variance alternative to the false no-action alternative (issuing new NPDES permits that fail to achieve water quality standards). Viewed through that lens, the Preliminary DEIS states that granting the variances will be environmentally beneficial in comparison to simply reissuing the permits without variances, with no ability to ensure compliance with the 7 ppq PCB criterion.

But as discussed above, the comparison is false; a true no-action alternative would be to allow the covered facilities' NPDES permits to lapse without renewal, thus ending the discharges altogether. Compared to that alternative, allowing the covered facilities to continue to discharge (with variances) may indeed have adverse impacts, since allowing any continuing discharge of PCBs is no doubt more harmful than completely eliminating them.

The Preliminary DEIS should be revised so that it compares (a) the environmental impacts of issuing the variances with (b) the environmental impacts of ending the discharges because the covered facilities cannot comply with applicable water quality standards. We cannot say at this time what the results of such an analysis would be. But comparing the proposed variances to a false no-action alternative does not constitute the type of "hard look" mandated by SEPA.

III. CLEAN WATER ACT ISSUES

A. Overview of the Clean Water Act

The objective of the Clean Water Act is ''to restore and maintain the chemical, physical, and biological integrity of the Nation's waters,'' and to achieve ''wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water.'' 33 U.S.C. § 1251(a) and (a)(2). To these ends, the Act makes it unlawful for any person to discharge any pollutant to any river, lake, or similar surface waterbody unless the discharge is authorized under, and compliant with, an NPDES permit issued under Section 402 of the Act, 33 U.S.C. § 1342. Such permits are the Act's primary tool for regulating and reducing the discharge of harmful pollutants from point sources such as Kaiser Aluminum, Inland Empire, and the municipal dischargers currently requesting variances from Washington's 7 ppq PCB criterion (Liberty Lake, Spokane County, and the City of Spokane).

NPDES permits, in turn, have two essential components—technology-based effluent limitations (also known as "TBELs"), and water-quality based effluent limitations (also known as "WQBELs"). In essence, the former (TBELs) require the permittee to install and comply with

increasingly stringent water treatment technology so that the level of pollution reduction continues to improve as advances in technology are made. TBELs are supposed become stricter and stricter over time, as new pollution reduction technology becomes available.[4] For example, for toxic pollutants like PCBs discharged from private facilities like Kaiser and Inland, these TBELs generally must require the permittee to comply with a standard known as "Best Available Technology" or "BAT." As one court has explained, BAT is "'the CWA's most stringent standard' for setting discharge limits for existing sources." *Sw. Elec. Power Co. v. United States Envtl. Prot. Agency*, 920 F.3d 999, 1016 (5th Cir. 2019) (citing 33 U.S.C. §§ 1311(b)(2), 1314(b)(2). In essence, BAT requires each facility to install the water treatment technology used by the "single best-performing plant in [its] industrial field," which acts as "a beacon to show what is possible." *Id.* at 1018. BAT is a "best of the best" standard, reflecting the great harm that can be done by discharging toxic pollutants to surface waters of the United States.

WQBELs, in contrast, represent any *additional* permit limits over and above technology-based limits that are needed to comply with state water quality standards. In general, water quality standards consist of "designated uses," which set out, for each waterbody, the environmental objectives that the state seeks to achieve (*i.e.,* maintaining water quality suitable for swimming or fishing); water quality criteria, the purpose of which is to define minimum water quality conditions necessary to protect the designate use; and an antidegradation policy, the purpose of which is to provide a framework for maintaining and protecting water quality that has already been achieved. *See* 40 C.F.R. 131.3(b, e, h). For example, the topic of this memo concerns Washington's PCB criterion of 7 ppq, the purpose of which is to protect the designated uses of human fish consumption and water supply in the Spokane River.

The Clean Water Act generally requires all polluting discharges to comply with these basic requirements, and forbids any discharge that would violate state water quality standards. *See, e.g.,* 33 U.S.C. § 1342(b)(1)(C) (requiring, "[n]ot later than July 1, 1977, any more stringent [permit] limitation . . . to implement any applicable water quality standard established pursuant to this chapter."). However, the Act also contains limited mechanisms for allowing a discharger to avoid compliance with these requirements on a time-limited, temporary basis.

One such mechanism is a variance, which is defined under the Clean Water Act as "a time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s) that reflect the highest attainable condition during the term of the WQS variance." 40 C.F.R. § 131.3(o). In essence, a variance is a temporary change to a state's water quality standards, the purpose of which is to allow a particular permittee to continue discharging, notwithstanding that the discharge violates applicable standards. The ultimate purpose of a variance is to give the permittee time to come into compliance, not simply to excuse non-compliance in perpetuity. For this reason,

[4] *See, e.g., Nat. Res. Def. Council, Inc. v. U.S. E.P.A.*, 822 F.2d 104, 123 (D.C. Cir. 1987) (observing, "the most salient characteristic of [the CWA], articulated time and again by its architects and embedded in the statutory language, is that it is technology-forcing").

Washington's own regulations make clear that a variance should only be granted "for the minimum time estimated to meet the underlying standard(s)." WAC 173-201A-420(5)(a). During the variance period, the permittee must also attain the "highest attainable condition," which generally means it must do the best it can to attain applicable standards. *See* 40 CFR § 131.14(b)(1)(ii).

In this case, the variances proposed by Ecology would effectively allow the five covered facilities to continue discharging PCBs to the Spokane River, in violation of the state's 7 ppq PCB criterion for human fish consumption and water supply. The variances have essentially two components. First, the variances would replace the state's "fish harvesting" and "water supply" designated uses for the Spokane River with new designated uses called "limited fish harvest" and "limited water supply." In other words, in order to allow the covered facilities to continue discharging, these designated uses will be downgraded for the next 20 years (the term of the variances), supporting only "limited" consumption and water supply over that period of time.

Second, the variances establish a framework for each covered facility to make steps toward ultimate compliance with the 7 ppq PCB criterion over the next 20 years. These steps are discussed in the Pollution Minimization Plans (or PMPs) referenced above. In part, the PMPs require each facility covered by the proposed variances to study possible new technologies during the variance period, to evaluate their effectiveness at removing PCBs, and to gather data on PCB levels in the Spokane River. If more effective technologies are found during the 20-year variance period, the variances would allow Ecology to require their ultimate installation and use.

Below, we identify several problems with the proposed variances under the Clean Water Act.

B. Failure to Evaluate Whether Full "Fish Harvest" and "Water Supply" Are Existing Uses

First, Ecology fails to discuss whether the designated uses of full fish harvesting and water supply, currently designated for the Spokane River, are also "existing uses" as that term is used in the Clean Water Act. In general, an existing use is one that was "actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." 40 C.F.R. 131.3(e). In turn, this definition refers the date of EPA's first adopted regulations under the Clean Water Act, in which EPA established that "no further water quality degradation which would interfere with or become injurious to existing instream water uses is allowable." *See* 40 C.F.R. § 130.17(e)(1) (1978); 40 Fed. Reg. 55336 (Nov. 28, 1975). The upshot of this issue is that the Clean Water forbids the removal or downgrading of any designated use that is also an existing use under the Act. *See* 40 C.F.R. § 131.10(h) ("States may not remove designated uses if . . . [t]hey are existing uses, as defined in § 131.3, unless a use requiring more stringent criteria is added."); 40 C.F.R. § 131.12(a)(1) ("Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected."). The idea is that beginning on November 28, 1975, water quality would only improve, and any uses existing on that date would be maintained.[5]

[5] This concept is also expressed in Washington's Tier I Antidegradation rules, which apply

In this case, Ecology proposes to downgrade the Spokane River's fish harvest and water supply uses on the basis of 40 C.F.R. § 131.10(g), which enumerates a series of factors that may be used for the removal or downgrading of designated uses. In particular, Ecology relies on 40 C.F.R. § 131.10(g)(3), which allows a designated use to be downgraded when "[h]uman caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place."

However, the preamble to the (g)(3) factor makes clear that it cannot be used to remove or downgrade a designated use that is also an existing use. *See* 40 C.F.R. §131.10(g) (states may only "remove a use that is *not* an existing use" based on factors) (emphasis added). Applied here, the Spokane River has undoubtedly been used for fish harvesting and water supply since before November 28, 1975. Yet, the various documents supporting Ecology's proposed variances provide no assessment of whether the current designated uses (full fish harvesting and full water supply) are also existing uses under the Act. Ecology should evaluate this issue and, if it is determined that the current designated uses are also existing uses, then Ecology's current proposal to downgrade the uses for 20 years is very arguably illegal.

C. Failure to Demonstrate that PCB Levels in the Spokane River "Cannot be Remedied"

Even if Ecology could remove or downgrade the current fish harvesting and water supply designated uses, it has not shown that PCB levels in the Spokane River cannot be remedied by implementing available technology and nonpoint source controls. Citing 40 C.F.R. §131.10(g)(3), Ecology argues that meeting the 7 ppq PCB criterion in the Spokane River is not "feasible" and would be too expensive. On this basis, Ecology asserts that PCB levels in the Spokane River "cannot be remedied" within the meaning of 40 C.F.R. §131.10(g)(3).

But on its face, 40 C.F.R. §131.10(g)(3) does not contain a feasibility component. Other 131.10(g) factors do contain such a component.[6] But the (g)(3) factor does not. Instead, it asks only whether the harmful conditions "*cannot* be remedied"—an absolute standard.

Ecology should either assess the validity of the proposed variances under other factors at 40 C.F.R. § 131.10(g)—*i.e.,* factors other than (g)(3)—or it should explain why PCB levels in the Spokane River truly cannot be remedied even with the various technologies and nonpoint source control methods rejected in the TSD as being too expensive. This analysis should include possible actions by Washington to reduce PCB loading from Idaho, which currently accounts for 30% of the load. *See* TSD at 10. Under the Clean Water Act, Washington can object to any NPDES permit issued in Idaho that would cause or contribute to violations of Washington's 7 ppq PCB criterion. *See,*

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to the Spokane River. *See* WAC 173-201A 310(1) (providing that "[e]xisting . . . uses *must* be maintained and protected") (emphasis added).

[6] *See* 40 C.F.R. § 131.10(g)(4) (allowing designated use to be removed or downgraded when "[d]ams, diversions or other types of hydrologic modifications preclude the attainment of the use, *and it is not feasible* to restore the water body to its original condition . . . .") (emphasis added).

e.g., Arkansas v. Oklahoma, 503 U.S. 91, 112 S.Ct. 1046 (1992); 40 C.F.R. § 122.4(d) (NPDES permits shall comply with water quality standards "of all affected states"). Such actions should be part of any analysis of whether violations of that criterion "cannot be remedied" within the meaning of 40 C.F.R. §131.10(g)(3).

D. Ecology's "Variance to the Variance" Approach to Kaiser and Inland Empire

PCBs are toxic pollutants under the Clean Water Act. *See* 40 C.F.R. § 401.15. The regulations set out at 40 C.F.R. § 125.3 describe the technology standard that applies to private industrial dischargers of PCBs like Kaiser Aluminum and Inland Empire. As discussed above, that technology standard is "Best Available Technology" or "BAT." 40 C.F.R. § 125.3(a)(2)(iii). Yet, neither Kaiser nor Inland appear to be complying with the BAT requirement. No variances should be granted until after they do so.

For example, Kaiser Aluminum is using a filtration system based on walnut shells, which it installed 18 years ago in 2002. The facility is currently exploring two other candidate technologies for removing PCBs from its effluent: ultraviolet treatment coupled with advanced oxidation processes ("UV/AOP") and a membrane bioreactor ("MBR"). But as Ecology states in its Technical Support Document, Kaiser "has not yet installed the best available pollutant control technologies that provide the greatest pollutant reduction achievable." TSD at 47. In other words, Kaiser is not currently meeting BAT.

Similarly, Ecology's TSD reports that Inland Empire is currently testing a new Membrane Pilot System, which may achieve a PCB removal rate of 99%. TSD at 50 (Table 21). However, that system has not been fully implemented and only limited effluent sampling data from the new system is reported in the TSD. It is possible that Inland's new membrane system will constitute BAT, and based on information provided in the TSD, it appears to do a better job of removing PCBs than the current system. But like Kaiser, it appears that the Inland facility is not currently in compliance with the Clean Water Act's BAT requirement.

For both Kaiser and Inland, the proposed variances would allow them time to determine how to upgrade their facilities, and what currently-available technologies they will use to better remove PCBs from their discharges—despite that even those newer technologies likely will not meet the state's 7 ppq PCB criterion. In other words, the variances do not simply provide time to figure out how to meet the applicable criterion. Instead, they appear to provide time for these facilities to figure out even how to begin making initial steps toward that ultimate goal.

Importantly, this "variance from the variance" or "plan to make a plan" approach was recently rejected by the United States District Court for the District of Montana. *See Upper Missouri Waterkeeper v. United States Envtl. Prot. Agency*, 377 F. Supp. 3d 1156 (D. Mont. 2019). In that case, the court held that a variance is not a grace period to determine what initial steps a facility must take towards even partial compliance with water quality standards. Rather, the variance period must begin with the facility already doing all that is possible to achieve applicable water quality standards. Then, if standards still cannot be achieved even after those initial steps are taken,

a variance may be granted to allow the facility time to figure out how ultimately to comply with the standards. The court held:

> Congress contemplated that attainment of a state's base WQS would not always be attainable immediately. The regulations effectuate this purpose by allowing dischargers time-limited variances to reach base criteria. . . . Defendants acted arbitrarily and capriciously when they set forth a seventeen-year timeline after their first triennial review merely to meet the relaxed criteria of the Current Variance Standard. The CWA does not contemplate the ability of a state to adopt a variance from the variance.

Upper Missouri Waterkeeper, 377 F. Supp. 3d at1169–70.

In short, variances are not supposed to give polluters time to work *toward* a highest attainable condition or BAT. Rather, they allow a facility a limited amount of time to work *from* that condition to achieve the base water quality standards—here, the state's 7 ppq PCB criterion.

The newer technologies cited in Ecology's TSD appear to be available to Kaiser and Inland now. Allowing them several years even to identify that technology and take other steps toward attaining a highest attainable condition violates the rule above. Ecology should require these facilities to demonstrate, prior to issuing any variances, that they have already implemented BAT and that they have already attained the highest attainable condition within the meaning of EPA's variance rules. Only after they meet those standards should Ecology consider granting a variance.

E. Kaiser's and Inland Empire's Failure to Provide Sufficient Water Quality Data

To grant a variance, Ecology's regulations require the applicant to submit "[s]ufficient water quality data and analyses to characterize receiving and discharge water pollutant concentrations." WAC 173-201A-420(3)(d). This data is then used by Ecology to determine the facility's particular variance requirements and highest attainable condition. Neither Kaiser nor Inland Empire has satisfied this requirement.

Ecology recognizes that Kaiser did not provide sufficient data and analysis in its variance application. For example, Ecology states: "In developing Kaiser's [variance], Ecology considered setting a numeric interim effluent condition reflecting the greatest pollutant reduction achievable. Setting an effluent loading value or minimum percent removal efficiency through the treatment system will depend on a number of variables (reduction of effluent flows and influent loadings, and type of treatment system ultimately installed) which Ecology cannot predict with certainty at this time." TSD at 52. But under WAC 173-201A-420(3)(d), data and analysis regarding effluent flows, influent loadings, and the type of treatment system installed is the kind of information that should ordinarily accompany a complete variance application.

This lack of information from Kaiser is again shown in Table 23 of the TSD. For example, Note 6 to Table 23 states that PCB levels in Kaiser's effluent are "[e]stimated using existing Kaiser effluent TSS data," presumably because Kaiser did not supply data and analysis regarding actual PCB levels. Similarly, Notes 7–9 to Table 23 further state: "Specific studies would be needed on Kaiser's effluent to verify the feasibility and removal efficiencies of [granular activated carbon, powdered activated carbon, and advanced oxidation]." These studies should already have been conducted and the data and analysis from them supplied to Ecology with Kaiser's variance application. After Kaiser implements BAT, Ecology should require Kaiser to provide sufficient data and analysis of the efficacy of its new treatment system, in order to allow Ecology to determine the highest presently achievable condition (post-BAT). Only then should a variance be considered.

In turn, the TSD notes that setting a variance for Inland Empire "presented a challenge due to the limited number of samples for percent removal obtained from both the wastewater treatment system and membrane systems[.]" TSD at 50. Inland provided only two paired samples, notwithstanding that the minimum number required by Ecology is 10. *See* TSD at 47. As above with Kaiser, the answer to this problem is not to reward Inland with a variance based on incomplete information. Instead, the remedy should be to deny the variance until all necessary sampling has been completed, and sufficient data has been submitted to Ecology. Instead of refining Inland Empire Paper's variance as its "treatment system comes online and additional data are collected," TSD at 51, Ecology should require Inland to provide a minimum of ten or more paired samples at the outset.

Until Kaiser Aluminum and Inland Empire install and implement BAT, and provide sufficient data and analysis to characterize receiving and discharge water pollutant concentrations as required by WAC 173-201A-420(3)(d), any consideration of a variance is premature.

F. Failure to Show that the Municipal Dischargers Cannot Do a Better Job of Removing PCBs From Their Effluent

With respect to the municipal dischargers (Liberty Lake, Spokane County, and the City of Spokane), Ecology has not provided sufficient information to show that they are taking all feasible steps toward meeting the state's 7 ppq PCB criterion. Such a showing is necessary, since a variance must demonstrate that the recipient is achieving the "highest attainable condition" short of full compliance. *See* 40 C.F.R. § 131.14(b)(1)(ii). To meet that standard, these facilities must show that they are making "the greatest pollution reduction achievable," and that they are doing so "with the pollutant control technologies installed at the time [the variance is granted]." *Id*. at (b)(1)(ii)(A)(3).

Addressing this standard, Ecology's Technical Support Document discusses the current treatment technologies currently used at two of the municipal facilities covered by the proposed variances, and notes that the City of Spokane has plans to similarly upgrade its facility by 2021. *See* TSD at 25–30. These technologies include a "step-feed nitrification/denitrification membrane bioreactor that utilizes chemical phosphorus removal" at Spokane County; a "chemical coagulation and membrane ultrafiltration system" at Liberty Lake; and "tertiary membranes with microfiltration"

planned for the City of Spokane. After providing a brief synopsis of each facility, the TSD concludes its discussion of these technologies with the following paragraph:

> PCBs are hydrophobic with low water solubility and they generally adhere to suspended solids, organic matter, and oils present in domestic and industrial wastewater. The municipal wastewater treatment facilities are designed to treat or remove both solids and organics. This results in PCB removal efficiencies of greater than 95%. Spokane County and Liberty Lake have installed and operate advanced treatment facilities. The City of Spokane is currently installing systems that include physical and chemical treatment processes, which when combined, provide the greatest pollutant reduction available for PCBs. Currently, there are no demonstrated technologies implemented at full scale for municipal wastewater treatment systems that can achieve the current water quality criteria for PCBs (7 ppq).

TSD at 30.

It appears from context that Ecology intends the paragraph above to mean that each of these facilities is currently making "the greatest pollution reduction achievable," or will do so in the near future. However, with respect to Liberty Lake and Spokane County, that conclusion does not follow from the text of the paragraph quoted above. For example, use of an "advanced" system that can remove 95% of PCBs does necessarily mean that a facility is making "the greatest pollution reduction achievable." Nor is it relevant that no identified technology can meet the 7 ppq PCB standard when implemented at full scale. Other technologies might represent the "greatest possible reduction" even without meeting the criterion (they might just do a better job).

Later, the TSD includes a discussion of various physical, chemical, biological, and thermal technologies for treating PCB-contaminated effluent, concluding that none of them currently represents a complete solution to the problem. TSD at 34–35. But even if "no available full-scale technology exists to meet the current human health criterion" on its own (TSD at 34), a treatment train of several technologies—for example, combining physical, chemical, biological, *and* thermal technologies—could be effective in treating effluent and protecting existing uses and public health. This treatment train solution would also confer significant co-benefits for public health, because the same technologies that are effective in PCB treatment are effective in removing a host of other dangerous chemicals. There is no analysis of this issue in the TSD.

The TSD also discusses possible alternative methods for reducing the level of PCBs discharged from these facilities, such as beneficial reuse and evaporation, but concludes that none provides a complete solution. *See* TSD at 39–45. For example, Ecology rejected evaporation because of the large "minimum amount of area, in acres, required for each of the facilities to be able to remove their *entire* discharge from the river and use evaporative lagoons exclusively for disposal of effluent." TSD at 45 (emphasis supplied). Similarly, the TSD rejects beneficial reuse, in part, because "it is unlikely that either [Spokane County or the City of Spokane] would be able to

completely remove their discharges from the Spokane River without impairing downstream water rights." TSD at 41 (emphasis added). Noticeably lacking is any assessment of whether these alternatives could be effectively used as a partial solution, either alone or in conjunction with the other treatment methods discussed in the TSD, to better approximate the state's 7 ppq PCB criterion For example, could the municipalities use membrane filtration to send "clean" effluent to the river, thereby reducing the volume of water that remains contaminated with PCBs, and then using evaporation lagoons for that reduced volume of contaminated effluent? The TSD does not assess this or any other ways that the various alternatives might be combined.

Ultimately, lacking from Ecology's analysis is whether any of the various alternative technologies and methods can be used either (a) to provide a better partial solution to the PCB problem; or (b) in conjunction with each other to provide a more complete solution.

G. Failure to Require Sufficient Data From the Municipal Dischargers and Rewards for Doing Less

Last, like Kaiser and Inland, it does not appear that the three municipal dischargers supplied sufficient effluent sampling data to support a variance. The TSD focuses on Spokane County's data, because it is the only facility currently implementing technologies that Ecology characterizes as the "greatest available pollutant reduction control." Liberty Lake has not yet optimized the technology it installed 2017, "resulting in variability in their data set" and insufficient data to conduct statistical evaluations. TSD at 48. The City of Spokane apparently provided no data whatsoever. *Id*.

Due to lack of data, the TSD looks to Spokane County's data to set the percent removal standard for Liberty Lake and the City of Spokane. But in doing so, Ecology does not hold them to the same standard. While Ecology proposes to hold Spokane County to a percent removal standard of 97.6%, Liberty Lake is proposed to have a lower minimum removal efficiency of 97%, and the City of Spokane, which provided no data, is rewarded with a minimum removal efficiency of 95%. TSD at 50, Table 20. In effect, Spokane County is punished for doing more in support of its application, while Liberty Lake and the City of Spokane are rewarded for doing less. These variance applications are the first of their kind in the state and more are likely to follow. Ecology is sending the wrong message and creating an incentive for dischargers of toxic pollutants to do as little implementation and analysis as possible, in order to increase the amount of uncertainty that Ecology has to contend with, resulting in lower minimum removal efficiencies at the beginning of the variance period.

Ecology should require the municipal dischargers to fully implement the technology that will result in the greatest achievable pollutant reduction. After full implementation of this technology, the municipalities should collect and analyze data regarding the efficiency of the new treatment technology and supply that data to Ecology in conjunction with a complete, properly supported variance application. All of this should be done before any variances are granted.

Water policy pathways
Healthier waters, stronger communities

TO: Rick Eichstaedt, Director, Gonzaga Environmental Law and Land Use Clinic

FROM: Gayle Killam, Principal, Water Policy Pathways LLC

DATE: July 23, 2020

RE: Informal comment period on Washington Department of Ecology's preliminary draft PCB variance rule and supporting documents

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Water Policy Pathways LLC (WPP) has been engaged by Gonzaga Environmental Law and Land Use Clinic to provide comments on the following documents released by the Washington Department of Ecology (Ecology) on June 10th for informal "feedback":

- Preliminary Draft Variance Rule Language (Draft Variance Rule);
- Preliminary Draft State Technical Support Document (Draft Technical Document);
- Preliminary Draft Environmental Impact Statement (DEIS);
- Preliminary Draft Implementation Plan (Draft Implementation Plan).

To assist in the review of these documents, WPP has examined the five discharger variance applications, documents and notes from the Spokane Regional Toxics Task Force, federal and state variance and water quality standards regulations, Montana's variance guidance document, PCB Total Maximum Daily Loads within Washington state and in other states, and Washington's impaired waters list.

Gayle Killam has more than 25 years of water policy and regulatory experience at the federal state and local levels in the Pacific Northwest and across the country.

Gayle has worked with non-profit organizations, landowners, local, state and federal government staff, individuals, trade associations and the private sector over the years to improve implementation and functionality of water programs, policies and laws. Her work includes state and federal policy analysis, training, facilitation, testimony, and 1-on-1 consultation.

Gayle was the editor and primary author of the second edition of River Network's "The Clean Water Act Owner's Manual." She created River Network's Clean Water Act program and online course and co-authored two field guides on pollution permits and TMDL restoration plans. Prior to establishing her business, Gayle worked for River Network, Oregon Environmental Council, the Army Corps of Engineers, Resources for the Future and economic consulting firms in the Boston area. Gayle received her Masters' degree in resource economics and policy from Duke University's Nicholas School of the Environment and Earth Sciences and her Bachelors' degree in economics from Yale University.

General Comments

- **Significant change to target water quality criterion**
  Review of these documents is limited because all of them refer to 7pg/L as the water quality criterion for PCBs. Because this criterion is now 170pg/L, all the targets, discussions of shortcomings of technology, and logic behind the need and defense of variances are no longer relevant.

- **Variance for persistent bioaccumulative toxin**
  There is no precedent for allowing a variance for PCBs or other PBTs. Since allowing any amount of these contaminants to be discharged into the environment is exacerbating the known danger to human and ecological health with long term, generational consequences, developing a variance that authorizes 10-20 years of leeway in dealing with the problem is not the responsible way to address the uncertainty around treatment technology.

- **EPA promoting variance use**
  With the adoption of the 2015 changes to federal water quality standards regulations that included more detail about how variances can be used, EPA has developed the WQS Variance Building Tool[1] and seems to be pushing states and dischargers to use variances. There are damaging implications nationally for this approach especially with respect to bioaccumulative contaminants.

- **Tribal and other downstream uses and criteria**
  In federal and state water quality standards regulations, protecting downstream uses from harm is the legal requirement[2], yet the downstream Spokane Tribe's PCB water quality criterion of 1.5pg/L is only briefly mentioned in the Draft Technical Document (p.7). The exact language of this requirement, "shall ensure that … water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters" would properly lead to greater attention at least in the DEIS if it had been adequately considered.

- **Accountability for PCB reduction in Pollutant Minimization Plans (PMPs)**
  Neither the Draft Variance Rule nor the Draft Implementation Plan make clear the dischargers' accountability to measurable commitments for reducing PCBs in their Pollutant Minimization Plans (PMPs). More detail about setting and reporting on milestones in a publicly transparent way (available on a website) and on a more frequent basis is needed in the variance itself. In addition, it needs to be more clear which actions and schedules, if not all, in the PMPs will be incorporated into NPDES permits as enforceable conditions. See sections below for more detail.

- **Highest Attainable Condition (HAC)**
  There is some confusion about whether the HAC refers to the attainable condition with current technology or that which is being pursued by the time of the interim review. In the federal regulation[3], HAC can be the "…greatest pollutant reduction achievable with

[1] https://www.epa.gov/sites/production/files/2017-07/documents/variance-building-tool-faqs.pdf.
[2] 40 C.F.R. § 131.10(b).
[3] 40 C.F.R. § 131.14(b)(ii)(A)(3). If no additional feasible pollutant control technology can be identified, the interim criterion or interim effluent condition that reflects the greatest pollutant reduction achievable with the pollutant

the pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program." Yet some of the preliminary draft documents appear to be using HAC as the pollutant reduction attainable at a period in the future. Is it at the first interim review? Is it at the end of the 10- or 20-year period (depending on the discharger)? This uncertainty needs to be clarified.

Although the federal regulations allow HAC to be developed with current installed pollution control in mind, such an approach does not fit with the intention of the highest attainable condition being better than status quo. Nor does "highest attainable condition" fit with the reality that there are "additional feasible pollutant control technologies" that have yet to be installed at every one of the permitted facilities if combinations of treatment, including greater stormwater pollution controls, are considered. While there is certainly disagreement about what the appropriate water quality standard may be for PCBs, there doesn't seem to be disagreement about the fact that legacy sources and even non-legacy sources need to decrease with efforts to clean up contaminated areas and remove sources from the waste stream. Add to that the likelihood that treatment technology will continue to improve and defining HAC as the status quo makes little sense.

- **Technology-based effluent limits or effluent limit guidelines**
  No federal guidance such as technology-based effluent limits or effluent limit guidelines has been developed for entities discharging PCBs. This is in no small part because, as banned substances, PCBs are not "expected" to be in an active waste stream. As the situation in the Spokane River demonstrates (and likely many other places in Washington and around the country), there is a great need for federal guidance and consistency regarding the state-of-the art technology and multiple treatment options for eliminating the discharge of PCBs into water bodies.

- **Precedent for all PCB-impaired waters in Washington and nationwide**
  If the current rule language were to be proposed, adopted by Washington, and approved by EPA, it would immediately set a precedent for all dischargers contributing to Washington's (or any state's) PCB-impaired waters through wastewater or stormwater. This may lead to efforts to develop new variances to modify NPDES permits and existing PCB TMDLs that allow up to 20-year extensions of commitments to reducing PCBs in waste streams.

- **TMDL development**
  Renewing efforts to develop a legally required TMDL is preferable to the 5 discharger-specific variances. Because the underlying water quality standards are not replaced by the TMDL,[4] they continue to be impaired and the impaired segments of the river will still legally require development of a TMDL. Finishing that work, even if it takes four more years as stated in the DEIS (p.8), would clarify hotspots and sources, and, perhaps by then, improved detection and treatment technology would allow for greater

control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program.
[4] 40 C.F.R. § 131.14(a)(2).

controls and better compliance monitoring to be planned for each of the five dischargers into the Spokane River. In the meantime, returning to and updating the draft NPDES permits from 2016 that employed the 170pg/L in their effluent limits would be the most efficient approach to renewing NPDES permits in 2021.

Federal Water Quality Standards regulation

The 2015 federal update to Water Quality Standards[5] included changes and details to water quality standards variances. It is important to point out that the changes were intended to prevent dischargers or states from using the Use Attainability Process to permanently downgrade designated uses as stated in the preamble to the regulation:

> These two tools [note: referring to variances and compliance schedules] help states and authorized tribes focus on making incremental progress in improving water quality, rather than pursuing a downgrade of the underlying water quality goals through a designated use change, when the current designated use is difficult to attain. (Preamble I.C.).

The change to the federal variance rule led to EPA's development of tools (as mentioned above) and promotion of the use of variances. The development of variance applications by the dischargers to meet the 7pg/L criterion imposed by EPA, and the development of the preliminary draft variance rule and supporting documents by Ecology were supported, if not encouraged by EPA, yet they do not lead to a collective strategy that would be characterized as "making incremental progress."

Preliminary Draft Variance

General language

- **Eligibility**
  The language needs a section on eligibility for a variance. Examples of what might belong in that section include the language in Montana's Guidance for Water Quality Standards Variances.[6] Examples include no jeopardy to endangered species, no unreasonable risk to human health, no removal of an existing use, and that the issuance of the variance conforms with antidegradation policies and procedures.

- **Accountability for PCB reduction in Pollutant Minimization Plans**
  In both the federal and existing state regulatory language, the interim review timeframe is "at least" or "no less frequently than" every five years. The following elements should be included within the variance language to better ensure accountability, transparency and enforceability of the actions committed to by the dischargers. Some of the elements are described in the Draft Implementation Plan and/or the Draft Technical Document, however, they need to be explicitly included in the variance.

[5] https://www.epa.gov/wqs-tech/final-rulemaking-update-national-water-quality-standards-regulation.
[6] https://www.pca.state.mn.us/sites/default/files/wq-wwprm2-10a.pdf, p.4-5.

- Incorporate entire PMPs and schedules into NPDES permits as permit conditions[7] (WAC 173-201A-240(7)).
- Include required annual reporting on PMPs (already in Draft Technical Document).
- Provide online public access to annual reporting (WAC 173-201A-240(4)).
- Clarify beginning of interim review a year or more before beginning of the application process for the NPDES permit (Draft Implementation Plan p.9). This timing allows for the permittees to include the results of that review in the application process that is required 180 days ahead of expiration. The public should be involved right away. Draft variance rule language reads that the interim review will be coordinated with the public review process of the permit renewal (WAC 173-201A-240(8)(i)). That is confusing based on your timeline in the Implementation Plan.
- Allow for annual public process to submit new information relevant to any variance and allow for public to petition to reopen permits if new information so warrants (WAC 173-201A-240(7)(c)).
- Prohibit the administrative delay of a variance interim review even if the NPDES permit is administratively continued.

Specific language for proposed variances

- **Human health criterion transformed into a technical feasibility analysis**
  This process has turned the protections of existing and designated uses through water quality criteria, effluent limitations in NPDES permits, Total Maximum Daily Loads and best management practices into a technological debate and discussion of affordability. Even discussing the health of tribal members and members of the Eastern European, Asian and Pacific Islander communities who eat more than 175 grams of fish from the Spokane River as "existing and designated uses" is a dehumanizing way to characterize the required protections of the Clean Water Act. The entities contributing PCBs to the Spokane River in any way must take responsibility for their impact on the lives of populations dependent on fish from the Spokane River.

- **Justification for variance**
  In Table 622, "Factor 3" is listed as the justification for each of the variances. While the footnote explains that human caused conditions or sources prevent the attainment of the fish harvest use," the actual "Factor 3" listed in federal regulations reads:

  > Human caused conditions or sources of pollution prevent the attainment of the use and *cannot be remedied* or would cause more environmental damage to correct than to leave in place;[8] (emphasis added)

  Humans have and continue to cause PCB pollution, but to apply this factor, there must be a demonstration that the pollution "cannot be remedied," and that has not been accomplished. There may not be an available technology to get to 7pg/L today, but there are sampling results that show that some of the dischargers' effluent is sometimes below 170pg/L. What do we know about when those samples were taken? Does that

[7] EPA preamble to the 2015 WQS Rulemaking: As part of the applicable WQS, the permitting authority must use the PMP (along with the quantifiable expression of the "greatest pollutant reduction achievable") to derive NPDES permit limits and requirements. https://www.regulations.gov/document?D=EPA-HQ-OW-2010-0606-0288 ; 40 C.F.R. § 131.14(c).
[8] 40 C.F.R. § 131.10(g)(3).

information help with identification of reduction strategies? There are several examples in the variance applications that demonstrate that the dischargers have looked at strategies for decreasing pollutant discharge through land application, groundwater injection and source reduction (improving pretreatment, changing what products are recycled and using groundwater for cooling). These documents have not evaluated numerous scenarios that combine current treatment approaches. With time and investment, emerging treatment technologies are likely to prove successful as well.

- **Highest Attainable Condition**
  Include in Table 622 how each discharger is defining HAC. For example, Spokane County defines it as what their current technology can achieve, whereas the City of Spokane is defining it as what can be achieved in two years when the construction for Next Level Treatment is completed.

  Given the discussion above about the need to address the applications toward 170pg/L, and that treatment technology to get to that level does exist, the appropriate HAC would comply with 40 C.F.R. §131.14(b)(1)(ii)(A)(*2*) "The interim effluent condition that reflects the greatest pollutant reduction achievable." However, the Ecology Draft Variance Rule does not fully comply with the federal regulations regarding HAC in allowing for HAC to be "either the condition at the time of adoption or a more stringent condition identified during the interim review."[9] This discrepancy needs to be addressed.

- **Length of variances too long**
  Twenty years is an excessive length for four of the proposed variances. It is not clear to the reader why the agency adopted the lengths proposed by the dischargers. Such a pre-determined length, even with multiple interim reviews, sets an expectation that the status quo, currently installed technology and efforts to reduce PCBs from influent (in the case of the sewage treatment plants) is sufficient and that as long as things don't get worse, they will be allowed to carry on as is. A 20-year variance creates a legal authorization of the status quo which everyone agrees is detrimental to human health, (especially vulnerable communities dependent on fish for subsistence) and the ecological health of a river that is legally defined as impaired and for which Ecology is legally required to develop a TMDL because the underlying standards are not replaced by the variance.

- **Percent removal is not sufficient for quantifiable expression**
  The permittees approach to quantifying the HAC needs to include the pg/L concentrations of their effluent. Percent removal from a really high load will still be a really high amount of PCBs being discharged into the river. The estimates of what their current (or soon to be installed) technology can remove are included in their applications. These numbers need to be included in the variance. Whatever pollutants are discharging out of the pipe are discharger responsibility even if they are significantly coming from upstream sources in influent.

[9] WAC 173-201A-240(8)(a)(iii)).

- **Codify milestones and timelines**
  Greater detail on milestones and timelines from the PMPs is needed in each discharger's Table 622.

Preliminary Draft Implementation Plan

- The preliminary draft Implementation Plan echoes several areas addressed in general comments or in comments on the variance language. These areas include:
  - clarify incorporation of PMPs as enforceable conditions into the permits (p.8);
  - codify dischargers' plans to report on PMP annually and include that requirement in the Implementation Plan (p.8);
  - solicit readily available information relevant to the variance from the public annually (p.4);
  - quantifiable portion of the HAC should include a concentration, not just percent removal (p.5); and
  - public involvement should be encouraged throughout the interim review and prior to permit renewal and should not depend on the public appeal provisions of the permit (p.9).
- All other relevant programs must be included.
  There is inadequate attention to existing stormwater permits and nonpoint sources associated with each of the dischargers' facilities and operation.
- The State PMP, milestones and timelines should be described, even if the details are in the Draft Technical Document.

Preliminary Draft Environmental Impact Statement

- Evaluation of the positive and negative impacts of only two alternatives is not a sufficient examination of options available to the state. Examples of missing options include:
  - Not reissuing any one or all of the NPDES permits and allowing them to expire until discharge of PCBs can be properly controlled to meet downstream uses (which should be the "No Action" alternative).
  - Completion of the TMDL either instead of or in addition to the variance;
  - No variances, shorter variances or different-length variances for each discharger based on their individual treatment technology situation;
  - Different mixes of actions, measurables and timelines
  - Development of technology-based effluent limitations; and
  - Coordinating emerging technology research and pilot studies across dischargers.

- The significant environmental impact of the options above deserve analysis against (a) each discharger variance alternative (which should be evaluated separately) and (b) the different No Action alternative of letting the permits expire. If different treatment options of each discharger are not evaluated for their environmental impact during the DEIS, when would that occur?
- Why did Ecology inform the applicants that the rulemaking would proceed on June 12, 2019 before any DEIS was performed (p.iv)? Would the rulemaking not be contingent on the favorable result from an EIS?

Preliminary Draft Technical Report

Several of the comments from above are echoed in the review of the Draft Technical Document. The following areas are worthy of note or emphasis:

- No mixing zone should ever be allowed (p.10-11);
- State Pollutant Minimization Plan doesn't include stormwater permits (municipal, construction or industrial) when PCBs are clearly carried by stormwater onto each facility and into the treatment systems of the publicly-owned treatment works and Kaiser (p 54-57); and
- Required annual reports need to be in Draft Variance Rule and Draft Implementation Plan (p.60).

Recommendations

The preliminary draft documents have not demonstrated sufficient justification for water quality standards variances for these five dischargers. The use of the variance, especially for the long timeframes proposed, is a de facto "not-so-temporary" downgrading of uses that many would argue are existing uses, and existing uses may not be downgraded.

The following work must proceed before any further action on this draft rule and the variance applications is taken:

1. All analysis – sampling, evaluation of technology and best management practices, and calculation of highest attainable condition - must focus on 170 pg/L as the target water quality criterion and protection of all downstream uses.
2. Work on the Draft Spokane River TMDL must be revived and the draft itself made available to the public again.
3. Draft 2016 NPDES permits for the dischargers should be revived and made available to the public again.

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July 24, 2020

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Re: Downstream Tribal Water Quality Standards Limits on State Variances

Dear Mr. Eichstaedt,

Per your request on behalf of Gonzaga University Legal Services, this letter provides a legal opinion regarding limits under the Clean Water Act ("CWA") on a State's authority to adopt variances from its water quality standards ("WQS") and EPA's authority to disapprove such variances based on downstream Tribal WQS. You have requested this opinion for reference in comments to the Washington State Department of Ecology regarding proposed variances for five dischargers into the Spokane River notwithstanding downstream WQS by the Spokane Tribe. In this letter, we summarize our opinions, then state our relevant qualifications, identify relevant documents reviewed, explain material background and our analysis, recap our basic opinions, and note relevant limitations.

In summary, first, per 40 C.F.R. § 131.14(a)(4), a State may not adopt WQS variances if the designated use and criterion addressed by the applicable WQS can be achieved by implementing technology-based effluent limits required under CWA Sections 301(b) and 306. Second, EPA has authority to require upstream jurisdictions and dischargers to comply with more stringent downstream tribal WQS in State WQS variance approval decisions under 40 C.F.R. § 131.14, and in those decisions EPA must address how WQS variances affect stricter downstream Tribal WQS following timely and meaningful tribal consultation. Third, per 40 C.F.R. § 131.14(b)(2)(i)(A), EPA must disapprove WQS variances that affect fish consumption use if attaining the designated use is feasible. Fourth, per 40 C.F.R. § 131.14(b)(1)(ii), EPA must disapprove WQS variances if their requirements either do not represent the highest attainable condition of the applicable water body or water body segment throughout the term of the variance or would result in any lowering of the currently attained ambient water quality. Fifth and finally, downstream Tribes that are authorized by EPA for treatment as a state ("TAS") regarding WQS may object to such upstream discharges or WQS variances to protect their own designated uses pursuant to EPA's dispute resolution mechanism in 40 C.F.R. § 131.7.

I. QUALIFICATIONS

Between the two partners at our law firm, we have over 38 years of experience in advising and representing Indian tribes and federal officials and agencies regarding environmental and other matters. Among other experience, we both have worked for the U.S. Environmental Protection Agency ("EPA") Office of General Counsel ("OGC") in Washington, D.C., on application of federal environmental standards in Indian country, including addressing WQS and tribal-state jurisdiction disputes. For example, Dan Rey-Bear worked at the EPA OGC on the jurisdictional analysis for the first tribal WQS TAS decision under CWA Section 518(e), 33 U.S.C. § 1377(e). He subsequently published a national award-winning law review article about that. Daniel I.S.J. Rey-Bear, *The Flathead Water Quality Standards Dispute: Legal Bases for Tribe Regulatory Authority Over Non-Indian Reservation Lands*, 20 Am. Indian L. Rev. 151 (1995-1996). In private practice, Dan relevantly has advised and represented Indian tribes regarding jurisdictional statements to qualify for WQS TAS, conducted tribal WQS training, prepared tribal environmental laws including wetlands regulations to qualify for CWA TAS, and negotiated tribal-state cooperative agreements for non-point source management under the CWA and underground storage tank oversight. Dan also has analyzed, addressed, and litigated environmental remediation on tribal lands and litigated jurisdictional issues under the Safe Drinking Water Act, *see HRI, Inc. v. U.S. E.P.A.*, 198 F.3d 1224 (10th Cir. 2000).

In turn, before going into private practice, Tim McLaughlin was an Honors Trial Attorney at the United States Department of Justice ("DOJ") in Washington, D.C., where he served in the Indian Resources Section of the Environment and Natural Resources Division. In that position, Tim represented the United States in its trust capacity on behalf of Indian tribes to quantify Indian water rights in Oregon and on water rights transfers in Arizona. Before working at DOJ, Tim was an Attorney-Advisor at the EPA OGC in Washington, D.C. There, he worked on environmental issues affecting EPA and Indian tribes, including TAS issues, Indian and federal regulatory authority, tribal consultation, and federal general counsel matters involving various environmental laws affecting Indians and international environmental law. Among other things, Tim worked on the agency remand from *HRI, Inc. v. EPA*, 198 F.3d 1224 (10th Cir. 2000), regarding regulatory authority for in-situ injection uranium mining in western New Mexico.

II. DOCUMENTS REVIEWED

In rendering the opinions in this letter, we have reviewed the following materials:

A. Federal statutes and regulations – CWA Sections 101, 301, 303, and 518 (codified as amended at 33 U.S.C. §§ 1251, 1311, 1313, 1377) and 40 C.F.R. Parts 122, 123, and 131;

B. Cases – *County of Maui, Hawaii v. Hawaii Wildlife Fund*, 140 S. Ct. 1462 (2020); *Arkansas v. Oklahoma*, 503 U.S. 91 (1992); *El Dorado Chem. Co. v. U.S. E.P.A.*, 763 F.3d 950 (8th Cir. 2014); *Pronsolino v. Nastri*, 291 F.3d 1123 (9th Cir. 2002); *Wisconsin v. E.P.A.*, 266 F.3d 741 (7th Cir. 2001); *American Wildlands v. Browner*, 260 F.3d 1192 (10th Cir. 2001); *City of Albuquerque v. Browner*, 97 F.3d 415 (10th Cir. 1996); *Upper Missouri Waterkeeper v. U.S. E.P.A.*, 377 F. Supp. 3d 1156 (D. Mont. 2019), *reconsid. denied*, 2019 WL 7020145 (D. Mont. 2019), *appeals filed*, Nos. 20-35135, 20-35136, and 20-35137 (9th Cir. Feb. 18, 2020); *Northwest*

Envtl. Advocates v. U.S. E.P.A., 855 F. Supp. 2d 1199 (D. Or. 2012), *clarified*, 2012 WL 13195656 (D. Or. 2012); *Pennaco Energy, Inc. v. U.S. E.P.A.*, 692 F. Supp. 2d 1297 (D. Wyo. 2009);

C. Federal policies – Exec. Order No. 13,175, 65 Fed. Reg. 67,249 (Nov. 9, 2000); EPA Policy on Consultation and Coordination with Indian Tribes (May 4, 2011), available at https://www.epa.gov/tribal/epa-policy-consultation-and-coordination-indian-tribes ("EPA Tribal Consultation Policy");

D. Federal regulatory actions – EPA, WQS Regulatory Revisions: Final Rule, 80 Fed. Reg. 51,020 (Aug. 21, 2015); Letter from Daniel D. Opalski, Director, Office of Watersheds and Water, Region 10, EPA, to Hon. Chairman Marchand, Colville Business Council, Confederated Tribes of Colville Reservation (May 2, 2018) (concerning TAS approval for CWA Sections 303(c) and 401) ("EPA Colville WQS Letter"), available at https://www.epa.gov/wqs-tech/water-quality-standards-regulations-confederated-tribes-colville-reservation; Spokane Tribe of Indians, Surface WQS (eff. Dec. 19, 2013) (Dec. 8, 2017) ("Spokane Tribe WQS"), available at https://www.epa.gov/sites/production/files/2014-12/documents/spokane-tribe-wqs.pdf, including without limitation Letter from Daniel D. Opalski, Director, Office of Water and Watersheds, Region 10, EPA, to Hon. Rudy Peone, Chairman, Spokane Tribe (Dec. 19, 2013) ("EPA Spokane Letter") and Region 10, EPA, Technical Support Document for Action on the Revised Surface WQS of the Spokane Tribe of Indians Submitted April 2010 (Dec. 11, 2013) ("EPA Spokane TSD"); and

E. State law and regulatory actions – WAC 173-201A-240 (certified Jan. 23, 2020), available at https://apps.leg.wa.gov/wac/default.aspx?cite=173-201a; Washington State Department of Ecology rulemaking to adopt WQS variances for the Spokane River for (i) Liberty Lake Sewer and Water District Water Reclamation Facility, (ii) Kaiser Aluminum Washington LLC, (iii) Inland Empire Paper Company, (iv) Spokane County Regional Water Reclamation Facility, and (v) the City of Spokane Riverside Park Water Reclamation Facility, all available at https://ecology.wa.gov/Regulations-Permits/Laws-rules-rulemaking/Rulemaking/WAC173-201A-variances.

III. BACKGROUND

A. CWA WQS

The CWA establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. *See generally* 33 U.S.C. § 1251 *et seq*. Under the CWA, it is unlawful to discharge any pollutant into navigable waters from a point source or the functional equivalent of a direct discharge from a point source, except as authorized by the CWA. CWA § 301(a), 33 U.S.C. § 1311(a); *County of Maui, Hawaii v. Hawaii Wildlife Fund*, 140 S. Ct. 1462, 1468 (2020). Under the CWA, the National Pollutant Discharge Elimination System ("NPDES") permit program controls discharges. *See generally* CWA §§ 301(e), 302(a), 402(a), 33 U.S.C. §§ 1311(e), 1312(a), 1342(a); 84 Fed. Reg. 3324, 3324-38 (June 12, 2019). Point sources are "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged" but not "agricultural stormwater discharges and

return flows from irrigated agriculture." CWA § 502(14), 33 U.S.C. § 1362(14) (definition).

In addition, Section 303(c) of the CWA and its implementing regulations provide that States and authorized Tribes can assume primary responsibility for establishing, administering, and revising WQS. *See* 33 U.S.C. § 1313(c); 40 C.F.R. Part 131. States are "required to set WQS for *all* waters within their boundaries regardless of the sources of the pollution entering the waters." *Pronsolino*, 291 F.3d at 1127 (emphasis in original). WQS consist of three elements:

> first, each water body must be given a "designated use," such as recreation or the protection of aquatic life; second, the standards must specify for each body of water the amounts of various pollutants or pollutant parameters that may be present without impairing the designated use; and finally, each state must adopt an antidegradation review policy which will allow the state to assess activities that may lower the water quality of the water body. 33 U.S.C. § 1313(c)(2)(A) and 40 C.F.R. §§ 130.3, 130.10(d)(4), 131.6, 131.10, and 131.11. Further, each state is required to identify all of the waters within its borders not meeting water quality standards and establish "total maximum daily loads" ("TMDL") for those waters. 33 U.S.C. § 1313(d). A TMDL defines the specified maximum amount of a pollutant which can be discharged into a body of water from all sources combined. *Dioxin/Organochlorine Ctr. v. Clarke*, 57 F.3d 1517, 1520 (9th Cir.1995).

American Wildlands, 260 F.3d at 1194.

These use designations in WQS are important. Namely,

> Section 101(a) of the CWA provides that the ultimate objective of the Act is to restore and to maintain the chemical, physical, and biological integrity of the Nation's waters. The national goal in CWA section 101(a)(2) is water quality that provides for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water "wherever attainable." EPA's WQS regulation at 40 CFR part 131, specifically §§ 131.10(j) and (k), interprets and implements these provisions through requirements that WQS protect the uses specified in CWA section 101(a)(2) unless states and authorized tribes show those uses are unattainable through a use attainability analysis (UAA) consistent with EPA's regulation, effectively creating a rebuttable presumption of attainability.

80 Fed. Reg. at 51,024. This rebuttable presumption under the CWA has been upheld against a court challenge. *Id.* at n.12 (citing *Idaho Mining Ass'n v. Browner*, 90 F. Supp. 2d 1078, 1097-98 (D. Idaho 2000)). Furthermore, based on the CWA Section 303(c)(2)(A) requirement that WQS must protect public health, EPA since 1992 has recognized "that the consumption of aquatic life is a use specified in section 101(a)(2) of the Act" so that "not only can fish and shellfish thrive in a water body, but when caught, they can also be safely eaten by humans." *Id.* at 51,027.

Next, the specific water quality criteria in WQS must be "sufficient to protect the designated uses." 40 C.F.R. § 131.6(c); *see id.* § 131.11(a). For this, relevant here, CWA Section 303(c)(2)(B) requires that States and authorized Tribes adopt "specific numerical" water quality criteria for toxic pollutants listed pursuant to Section 307(a)(1) for which EPA has published

criteria under Section 304(a) where the discharge or presence of those toxics could reasonably be expected to interfere with the designated uses adopted by the State or authorized Tribe. 33 U.S.C. § 1313(c)(2)(B). Furthermore, States or authorized Tribes can establish narrative criteria where numeric criteria cannot be determined or to supplement numeric criteria. *See id*; 40 C.F.R. § 131.11(b)(2). Section 303(c) also authorizes States and authorized Tribes to submit new or revised WQS to EPA for review. 33 U.S.C. § 1313(c)(2)(A). EPA is required to review these changes to ensure revisions to WQS are consistent with the CWA. *Id.* § 1313(c)(3).

Finally, the antidegradation policies adopted in state WQS must be consistent with the federal anti-degradation policy. 40 C.F.R. § 131.6(c), 131.12. Under that federal policy, state WQS policies must, at a minimum, ensure that "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." 40 C.F.R. § 131.12(a)(1). Additional antidegradation policy requirement apply to waters that exceed the quality necessary to support aquatic life and recreation. *See id.* § 131.12(a)(2)-(3); *American Wildlands*, 260 F.3d at 1194 (discussing the Tier I, Tier II, and Tier III protections).

B. EPA Review of WQS

Once a State or an authorized Tribe adopts WQS that satisfy the above requirements, the WQS must be submitted to and review by EPA for approval. *See* CWA § 303(c)(2)-(3), 33 U.S.C. § 1313(c)(2)-(3); 40 C.F.R. § 131.5(a). EPA must determine whether those WQS are consistent with the CWA, *American Wildlands*, 260 F.3d at 1197, and stringent enough to comply with EPA's standards and criteria, *Albuquerque*, 97 F.3d at 426. *See* 40 C.F.R. § 131.6 (outlining minimum requirements for WQS submissions). Among other federal WQS standards, "[i]n designating uses of a water body and the appropriate criteria for those uses, the State [or authorized Tribe] shall take into consideration the water quality standards of downstream waters and shall ensure that its water quality standards provide for the attainment and maintenance of the water quality standards of downstream waters." 40 C.F.R. § 131.10(b). Accordingly, EPA may disapprove initial or revised WQS to ensure that downstream WQS are maintained. *El Dorado*, 763 F.3d at 958-59.

In addition, all comments submitted to a State or authorized Tribe regarding the adoption or revision of WQS become part of the federal administrative record and are reviewed by EPA in determining whether to approve the proposed standards. *Albuquerque*, 97 F.3d at 425. EPA therefore has an enforceable obligation to fully consider the entire administrative record including objectively review all comments. *Pennaco Energy*, 692 F. Supp. 2d at 1309-10. EPA also must explain its analysis and reasoning, including whether appropriate technical and scientific data and analysis support the specific numeric criteria adopted by a State or an authorized Tribe *Id.* at 1310-12 & n.7. That also requires providing "'a rational connection between the facts found'" and the agency's conclusion. *Id.* at 1314 (quoting *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983)); *Northwest Envtl. Advocates*, 855 F. Supp. 2d at 1204, 1215 (citing *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1193 (9th Cir. 2008)). Finally, EPA must review any WQS provisions that affect how, whether, and when those WQS apply or may supplant, delay implementation of, or undermine application of WQS. *Northwest Envtl. Advocates*, 855 F. Supp. 2d at 1212 (concerning nonpoint sources).

C. WQS Variances

In situations where incremental improvements are needed to meet established WQS, EPA has provided for WQS variances to allow swift progress toward attaining a designated use that is not attainable immediately. *Upper Missouri Waterkeeper*, 377 F. Supp. 3d at 1165-66 (citing 80 Fed. Reg. at 51,039). For this, a State or an authorized Tribe may adopt WQS variances subject to public participation and EPA review and approval or disapproval 40 C.F.R. § 131.20(b), 131.14 para. 1. A WQS variance is a temporary modification to a designated use and associated water quality criteria that would otherwise apply for limited purposes, such as NPDES permits and certifications under CWA Section 401, while "[a]ll other applicable standards not specifically addressed by the WQS variance remain applicable." *See generally id.* § 131.3(o) (definition), .14(a) (applicability). WQS variances "help states and authorized tribes focus on making incremental progress in improving water quality, rather than pursuing a downgrade of the underlying water quality goals through a designated use change, when the current designated use is difficult to attain." 80 Fed. Reg. at 51,022. Moreover, WQS variances must be used appropriately to "facilitate progress toward attaining designated uses." *Id.* at 51,035. Thus, EPA has authority to determine whether any WQS variances adopted by a State or an authorized Tribe are consistent with Section 131.14. 40 C.F.R. § 131.5(a)(4); 80 Fed. Reg. at 51,036.

Under Section 131.14, WQS variances are based on a use attainability demonstration and target achievement of "the highest attainable condition of the water body or waterbody segment" during the variance period. *See* 40 C.F.R. §§ 131.3(o), 131.14(b)(1)(ii). Also, a WQS variance may address a specific permittee or water body or waterbody segments and will only apply to the specified permittees or water body or waterbody segments. *Id*. § 131.14(a)(1). Accordingly, all other applicable WQS, designated uses, and criteria not specifically addressed by a WQS variance remain applicable. *Id*. § 131.14(a)(2). A typical WQS variance modifies the use for discharge of a single pollutant from a single source for a period "only . . . as long as necessary to achieve the highest attainable condition" and may be for greater than five years only with reevaluations no less frequently than every five years. *Id*. § 131.14(b)(1)(iv)-(v). Under these standards, a variance must set forth a timeline that ends with the ultimate attainment of the current, approved WQS rather than simply improving water quality to the level of relaxed criteria in the variance. *Upper Missouri Waterkeeper*, 377 F. Supp. 3d at 1171.

Once approved by EPA, a WQS variance serves as the applicable WQS for relevant NPDES permits for the term of the variance. *Id*. § 131.14(a)(3), 131.14(c). Also, any limits and requirements necessary to implement the WQS variance are included as enforceable conditions of the NPDES permit for the permittee(s) subject to the WQS variance. *Id.* Finally, States and other certifying entities may use approved WQS variances for certifications under CWA Section 401. *Id.* § 131.14(a)(3).

D. CWA TAS and Dispute Resolution

Once authorized by EPA, Indian tribes can be treated as states, with primary responsibility for reviewing, establishing, and revising WQS within their jurisdictions. *See* 33 U.S.C. § 1377(e); 40 C.F.R. § 131.3(j), 131.4(a), 131.8. Relevant here, the CWA requires that EPA

> provide a mechanism for the resolution of any unreasonable consequences that may arise as a result of differing water quality standards that may be set by States and Indian tribes located on common bodies of water. Such mechanism shall provide for explicit consideration of relevant factors including, but not limited to, the effects of differing water quality permit requirements on upstream and downstream dischargers, economic impacts, and present and historical uses and quality of the waters subject to such standards. Such mechanism should provide for the avoidance of such unreasonable consequences in a manner consistent with the objective of this chapter.

33 U.S.C. § 1377(e).

That dispute resolution mechanism established by EPA applies in the following situation:

> The [EPA] Regional Administrator shall attempt to resolve such disputes where:
> (1) The difference in water quality standards results in unreasonable consequences;
> (2) The dispute is between a State (as defined in §131.3(j) but exclusive of all Indian Tribes) and a Tribe which EPA has determined is eligible to the same extent as a State for purposes of water quality standards;
> (3) A reasonable effort to resolve the dispute without EPA involvement has been made;
> (4) The requested relief is consistent with the provisions of the Clean Water Act and other relevant law;
> (5) The differing State and Tribal water quality standards have been adopted pursuant to State and Tribal law and approved by EPA; and
> (6) A valid written request has been submitted by either the Tribe or the State.

40 C.F.R. § 131.7(b).

Either a State or a Tribe may request in writing, subject to certain criteria, for EPA to resolve any dispute which satisfies the above criteria. *Id.* § 131.7(c). If the Regional Administrator determines that EPA involvement is appropriate based on the above-quoted factors, the Regional Administrator shall, within 30 days, notify the relevant State and Tribe that the Regional Administrator is initiating an EPA dispute resolution action and solicit their written responses. *Id*. § 131.7(d). The Regional Administrator shall also make reasonable efforts to ensure that other interested individuals or groups have notice of that action. *Id.* These disputes can then be procedurally addressed via mediation or arbitration, or in accordance with an applicable dispute-resolution agreement entered into by the relevant State and Tribe. *See id*. § 131.7(e), (f)(1)-(2). Alternatively, if one or more parties refuse to participate in mediation or arbitration, the Regional Administrator may appoint a single official or panel to review available information concerning the dispute and issue a written recommendation for resolving the dispute. *Id*. § 131.7(f)(3).

E. Spokane River WQS and Variance Applications

The Spokane Tribe of Indians ("Spokane Tribe") reside on the Spokane Indian Reservation, which is located on the Spokane River downstream from the City of Spokane. In 2013, EPA

approved the Spokane Tribe's new and revised surface WQS. *See* EPA Spokane Letter. The most significant aspect of the Tribe's revised WQS are those related to human health criteria, which include a new fish consumption rate of 865 grams per day and drinking water intake rate of 4 liters per day. *Id*. at 3; EPA Spokane TSD at 7-8. Those provisions reflect the Tribe's goal of protecting fish consumption and drinking water rates characteristic of traditional Spokane Tribe subsistence practices, which are fundamentally a question of tribal policy and within the Tribe's authority under the CWA. EPA Spokane Letter at 3-4. Because the fish consumption rate and drinking water intake rates do not operate as independent WQS in isolation from human health criteria, but were just used to determine WQS, EPA did not take action to approve or disapprove those. *Id.* at 3.

Instead, EPA approved the majority of the Spokane Tribe's revised human health criteria because the methodology used by the Tribe to develop the fish consumption rate and other variables used in developing the criteria were scientifically sound and sufficient to protect the designated uses, which are designed to protect fish consumption and drinking water rates characteristic of the traditional Spokane subsistence lifestyle. EPA Spokane Letter at 3-4 (quoting 40 C.F.R. § 131.11(a)); EPA Spokane TSD at 16-17, 20 (same), 21. Among other things, the Spokane Tribe's revised standards for total PCBs are 1.30E-06 micrograms per liter (µg/L) (i.e., parts per billion or ppb) for water and organisms as well as organisms only. As a result of these revisions, the Spokane Tribe's human health toxics criteria are generally more stringent than the default values recommended by the EPA in national guidance, EPA Spokane Letter at 3, which is allowable under the CWA, EPA Spokane TSD at 20-21.

Additionally, downstream from and adjacent to the Spokane Reservation are the Confederated Tribes of the Colville Reservation ("CTCR"). The Colville Reservation's southern boundary is the Columbia River, which is also called Lake Roosevelt above the Grand Coulee Dam, into which the Spokane River flows directly near the most southeasterly point of the Colville Reservation. That confluence is also the most southwesterly point of the Spokane Tribe's Reservation, along the Spokane River. The Colville Tribes have been granted TAS status but have not established their own WQS. *See* EPA Colville WQS Letter (concerning approval of CTCR for TAS for CWA Sections 303(c) and 401). Instead, EPA pursuant to its authority under CWA Section 303(c)(4)(B) in 1989 promulgated WQS for the Colville Reservation as necessary to meet the requirements of the CWA. *See* 40 C.F.R. §§ 131.22, 131.35; 80 Fed. Reg. at 51,023 & n.11 (noting same). In particular, the EPA-promulgated Colville WQS designate Lake Roosevelt as Class I, 40 C.F.R. § 131.35(h)(1), and specify that that class of water should protect salmon harvesting, *id.* § 131.35(f)(1)(i)(C), including that "[t]oxic, radioactive, nonconventional, or deleterious material concentrations shall be less than those of public health significance, or which may cause acute or chronic toxic conditions to the aquatic biota, or which may adversely affect designated water uses[,]" *id.* § 131.35(f)(1)(ii)(G).

In contrast to the above, the Washington State WQS for total PCBs is 0.00017 µg/L or ppb, based on a fish consumption rate of 175 grams per day. WAC 173-201A-240(5), (5)(b), Table 240, & footnote E. However, those WQS for toxic substances regarding human health protection begin with the following additional narrative limit, consistent with 40 C.F.R. § 131.10(b): "All waters shall maintain a level of water quality when entering downstream waters that provides for the attainment and maintenance of the water quality standards of those downstream waters, including the waters of another state." *Id.* § 173-201A-240(5)(b). Notwithstanding that regulation and that provision, the five variance applications that have been submitted to Washington State by

dischargers to request WQS variances for their discharges to the Spokane River upstream of the Spokane and Colville Reservations do not squarely address attainment of the WQS for either the Spokane or Colville Reservations. *See supra* § II.E.

IV. ANALYSIS: Downstream WQS Limit Upstream Variance Authority In Five Ways

A. EPA may require upstream dischargers to comply with downstream WQS and must address how WQS variances affect stricter downstream tribal WQS following timely and meaningful tribal consultation.

CWA Section 402 authorizes EPA to require an upstream discharger subject to the NPDES regime to comply with downstream state WQS. *Arkansas,* 503 U.S. at 102, 107 (citing 33 U.S.C. § 1342(b)(3), (5)). "Although these provisions do not authorize the downstream State to veto the issuance of a permit for a new point source in another State, the [EPA] Administrator retains authority to block the issuance of any state-issued permit that is outside the guidelines and requirements of the Act." *Id.* at 102 (quoting 33 U.S.C. § 1342(d)(2)). In turn, CWA Section 401 prohibits the issuance of any federal license or permit over the objection of an affected State unless compliance with the affected State's WQS can be ensured when EPA itself is the permit issuing regulatory authority. *Id.* at 103 (citing 33 U.S.C. § 1341(a)(2)).

Consistent with those aspects of the CWA, since CWA Section 518 regarding Indian tribes incorporates CWA Sections 401 and 402, the CWA also authorizes EPA to block NPDES permits for upstream point source dischargers that do not comply with downstream EPA-approved tribal WQS. *See Albuquerque,* 97 F.3d at 423-24 & n.13 (concerning 33 U.S.C. §§ 1341, 1342, 1377). The same necessarily also applies to EPA-promulgated WQS for a downstream tribe. *See* 40 C.F.R. § 131.10(b), 131.22(c); *cf.* 80 Fed. Reg. at 51,021 ("[I]f the Administrator makes a determination under CWA section 303(c)(4)(B) that a new or revised WQS is necessary, EPA must propose and promulgate federal standards for a state or authorized tribe, unless the state or authorized tribe develops and EPA approves its own WQS first."). Also, the CWA authorizes EPA to require upstream NPDES dischargers to comply with downstream Tribal WQS. *See Albuquerque*, 97 F.3d at 423-24. In accordance with all those federal constraints, Washington State's own WQS for toxic substances regarding human health protection expressly acknowledge that "[a]ll waters shall maintain a legal of water quality when entering downstream waters that provides for the attainment and maintenance of the water quality standards of those downstream waters, including the waters of another state." WAC 173-201A-240(5)(b). Thus, because downstream Tribal and State WQS constitute applicable standards that constrain upstream WQS, those downstream WQS also necessarily constrain upstream WQS variances. *See* 40 C.F.R. § 131.10(b), 131.14; *see also id.* § 131.7.

Under all these authorities, EPA may condition approval of WQS variances based on attainment of downstream federal or tribally issued tribal WQS. Alternatively,

> [i]n deciding whether to issue a permit for discharge within a state that may violate the water quality standards of a downstream tribe, the EPA may ask the parties to engage in mediation or arbitration, in which the decision-maker and the EPA administrator, who has the final authority over the issuance of the permit, will consider such factors as "the effects of differing water quality permit requirements

> on upstream and downstream dischargers, economic impacts, and present and historical uses and quality of the waters subject to such standards." The EPA may then ask the tribe to issue a temporary variance from its standards for the particular discharge or may ask the state to provide additional water pollution controls.

Wisconsin, 266 F.3d at 749 (quoting 33 U.S.C. § 1377(e)).

Here, EPA is certainly aware of the stricter relevant WQS of the Spokane Tribe and those that EPA itself promulgated for the Colville Reservation. *See* 40 C.F.R. § 131.35; EPA Spokane Letter at 3-4. Given those federally approved and issued downstream tribal WQS, EPA must consult in a timely and meaningful manner with the Spokane and Colville Tribes before and regarding any approval actions regarding upstream WQS variances that have substantial direct effects on those tribal WQS and waters. *See* Exec. Order No. 13,175, § 5(a), 65 Fed. Reg. at 67,250; EPA Tribal Consultation Policy. That includes a four-step process of identification, notification, input, and follow up. EPA Tribal Consultation Policy at § V.A.1-4.

In particular, "[c]onsultation should occur early enough to allow tribes the opportunity to provide meaningful input that can be considered prior to EPA deciding whether, how, or when to act on the matter under consideration. A[nd a]s proposals and options are developed, consultation and coordination should be continued, to ensure that the overall range of options and decisions is shared and deliberated by all concerned parties, including additions or amendments that occur later in the process." *Id.* § V.C. In addition, EPA must "provide[] feedback to the tribes(s) involved in the consultation to explain how their input was considered in the final action. This feedback should be a formal, written communication from a senior EPA official involved to the most senior tribal official involved in the consultation." *Id.* § V.A.4. All this means that EPA must address the downstream Spokane and Colville WQS before and in any approval decision regarding the proposed upstream WQS variances regarding discharges to the Spokane River.

B. EPA must disapprove WQS variances if the designated use and criteria addressed by the variances can be achieved by implementing technology-based effluent limits required under CWA Sections 301(b) and 306.

The federal regulation governing applicability for WQS variances provides that "[a] State may not adopt WQS variances if the designated use and criterion addressed by the WQS variance can be achieved by implementing technology-based effluent limits required under sections 301(b) and 306 of the Act." 40 C.F.R. § 131.14(a)(4). Accordingly, if the applicable WQS can be achieved by such implementation, EPA must deny the WQS variances. And because downstream WQS are implicated by WQS variances, as explained above, this requirement also encompasses achievement of downstream WQS and corresponding designated uses and criteria. Given this, Washington State may not approve the proposed five discharger-specific WQS variances for the Spokane River if the relevant downstream tribal WQS can be achieved by implementing technology-based effluent limits required under CWA Sections 301(b) and 306. And if Washington State approves these WQS variances in those situations, contrary to the governing federal regulation, EPA must disapprove the variances.

C. EPA also must disapprove WQS variances that affect fish consumption use if attaining the designated use is feasible.

The federal regulation that prescribes requirements for WQS variances provides that, "[f]or a WQS variance to a use specified in section 101(a)(2) of the Act or a sub-category of such a use, the State must demonstrate that attaining the designated use and criterion is not feasible throughout the term of the WQS variance[.]" 40 C.F.R. § 131.14(b)(2)(i)(A). Thus, if a State cannot demonstrate this, EPA must disapprove the WQS variance. As noted above, EPA has recognized since 1992 "that the consumption of aquatic life is a use specified in section 101(a)(2) of the Act" so that "not only can fish and shellfish thrive in a water body, but when caught, they can also be safely eaten by humans." 80 Fed. Reg. at 51,027. Given that, if a State desires to adopt a variance from a fish consumption use, it must demonstrate that attaining the designated use and criterion is not feasible throughout the term of the proposed WQS variance. Accordingly, here, EPA must disapprove the proposed WQS variances for the Spokane River that affect fish consumption use if attaining the designated use is feasible at any time during the term of the proposed variances.

D. EPA also must disapprove WQS variances if their requirements either do not represent the highest attainable condition of the water body or water body segment applicable throughout the term of the variance or would result in any lowering of the currently attained ambient water quality.

The federal regulation that prescribes requirements for WQS variances also provides that a WQS variance must include "the requirements that apply throughout the term of the WQS variance." 40 C.F.R. § 131.14(b)(1)(ii). In particular, "the requirements shall represent the highest attainable condition of the water body or waterbody segment applicable throughout the term of the WQS variance" and "shall not result in any lowering of the currently attained ambient water quality[.]" *Id*. (except for lake, wetland, or stream restoration under 40 C.F.R. § 131.14(b)(2)(i)(A)(2)). Moreover, a state "must specify the highest attainable condition of the water body or water body segment as a quantifiable expression" reflecting the "highest attainable interim criterion" or "the interim effluent condition that reflects the greatest pollutant reduction achievable" or "that reflects the greatest pollutant reduction achievable with pollutant control technologies installed at the time the State adopts the WQS variance, and the adoption and implementation of a Pollutant Minimization Program." *Id*. The latter is a structured set of activities to improve processes and pollutant controls that will prevent and reduce pollutant loadings. *See* 40 C.F.R. § 131.3 (definitions). Based on all this, EPA must disapprove WQS variances if their requirements either do not represent the highest attainable condition of the water body or water body segment applicable throughout the term of the variance or would result in any lowering of the currently attained ambient water quality. This standard must be met for federal approval of any WQS variances that Washington State adopts for the Spokane River.

E. Downstream States and authorized Tribes may invoke dispute resolution to make upstream WQS variances comply with their WQS.

Like States, Tribes authorized with TAS status have unquestionable power and authority to regulate waters within their regulatory authority. *Supra* § III.B. Additionally, TAS status provides tribes with "the power to require upstream off-reservation dischargers . . . to make sure that their activities do not result in contamination of the downstream on-reservation waters (assuming . . . that the reservation standards are more stringent than those the state is imposing on

the upstream entity)." *Wisconsin*, 266 F.3d at 748. "Such compliance may impose higher compliance costs on the upstream company, or in the extreme case it might have the effect of prohibiting the discharge or the activities altogether." *Id.*

As also explained above, *supra* § III.B, CWA Section 518(e)(3) and 40 C.F.R. § 131.7 provide for resolving potentially conflicting interests between States and authorized Tribes that may have conflicting WQS. That provides a procedural mechanism to address insufficiently protective upstream WQS variances if EPA fails to do so itself in approving or disapproving them. As explained above, that allows for mediation, arbitration, or alternative resolution. Also, regardless of which approach is used, a participating Tribe can rely on the underlying categorical substantive standards under the CWA to "facilitate progress toward attaining designated uses[,]" including safe fish consumption. 80 Fed. Reg. at 51,027, 51,035. Thus, the Spokane or Colville Tribes could invoke that mechanism if EPA approves conflicting upstream WQS variances.

V. OPINIONS

Based on the foregoing and subject to the qualifications and limitations stated in this letter, we are of the opinion that:

A. EPA has authority to require that upstream dischargers and WQS variances comply with downstream tribal WQS and must address downstream tribal WQS in WQS variance approvals following timely and meaningful tribal consultation;

B. EPA must disapprove WQS variances if the designated uses and criteria addressed by them can be achieved by implementing technology-based effluent limits required under CWA Sections 301(b) and 306;

C. EPA must disapprove WQS variances that affect fish consumption use if attaining the designated use is feasible;

D. EPA must disapprove WQS variances if their requirements either do not represent the highest attainable condition of the water body or water body segment applicable throughout the term of the variances or would result in any lowering of the currently attained ambient water quality; and

E. authorized Tribes (i.e., with TAS) can invoke the dispute resolution mechanisms in 40 C.F.R. § 131.7 to object to EPA approval of upstream WQS variances that violate their own WQS.

VI. LIMITATIONS

In rendering the opinions in this letter, we have assumed without inquiry or investigation and qualified and limited our opinions as follows:

A. legal issues and relevant facts as presented us in rendering this opinion are truthful, accurate, and can be relied on by us in rendering these opinions and we have no obligations to make any independent inquiry or investigation thereof;

B. the opinions provided here apply only to the matters described above and are subject to changes in applicable statutes, regulations, case law, and facts, and judicial interpretation thereof, as well as the discretion of the court before which a proceeding may be brought;

C. no opinions expressed in this letter include any implied opinions and we specifically disclaim any responsibility to provide advice regarding any changes (or the need for changes) in this opinion letter resulting from changes in relevant facts or governing law occurring, learned, or communicated after the date of this letter;

D. this opinion letter only addresses the above legal requirements and does not address or evaluate any scientific or technical compliance with any WQS or designated uses; and

E. this opinion letter is rendered solely at the request and for the benefit of the addressee for this letter, and this opinion letter does not establish any attorney-client relationship between this law firm and any third-party.

Thank you for allowing us this opportunity to provide these opinions. Please let us know if you have any questions or comments regarding these matters or wish to discuss them further.

Sincerely,

Rey-Bear McLaughlin, LLP

Daniel I.S.J. Rey-Bear

Timothy H. McLaughlin

Assessment of the

PRELIMINARY DRAFT STATE TECHNICAL SUPPORT DOCUMENT FOR PCB VARIANCES ON THE SPOKANE RIVER

By Richard R. Horner
July 24, 2020

INTRODUCTION

While the Technical Support Document (TSD) establishes an adequate general outline for the variance process, in my view it has three major deficiencies:

- The best prospects for PCB reduction in the Spokane River and its biota in the relatively short and medium terms lie in source control actions, but the TSD does not cover that subject in sufficient breadth and depth.

- There are inefficiencies in the Pollutant Minimization Plans (PMPs) that could be corrected by cooperative actions by the dischargers.

- Some of the scheduling specified by the PMPs is too extended in my opinion.

These defects compromise what I believe should be the overarching goal of the process: to achieve the greatest possible reduction of PCBs in the Spokane River ecosystem in the shortest practically feasible time. I elaborate on each point in the following discussion.

INSUFFICIENT ATTENTION TO SOURCE CONTROL

Rationale for Increasing Emphasis on Source Control

The TSD, of course, deals directly with the five dischargers seeking variances. A study performed in 2003-2004 found that those five municipal and industrial plants accounted for only 20 percent of the PCB loading to the Spokane River within Washington, with 44 percent from municipal stormwater and 30 percent entering from Idaho. While the specific numbers may not apply today, the relative positions of the three dominating loading sources probably do. With treatment improvements recently completed at the Spokane County, Liberty Lake, and Inland Empire plants, quite possibly the dischargers' share is now below 20 percent. Moreover, it will probably fall further when treatment improvements are finished at the City of Spokane plant, seemingly soon, and, eventually, at Kaiser.

These circumstances suggest that the next round of PCB reduction can best be accomplished by addressing stormwater and the inflow from Idaho. In both instances, PCBs are surely widely distributed in the contributing drainages, but also have distinct sources that could be identified and mitigated. Admittedly, working interstate with a jurisdiction not suffering the consequences of chemicals originating there would have its difficulties. Putting that issue aside for the

moment, substantial progress could be made by tracing and excising sources of PCBs contributing to stormwater runoff in the urban portions of Washington's Spokane River watershed.

I recognize that these environmental sources of the pollutant are outside the direct areas of responsibility of the municipal and industrial wastewater plant operators. Yet, they are the entities that are seeking variances. At this point in time they do not have readily available technologies to upgrade treatment above the levels already installed at three plants, underway at a fourth, and recommended by Ecology for Kaiser. Even with these treatment improvements, the river is left in a condition unable to support its designated beneficial uses. Without additional actions, it will remain in that condition for the indefinite future. Consequently, Ecology should require the discharges to cooperate in and fund a comprehensive, goal-oriented program to identify the greatest sources of PCBs distributed in the regional environment and mitigate them in priority order.

Below, under the topic Pollutant Minimization Plan Inefficiencies, I recommend two additional cooperative efforts among the discharges to promote efficiency. At the end of this memorandum I suggest a mechanism for equitably allocating the responsibilities and costs of these joint programs.

Potential Sources for Remediation

The TSD identifies many of the sources that should be sought out in a comprehensive program to find and remove or reduce PCBs of environmental origin. TSD Table 10 provides a useful compilation, with particularly prevalent exposed PCB sources being aged electrical equipment; caulks; and paints, especially yellow applications for high visibility. Therefore, equipment graveyards, pavement and concrete structure joint caulks, road markings, and bollards are prime places to look for remediable PCBs.

One key source not identified by the TSD is automobile and other equipment dismantling operations and subsequent storage, handling, and disposal locations. Despite the ban on their use in manufacturing of these items four decades ago, PCBs are still commonly found in the non-metallic residues of these processes, which often are highly exposed to the outdoor environment. Therefore, substantial progress could be made in isolating these operations and materials from contact with rainfall and runoff at dismantlers, salvage yards, waste transfer stations, and landfills. There are no auto shredders in Spokane and its vicinity,[1] but the area does have 14 auto salvage yards;[2] three transfer stations;[3] and two landfills, one publicly owned facility for municipal solid waste, and one limited-purpose private landfill.[4]

In addition to the environmentally distributed PCB sources that could be addressed by targeted mitigation, a source specific to Inland Empire Paper is print ink contained in some recycled paper handled at the plant. The TSD does include this source for attention in that company's

[1] http://giecdn.blob.core.windows.net/fileuploads/file/rt_auto_shredder_poster.pdf (accessed July 9, 2020).
[2] https://www.salvage-parts.com/junk-yards/spokane-wa (accessed July 9, 2020).
[3] https://www.spokanecounty.org/2013/Regional-Disposal-Locations-Hours-Fees (accessed July 9, 2020).
[4] https://www.spokanecounty.org/DocumentCenter/View/4871/Final-2015Plan-PDF?bidId= (accessed July 9, 2020).

PMP, but it should more explicitly direct the company to investigate the extent of PCB-containing material in its recycled paper feedstock and its origins. That information should be used to determine what action should be taken to balance the competing interests of protecting the Spokane River on the one hand and saving resources through recycling on the other.

Regarding the PCB loading stemming from Idaho, the dischargers' cooperative program that I suggested above should reach out to the neighboring state to establish a relationship focused on the issue. As information accumulates from the source tracing and mitigation work in Washington, the knowledge should be conveyed to Idaho colleagues. Most source types and their relative PCB releases are probably common to the two states. Having been identified by intensive investigative work in Washington, they could be addressed in Idaho without that state having to do the preliminary work. The dischargers should assist in that work in all ways their legal, regulatory, and financial positions allow.

POLLUTANT MINIMIZATION PLAN INEFFICIENCIES

Literature Review Provisions

The TSD's Table 25 specifies Pollutant Minimization Program Actions to be taken by each discharger. A common action for the three municipal dischargers and Inland Empire is, "Conduct periodic literature review to identify emerging treatment technologies." That action is not specified for Kaiser, presumably because it is just now getting into the process of selecting advanced treatment. As I comment later, I believe that the PMP scheduling allows Kaiser too much time to complete installation of new treatment. That schedule should be tightened, and Kaiser too should be included in the periodic literature review directive.

As the TSD demonstrates on pages 34-38, there are numerous potential treatment technologies that could serve to reduce PCBs in municipal and industrial wastewater plant discharges. PCBs have a strong tendency to associate with solid particulate material in water, instead of in the dissolved state. Many other synthetic organic chemicals share this characteristic and can be captured by the same processes. With the combination of numerous chemicals and methods to remove them from wastewater, the potential volume of literature on the international scale is rich. That literature should be thoroughly reviewed within the first year of the variance period to define the present state of the technology. New reports should then be added at least biannually to stay current with developments.

Bench and Pilot Testing Provisions

Table 25 follows with the specification for the municipal dischargers and Inland Empire to, "Conduct bench scale/pilot studies on emerging PCB treatment technologies, as identified in periodic literature reviews." For the three municipal plants it goes on to state, "Conduct periodic review of alternative actions and implement feasible actions to reduce PCBs loading to the environment." That provision requires, among other identified feasible actions, the installation of additional treatment meeting the criteria. That statement is missing for Inland Empire, but must apply to that discharger too. Both actions quoted in this paragraph are missing in Kaiser's

case, again probably because of the lag in providing advanced treatment, but must be required of Kaiser too.

Conclusion

It is not efficient for three, four, or five entities, close to one another and having essentially the same problems and requirements, to perform literature reviews and bench and pilot testing separately. Ecology should require all to join in a cooperative effort to perform these tasks. Later, under the topic A Structure for a Cooperative Program, I give my recommendations for constituting such a program.

OVER-EXTENDED SCHEDULING

PMP Reevaluation Schedule

In accordance with the operative federal regulation, a water quality variance with a term greater than five years is reevaluated at least [emphasis added] every five years, meaning that a more compressed schedule can be specified. I believe that reevaluation should occur sooner than five years at the outset of the variance term and be adjusted according to the performance of the variance recipients. For example, with an initial reevaluation at the three-year point showing a high-performance level, the second reevaluation could be extended to five years later. On the other hand, inadequate performance would justify scheduling the next reevaluation once again in another three years, or even within two years. This strategy would be consistent with, and an addition to, the general adaptive management framework embedded in the state regulation governing variances and underlying the TSD overall. It would give the dischargers a strong incentive to elevate their performance.

Scheduling of Specific PMP Actions

There a number of instances where the frequencies and schedules in Tables 24 and 25 give more time than needed and should be allowed. I believe this leniency compromises what I stated earlier is my conception of the overarching goal of the TSD process: to achieve the greatest possible reduction of PCBs in the Spokane River ecosystem in the shortest practically feasible time. I give my alternative recommendations in Table 1.

As my Table 1 indicates, I take particular exception to the actions assigned to Kaiser in TSD Table 25. First, the firm is allowed far too long to select, design, and install a new treatment system. All of the other dischargers already have upgraded, or soon will, to the level of treatment Kaiser is just now beginning to consider. I believe that it is entirely feasible for Kaiser to complete the upgrade in half of the time allowed by the TSD. Second, Table 25 fails to assign Kaiser actions required of the other dischargers, namely literature review and bench or pilot testing of emerging technologies and actions to reduce PCBs loading to the environment. My recommended revisions to Table 25 correct these shortcomings.

Table 1. Recommended Alterations to the Frequencies and Schedules Prescribed in the TSD's Tables 24 and 25

Table 24					
Line	**Action**	**TSD Frequency**	**TSD Schedule**	**Recommended Frequency**	**Recommended Schedule**
1	Establish team	Once	By end of Year 1	Once	By end of Month 1
2	Identify procedures and methods for PMP effectiveness tracking	Once	By end of Year 1	Once	By end of Month 2
3	Submit proposed schedule for performing and completing PMP actions	Once	By end of Year 1	Once	By end of Month 3
4	Submit a Quality Assurance Project Plan (QAPP) for PMP PCB Sampling	Once	By end of Year 1 or as needed	By end of Month 6 and as needed with revision of the monitoring program	
10	Conduct periodic review of procurement policies	Ongoing	Review every 4 years	Ongoing	Review annually
11	Evaluate and optimize the solids dewatering and storage processes	Ongoing	By end of Year 10	By end of Year 3 and ongoing every 3 years	
13-14, 20-22	See Table 24	See Table 24	By Year 4 and every 5 years thereafter (prior to each mandatory interim review)	Same as Table 24	By the year preceding each mandatory interim review
Table 25					
1	Evaluate infiltration and inflow(I/I) to collection systems	Ongoing	Years 1-5 and implementation Years 6-15	Ongoing	Years 1-3 and implementation Years 4-15
3, 8	Conduct periodic literature review to identify emerging treatment technologies[a]	Ongoing	First report due by Year 4 and every 5 years thereafter	Ongoing	First report due by Year 1 and every 2 years thereafter
6, 15	Conduct periodic review of alternative actions and implement feasible actions to reduce PCBs loading to the environment[a, b]	Ongoing	Years 1-20	Ongoing	Years 1-20
16	Clean out north sewer	Ongoing	By Year 5, and as needed thereafter	Ongoing	By Year 1, and as needed thereafter

Table 1 continued

Line	Action	TSD Frequency	TSD Schedule	Recommended Frequency	Recommended Schedule
17	Refurbish PCB containing electrical equipment[c]	Ongoing	By Year 1 and as needed thereafter	Once	By Year 1
21	Identify and evaluate treatment technologies[d]	As necessary	Years 1-8	Once	By Year 1
22	Conduct bench/pilot scale testing of candidate technologies[d]	As necessary	By Year 8	Once	By Year 3
23	Submit final engineering design documents for selected treatment technology	Once	By Year 9	Once	By Year 4
24	Install and optimize selected treatment technology	Once	By Year 10	Once	By Year 5

[a] Kaiser should also be required to support and perform these actions in cooperation with the other dischargers. Furthermore, Kaiser, cooperating with the other dischargers, should also be required to support and conduct the actions, "Submit Scope of Work for conducting bench scale/pilot studies on emerging PCB treatment technologies, as identified during periodic literature reviews" and "Conduct bench scale/pilot studies on emerging PCB treatment technologies according to Ecology approved Scope of Work." These actions should be added to Kaiser's section of Table 25.

[b] In this concept, as discussed above, this action would be substantially upgraded to form a cooperative arrangement among the dischargers to conduct a comprehensive, goal-oriented program to identify the greatest sources of PCBs distributed in the regional environment and mitigate them in priority order.

[c] The goal for this action, as it appears to be stated in Table 25, is inadequate. All PCB-containing equipment should be identified and replaced with equipment not containing PCBs within the first year of the variance period.

[d] These specific actions pertain to Kaiser's selection and testing of its new stage of treatment. As indicated in note a above, Kaiser should also be required to support and perform such actions in cooperation with the other dischargers on an ongoing basis to keep abreast of treatment developments that further improve PCB capture.

A STRUCTURE FOR A COOPERATIVE PROGRAM

In passages above I recommended three actions on which the five dischargers should cooperate instead of pursuing separately: (1) environmental PCB source tracing and remediation; (2) treatment technology literature review; and (3) treatment technology bench and pilot testing. The variance recipients should form a consortium operated by a technical board representative of the participants. The board should hire a well-qualified consultant or consultants to perform the tasks under its direction.

Two issues associated with such an arrangement are allocation of funding support and representation on the board. In my opinion, a fair way to decide these issues would be allocation according to relative discharge of PCB mass loading to the river. The TSD presents PCB effluent data for each discharger that either directly cite mass loadings (mg/day) or give PCB concentrations (pg/L) that, along with flow data, can be applied to calculate loadings. These data appear in Tables 12-15 and 17. The years represented are not fully consistent among the

dischargers, starting as early as 2008 and as late as 2018 and terminating in either 2018 or 2019. Three of the dischargers completed advanced treatment projects during this period, events that most likely changed their discharge characteristics. Therefore, the tabulated data are not a perfect basis to make allocations.

A better basis would be to use data only from the time when the first advanced treatment system went on-line for an initial allocation of funding assessments. As data accumulate year by year, the relative mass loading releases should be recalculated and the assessments adjusted for the following year. A refinement would be to give some extra credit for those who installed advanced treatment at an early point, with a decrease in assessment in relation to the timing of installation. This arrangement would give all dischargers incentive to elevate their performance, particularly to encourage Kaiser to accelerate advanced treatment.

As an illustration for how the system would work, I used the TSD tabulated data, calculating mass loadings from concentration and flow information as necessary. Among the statistical reports for concentrations or loadings given in the tables, I used the medians. Table 2 summarizes the results. Hence, as the circumstances stood at the release of the TSD, Inland Empire would be assessed about one-third of the cost of the cooperative activities and the City slightly less and Kaiser slightly more than one-third.

Table 2. Relative Mass Loading Discharges by the Variance Applicants Based on Data Tabulated in the TSD

Discharger	Median PCB Mass Loading (mg/day)	Share of Total Mass Loading
Spokane County	3.67	2.0%
City of Spokane	52.1	27.9%
Liberty Lake	0.28	0.1%
Inland Empire	62.5	33.4%
Kaiser	68.3	36.6%
TOTAL	186.9	100.0%

Representation on the technical board could be decided similarly, with each participant having at least one member and otherwise membership in proportion to the funding assessment. Under this formula and based on the Table 2 data, a 20-member board would have one member each from Spokane County and Liberty Lake and the remaining 18 allocated five to the City, six to Inland Empire, and seven to Kaiser.

I intend these illustrations only as examples. Other workable and fair arrangements are surely possible. The important point to me is that certain actions under the variance structure could be conducted considerably more cost-effectively in a cooperative framework than under the individualized approach laid out in the TSD.

Curriculum Vitae

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University of Washington:
Emeritus Research Associate Professor,
Departments of Landscape Architecture and Civil and Environmental Engineering and
Sole Proprietor Consultant

EDUCATION

1976 - 1978 University of Washington, Seattle, Washington; Ph.D. (Civil Engineering)

1965 - 1966 University of Pennsylvania, Philadelphia, Pennsylvania; M.S. (Mechanical Engineering)

1961 - 1965 University of Pennsylvania, Philadelphia, Pennsylvania; B.S. *Cum Laude* (Mechanical Engineering)

HONORS AND AWARDS

Augustus Trask Ashton Scholarship, University of Pennsylvania, 1961 - 65
Annual Academic Honors, University of Pennsylvania, 1961 - 65
Tau Beta Pi National Engineering Honor Society
National Science Foundation Traineeship, University of Pennsylvania, 1965 - 66

EMPLOYMENT

1986 - Present Richard R. Horner, Sole Proprietor (offering services in environmental engineering and science)

2011 - Present University of Washington, Seattle, Washington
Emeritus Research Associate Professor

1981 - 2011 University of Washington, Seattle, Washington
Research Associate Professor

1986 - 1990 King County, Seattle, Washington
Coordinator of Puget Sound Wetland and Stormwater Management Research Program (part-time; continued under contract to University of Washington)

1969 - 1981 Northampton Community College, Bethlehem, Pennsylvania
Engineering Department (Coordinator, 1971 - 73 and 1978 - 79)
Environmental Studies Department (Co-coordinator, 1973 - 76 and 1978 - 1981)
Professor, 1978 - 1981; Associate Professor, 1973 - 78;
Assistant Professor, 1969 - 73,
Leave of Absence, 1977 - 78; Sabbatical Leave, 1976 - 77

1977 - 1978 University of Washington, Seattle, Washington
Department of Civil Engineering
Research Engineer, Highway Runoff Water Quality Project

1976 - 1977	University of Washington, Seattle, Washington Department of Civil Engineering and Institute for Environmental Studies Research Assistant and Teaching Assistant
1966 - 1969	Exxon Research and Engineering Company, Florham Park, New Jersey; Project Engineer
1965 - 1966	University of Pennsylvania, Philadelphia Pennsylvania Department of Mechanical Engineering; Research Assistant

NATIONAL COMMITTEES

National Academy of Sciences Panel on Reducing Stormwater Discharge Contributions to Water Pollution, 2007-2008.

Technical Advisory Panel for Water Environment Federation projects on Decentralized Stormwater Controls for Urban Retrofit and Combined Sewer Overflow Reduction, 2005-2007.

Co-chair, Engineering Foundation Conference on Effects of Watershed Development and Management on Aquatic Ecosystems, 1996.

National Academy of Sciences Panel on Costs of Damage by Highway Ice Control, 1990-91.

U.S. Environmental Protection Agency National Wetland Research Planning Panel, 1988, 1991.

RESEARCH PROJECTS

* Principal Investigator.
** Co-Principal Investigator. (Where undesignated, I was a member of the faculty investigation team without principal investigator status).

Effects of Waterfront Stormwater Solutions Prototypes on Water Quality Runoff in Puget Sound near Pomeroy Park - Manchester Beach; Washington Sea Grant; $148,838; 2015-17.

Development of a Stormwater Retrofit Plan for Water Resources Inventory Area (WRIA) 9 and Estimation of Costs for Retrofitting all Developed Lands of Puget Sound; U.S. Environmental Protection Agency and King County (WA); $243,619; 2010-13.

Ultra-Urban Stormwater Management; Seattle Public Utilities; $1,130,000; 1999-2008.*

Roadside Vegetation Management Study; Washington State Department of Transportation; $50,000; 2004-05.

The Ecological Response of Small Streams to Stormwater and Stormwater Controls; U. S. Environmental Protection Agency, cooperating with Watershed Management Institute (Crawfordsville, FL); $579,117; 1995-2003.*

Vegetated Stormwater Facility Maintenance; Washington State Department of Transportation; $86,000; 1998-2000.*

Roadside Drainage System Management for Water Quality Improvement; King and Snohomish (WA) Counties; $70,000; 1997-2000.*

Standardization of Wet Weather Protocols for Stream Impact and Treatment Technology Performance Assessments; Water Environment Research Foundation, cooperating with Water Research Center (Huntington Valley, Pennsylvania) and University of Illinois; $125,000; 1996-97.

Road Shoulder Treatments for Water Quality Protection; Washington State Department of Transportation and King County Roads Division; $90,000; 1995-96.**

Control of Nuisance Filamentous Algae in Streams by Invertebrate Grazing; National Science Foundation; $193,691; 1994-96.

Criteria for Protection of Urban Stream Ecosystems; Washington Department of Ecology; $230,000; 1994-96.

Region-Specific Time-Scale Toxicity in Aquatic Ecosystems; Water Environment Research Foundation, cooperating with Water Research Center (Huntington Valley, Pennsylvania) and University of Illinois; $670,000; 1994-96.

Establishing Reference Conditions for Freshwater Wetlands Restoration; U. S. Environmental Protection Agency; $75,000; 1993-97.

Stormwater Management Technical Assistance to Local Governments; Washington Department of Ecology; $115,000; 1992-93.*

Center for Urban Water Resources Management; Washington Department of Ecology; $336,490; plus $157,400 matching support from seven local governments; 1990-93.*

University of Washington Cooperative Unit for Wetlands and Water Quality Research; King County, Washington; amount varied by year; 1987-95.*

Assessment of Portage Bay Combined Sewer Overflows; City of Seattle; $132,676; 1990-91.*

Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase 3; National Science Foundation; $108,332; 1988-90.**

Design of Monitoring Programs for Determining Shellfish Bed Bacterial Contamination Problems; Washington Department of Ecology; $12,000; 1988-89.*

Puget Sound Protocols Development; Tetra Tech, Inc. and Puget Sound Estuary Program; $10,144; 1988.*

Improving the Cost Effectiveness of Highway Construction Site Erosion/ Pollution Control, Phase 2; Washington State Department of Transportation; $97,000; 1987-89.*

Wetland Mitigation Project Analysis; Washington State Department of Transportation; $74,985; 1987-89.*

Lake Chelan Water Quality Assessment; Harper-Owes, consultant to Washington State Department of Ecology; $42,977; 1986-88.

Quality of Management of Silver Lake; City of Everett; $67,463; 1986-88.

Effectiveness of WSDOT Wetlands Creation Projects; Washington State Department of Transportation; $42,308; 1986-87.*

Improving the Cost Effectiveness of Highway Construction Site Erosion/Pollution Control; Washington State Department of Transportation; $41,608; 1986-87.*

Management Significance of Bioavailable Phosphorus in Urban Runoff; State of Washington Water Research Center and Municipality of Metropolitan Seattle; $32,738; 1986-87.**

Environmental Monitoring and Evaluation of Calcium Magnesium Acetate (CMA); Transportation Research Board of National Academy of Sciences; $199,943; 1985-87.*

Conceptual Design of Monitoring Programs for Determination of Water Quality and Ecological Change Resulting from Nonpoint Source Discharges; Washington State Department of Ecology; $49,994; 1985-86.**

Development of an Integrated Land Treatment Approach for Improving the Quality of Metalliferous Mining Wastewaters; Washington Mining and Mineral Resources Research Institute; $4,000; 1985-86.*

Preliminary Investigation of Sewage Sludge Utilization on Roadsides; Washington State Department of Transportation; $6,664; 1984-85.*

Source Control of Transit Base Runoff Pollutants; Municipality of Metropolitan Seattle; $26,867; 1984-85.**

Lake Sammamish Future Water Quality; Municipality of Metropolitan Seattle; $28,500; 1984-85.

Implementation of Highway Runoff Water Quality Research Results; Washington State Department of Transportation; $13,998; 1984-85.*

Performance Evaluation of a Detention Basin and Coalescing Plate Oil Separator for Treating Urban stormwater Runoff; Washington State Water Research Center; 1984-85; $11,724.**

Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase 2; National Science Foundation; $99,088; 1983-85.**

Development of a Biological Overland Flow System for Treating Mining Wastewaters; Washington Mining and Mineral Resources Research Institute; $6,030; 1983-84.*

Nutrient Contributions of Agricultural Sites to the Moses Lake System; Moses Lake Conservation District; $15,039; 1982-84.*

Planning Implementation of Runoff Water Quality Research Findings; Washington State Department of Transportation; $12,735; 1982-83.**

Transport of Agricultural Nutrients to Moses Lake; Brown and Caldwell Engineers; $22,725; 1982-83.**

Investigation of Toxicant Concentration and Loading Effects on Aquatic Macroinvertebrates; University of Washington Graduate School Research Fund; $3,788; 1982.*

Sampling Design for Aquatic Ecological Monitoring; Electric Power Research Institute; $542,008; 1981-86.

Velocity-Related Critical Phosphorus Concentrations in Flowing Water; National Science Foundation; $70,310; 1980-82.

Highway Runoff Water Quality; Washington State Department of Transportation; $461,176; 1977-82.

BOOKS

Shaver, E., R. Horner, J. Skupien, C. May, and G. Ridley. *Fundamentals of Urban Runoff Management: Technical and Institutional Issues*, 2nd Edition. U.S. Environmental Protection Agency, Washington, D.C., 2007.

Azous, A. L. and R. R. Horner. *Wetlands and Urbanization: Implications for the Future*. Lewis Publishers, Boca Raton, FL, 2000.

Horner, R. R., J. J. Skupien, E. H. Livingston, and H. E. Shaver. *Fundamentals of Urban Runoff Management: Technical and Institutional Issues*. Terrene Institute, Washington, D. C., 1994.

REFEREED JOURNAL PUBLICATIONS AND BOOK CHAPTERS

Wright, O.M., E. Istanbulluoglu, R.R. Horner, C.L. DeGasperi, and J. Simmonds. 2018. Is There a Limit to Bioretention Effectiveness? Evaluation of Stormwater Bioretention Treatment Using a Lumped Ecohydrologic Watershed Model and Ecologically-Based Design Criteria. *Hydrological Processes* 2018:1-17.

Chapman, C. and R.R. Horner. Performance Assessment of a Street-Drainage Bioretention System. *Water Environment Research* 82(2): 109-119, 2010.

Horner, R. R. et al. Structural and Non-Structural Best Management Practices (BMPs) for Protecting Streams. In *Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation*, B. K. Urbonas (ed.), American Society of Civil Engineers, New York, pp. 60-77, 2002.

Comings, K. J., D. B. Booth, and R. R. Horner. Storm Water Pollutant Removal by Two Wet Ponds in Bellevue, Washington. *Journal of Environmental Engineering* 126(4):321-330, 2000.

Anderson, E. L., E. B. Welch, J. M. Jacoby, G. M. Schimek, and R. R. Horner. Periphyton Removal Related to Phosphorus and Grazer Biomass Level. *Freshwater Biology* 41:633-651, 1999.

Horner, R. R., D. B. Booth, A. Azous, and C. W. May. Watershed Determinants of Ecosystem Functioning. In *Effects of Watershed Development and Management on Aquatic Ecosystems*, L. A. Roesner (ed.), American Society of Civil Engineers, New York, pp. 251-274, 1997.

Horner, R.R. Toward Ecologically Based Urban Runoff Management. In *Urban Runoff and Receiving Systems*, E.E. Herricks (ed.), Lewis Publishers, Boca Raton, Florida, pp. 365-378, 1995.

Walton, S. P., E. B. Welch, and R. R. Horner. Stream Periphyton Response to Grazing and Changes in Phosphorus Concentration. *Hydrobiologia* 302:31-46, 1994.

Reinelt, L. E. and R. R. Horner. Pollutant Removal from Stormwater Runoff by Palustrine Wetlands Based on a Comprehensive Budget. *Ecological Engineering* 4:77-97, 1995.

Horner, R.R. and M.V. Brenner. Environmental Evaluation of Calcium Magnesium Acetate for Highway Deicing Applications. *Resources, Conservation and Recycling* 7:213-237, 1992.

Brenner, M.V. and R.R. Horner. Effects of Calcium Magnesium Acetate on Dissolved Oxygen in Water. *Resources, Conservation and Recycling* 7:239-265, 1992.

Reinelt, L.E., R.R. Horner, and R. Castensson. Nonpoint Source Water Quality Management: Improving Decision-Making Information through Water Quality Monitoring. *Journal of Environmental Management* 34:15-30, 1992.

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Horner, R.R., E.B. Welch, M.R. Seeley, and J.M. Jacoby. Responses of Periphyton to Changes in Current Velocity, Suspended Sediments and Phosphorus Concentration. *Freshwater Biology* 24:215-232, 1990.

Horner, R.R. Long-Term Effects of Urban Stormwater on Wetlands. In *Design of Urban Runoff Quality Controls*, L.A. Roesner, B. Urbonas, and M.B. Sonnen (eds.), American Society of Civil Engineers, New York, pp. 451-466, 1989.

Welch, E.B., R.R. Horner, and C.R. Patmont. Phosphorus Levels That Cause Nuisance Periphyton: A Management Approach. *Water Research* 23(4):401-405, 1989.

Butkus, S.R., E.B. Welch, R.R. Horner, and D.E. Spyridakis. Lake Response Modeling Using Biologically Available Phosphorus. *Journal of the Water Pollution Control Federation* 60(9):1663-1669, 1988.

Reinelt, L.E., R.R. Horner, and B.W. Mar. Nonpoint Source Pollution Monitoring Program Design. *Journal of Water Resources Planning and Management* 114(3):335-352, 1988.

Welch, E.B., J.M. Jacoby, R.R. Horner, and M.R. Seeley. Nuisance Biomass Levels of Periphytic Algae in Streams. *Hydrobiologia*, 157:161-168, 1988.

Reinelt, L.E., R. Castensson, and R.R. Horner. Modification of an Existing Monitoring Program to Address Nonpoint Source Pollution, A Case Study of the Svarta River Basin, Sweden. *Vatten* 43:199-208, 1987.

Mar, B.W., R.R. Horner, J.S. Richey, D.P. Lettenmaier, and R.N. Palmer. Data Acquisition, Cost-Effective Methods for Obtaining Data on Water Quality. *Environmental Science and Technology* 20(6):545-551, 1986.

Horner, R.R., J.S. Richey, and G.L. Thomas. A Conceptual Framework to Guide Aquatic Monitoring Program Design for Thermal Electric Power Plants. *Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Freshwater Ecosystems*, Special Technical Publication 894 of the American Society for Testing and Materials, Philadelphia, Pennsylvania, pp. 86-100, 1986.

Welch, E.B., D.E. Spyridakis, J.I. Shuster, and R.R. Horner. Declining Lake Sediment Phosphorus Release and Oxygen Deficit Following Wastewater Diversion. *Journal of the Water Pollution Control Federation* 58(1):92-96, 1986.

Richey, J.S., B.W. Mar, and R.R. Horner. The Delphi Technique in Environmental Assessment, Part 1: Implementation and Effectiveness. *Journal of Environmental Management* 21:135-146, 1985.

Richey, J.S., R.R. Horner, and B.W. Mar. The Delphi Technique in Environmental Assessment, Part 2: Consensus on Critical Issues in Environmental Monitoring Program Design. *Journal of Environmental Management* 21:147-159, 1985.

Horner, R.R. and B.W. Mar. Assessing Impacts of Operating Highways on Aquatic Ecosystems. *Transportation Research Record* 1017:47-55, 1985.

Horner, R.R., E.B. Welch, and R.B. Veenstra. Development of Nuisance Periphytic Algae in Laboratory Streams in Relation to Enrichment and Velocity. In *Periphyton of Freshwater Ecosystems*, R.G. Wetzel (ed.), Dr. W. Junk BV, the Hague, The Netherlands, pp. 121-134, 1983.

Horner, R.R. and B.W. Mar. A Guide for Assessing Water Quality Impacts of Highway Operations and Maintenance. *Transportation Research Record* 948:31-40, 1983.

Chui, T.W., B.W. Mar, and R.R. Horner. A Pollutant Loading Model for Highway Runoff. *Journal of Environmental Engineering Division*, ASCE 108:1193-1120, 1982.

Horner, R.R. and E.B. Welch. Stream Periphyton Development in Relation to Current Velocity and Nutrients. *Canadian Journal of Fisheries and Aquatic Sciences* 38:449-457, 1981.

REVIEWED PROCEEDINGS PUBLICATIONS

Horner, R. R. Stormwater Runoff Flow Control Benefits of Urban Drainage System Reconstruction According to Natural Principles. Presentation at Puget Sound—Strait of Georgia Research Conference, Vancouver, B. C., 2003.

May, C.W. and R.R. Horner. 2002. The Limitations of Mitigation-Based Stormwater Management in the Pacific Northwest and the Potential of a Conservation Strategy Based on Low-Impact Development Principles. Proc. 2002 ASCE Stormwater Conference, Portland, OR.

Horner, R. R. and C. R. Horner. Performance of a Perimeter ("Delaware") Sand Filter in Treating Stormwater Runoff from a Barge Loading Terminal. Proc. Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999, pp. 183-192, 1999.

Horner, R. R. and C. W. May. Regional Study Supports Natural Land Cover Protection as Leading Best Management Practice for Maintaining Stream Ecological Integrity. Proc. Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999, pp. 233-248, 1999.

Horner, R. R. Constructed Wetlands for Urban Runoff Water Quality Control. Proc. National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993, pp. 327-340, 1995.

Horner, R. R. Training for Construction Site Erosion Control and Stormwater Facility Inspection. Proc. National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993, pp. 426-450, 1995.

Horner, R. R. Overview of the Puget Sound Wetlands and Stormwater Management Research Program. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 141-145, 1995.

Horner, R. R. and L. E. Reinelt. Guidelines for Managing Urban Wetlands. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 171-178, 1995.

Taylor, B. K. Ludwa, and R. R. Horner. Urbanization Effects on Wetland Hydrology and Water Quality. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 146-154, 1995.

Reinelt, L.E. and R.R. Horner. Urban Stormwater Impacts on the Hydrology and Water Quality of Palustrine Wetlands in the Puget Sound Region. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1991; pp. 33-42.

Horner, R.R. Environmental Effects of Calcium Magnesium Acetate, Emphasizing Aquatic Ecosystem Effects. Proc. Conf. on Environmental Impacts of Highway Deicing, Institute of Ecology Publication No. 33, University of California, Davis; 1990; pp. 97-119.

Stockdale, E.C. and R.R. Horner. Using Freshwater Wetlands for Stormwater Management: A Progress Report. Proc. Wetlands 1988: Urban Wetlands and Riparian Habitat Symposium; Oakland, California, June 1988.

Horner, R.R. Highway Construction Site Erosion and Pollution Control: Recent Research Results. Proc. 39th Annual Road Builders' Clinic; Moscow, Idaho; March 1988; pp. 37-54.

Horner, R.R., F.B. Gutermuth, L.L. Conquest, and A.W. Johnson. Urban Stormwater and Puget Trough Wetlands. Proc. 1st Annual Meeting on Puget Sound Research; Seattle, Washington; March 1988; pp. 723-746.

Weiner, R.F., R.R. Horner, and J. Kettman. Preliminary Comparative Risk Assessment for Hanford Waste Sites. Proc. Waste Management 88; Tucson, Arizona; February 1988.

Stockdale, E.C. and R.R. Horner. Prospects for Wetlands Use in Stormwater Management. Proc. Coastal Zone 87 Conf.; Seattle, Washington; May 1987; pp. 3701-3714.

Horner, R.R. A Review of Wetland Water Quality Functions, Proc. Conf. on Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding; Port Townsend, Washington; May 1986; pp. 33-50.

Bain, R.C., Jr., R.R. Horner, and L. Nelson. Nonpoint Pollution Control Strategies for Moses Lake, Washington. Proc. Fifth Annual Conf. North American Lake Management Society; Lake Geneva, Wisconsin; November 1985; pp. 170-176.

Shuster, J.I., E.B. Welch, R.R. Horner, and D.E. Spyridakis. Response of Lake Sammamish to Urban Runoff Control. Proc. Fifth Annual Conf. North American Lake Management Society; Lake Geneva, Wisconsin; November 1985; pp. 229-234.

Horner, R.R., J.S. Richey, and B.W. Mar. A General Approach to Designing Environmental Monitoring Programs. Proc. Pacific Section AAAS Sym. on Biomonitors, Bioindicators and Bioassays of Environmental Quality; Missoula, Montana; June 1985.

Horner, R.R. Improvement of Environmental Impact Assessment of Nonpoint Sources of Water Pollution. Proc. Non-point Pollution Abatement Sym.; Milwaukee, Wisconsin; April 1985.

Horner, R.R., E.B. Welch, M.M. Wineman, M.J. Adolfson, and R.C. Bain, Jr. Nutrient Transport Processes in an Agricultural Watershed. Proc. Fourth Annual Conf. North American Lake Management Society; McAfee, New Jersey; October 1984; pp. 221-228.

Horner, R.R. and B.W. Mar. A Predictive Model for Highway Runoff Pollutant Concentrations and Loadings. Proc. Stormwater and Water Quality Management Model Users' Group Meeting. EPA 600/9-82-015; Alexandria, Virginia; March 1982; pp. 210-224.

TECHNICAL REPORTS

Horner, R.R. Development of a Stormwater Retrofit Plan for Water Resources Inventory Area 9: Flow and Water Quality Indicators and Targets. King County Water and Land Resources Division, Seattle, Washington, 2013.

Horner, R.R. and J. Gretz. Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices Applied to Meet Various Potential Stormwater Runoff Regulatory Standards. Report to U.S. Environmental Protection Agency by Natural Resources Defense Council, 2011.

Horner, R.R. Section 4-2, Protection and Restoration Strategies for Watersheds and Tributaries; Chapter 4: A Science-Based Review of Ecosystem Protection and Restoration Strategies for Puget Sound and Its Watersheds; Puget Sound Science Update. Puget Sound Partnership, Tacoma, WA, 2010.

Garrison, N., R.C. Wilkinson, and R. Horner. How Greening California Cities Can Address Water Resources and Climate Challenges in the 21st Century. Natural Resources Defense Council, 2009.

Horner, R. R. Supplementary Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for the San Francisco Bay Area. Natural Resources Defense Council, 2009.

Horner, R. R. Initial Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for the San Francisco Bay Area. Natural Resources Defense Council, 2009.

Horner, R. R. Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for Ventura County. Natural Resources Defense Council, 2008.

Horner, R. R. and C. Chapman. NW 110th Street Natural Drainage System Performance Monitoring, With Summary of Viewlands and 2nd Avenue NW SEA Streets Monitoring. Report to City of Seattle Public Utilities, 2007.

Horner, R. R. Investigation of the Feasibility and Benefits of Low-Impact Site Design Practices ("LID") for the San Diego Region. Natural Resources Defense Council, 2006.

Horner, R. R. SPU Drainage Rate Analysis Options: Recommendations on Certain Technical Issues. Report to City of Seattle Public Utilities, 2005.

Hill, K. and R. Horner. Assessment Of Alternatives In Roadside Vegetation Management. Report to Washington State Department of Transportation, 2005.

Horner, R. R. and Entranco, Inc. Regional Detention Facilities Retrofit Project: Evaluation of Regional Stormwater Ponds for Water Quality Improvements. Report to City of Bellevue Utilities Department, 2005.

Horner, R. R. and T. Osborn. Removal of Fecal Coliforms from Stormwater Runoff: A Literature Review. Report to City of Blaine, 2005.

Horner, R.R., H. Lim, and S.J. Burges. Hydrologic Monitoring of the Seattle Ultra-Urban Stormwater Management Projects: Summary of the 2000-2003 Water Years, Water Resources Series Technical Report Number 181. Department of Civil and Environmental Engineering, University of Washington, Seattle, WA. Report to City of Seattle Public Utilities, 2004.

Horner, R.R., C.W. May, and E.H. Livingston. Linkages Between Watershed and Stream Ecosystem Conditions in Three Regions of the United States. Report to U.S. Environmental Protection Agency by Watershed Management Institute, Inc., Crawfordville, FL, 2003.

Karr, J. R., R. R. Horner, and C R. Horner. EPA's Review of Washington's Water Quality Criteria: An Evaluation of Whether Washington's Criteria Proposal Protects Stream Health and Designated Uses. Report to National Wildlife Federation, 2003.

Horner, R.R., H. Lim, and S.J. Burges. Hydrologic Monitoring of the Seattle Ultra-Urban Stormwater Management Projects, Water Resources Series Technical Report Number 170. Department of Civil and Environmental Engineering, University of Washington, Seattle, WA. Report to City of Seattle Public Utilities, 2002.

Miller, A.V., S.B. Burges, and R.R. Horner. Hydrologic Monitoring of the Seattle Ultra-Urban Stormwater Management Projects, Water Resources Series Technical Report Number 166. Department of Civil and Environmental Engineering, University of Washington, Seattle, WA. Report to City of Seattle Public Utilities, 2001.

Mills, M. and R. R. Horner. Comprehensive Ditch and Culvert Program. Report to City of Seattle Public Utilities, 2001.

Colwell, S., R. R. Horner, D. B. Booth, and D. Gilvydis. A Survey of Ditches Along County Roads for Their Potential to Affect Storm Runoff Water Quality. Report to Snohomish County Surface Water Management Division, Snohomish County Road Maintenance, King County Land and Water Resources Division, King County Department of Transportation Road Maintenance, 2000.

Cammermayer, J. W. and R. R. Horner. Vegetated Stormwater Facility Maintenance. Report to Washington State Department of Transportation, WA-RD-495.1, 2000.

Azous, A. L. and R. R. Horner (eds.). Wetlands and Urbanization: Implications for the Future. Report to Washington Department of Ecology, 1997.

May, C. W., E. B. Welch, R. R. Horner, J. R. Karr, and B. W. Mar. Quality Indices for Urbanization Effects in Puget Sound Lowland Streams. Report to Washington Department of Ecology, 1997.

Livingston, E. H., H. E. Shaver, J. J. Skupien, and R. R. Horner. Operation, Maintenance, and Management of Stormwater Management Systems. Report to U. S. Environmental Protection Agency, 1997.

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St. John, M. S. and R. R. Horner. Effect of Road Shoulder Treatments on Highway Runoff Quality and Quantity. Report to Washington State Department of Transportation, WA-RD-429.1, 1997.

Horner, R.R. Storm Drainage Water Quality Rate Basis Recommendations. Report to City of Bellevue Utilities Department, 1996.

Horner, R. R. and C. R. Horner. Impacts on Aquatic Ecosystems and Organisms of Airplane and Airport Runway Deicing Chemicals. Report to Port of Seattle, Seattle, Washington, 1996.

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Horner, R. R. Program Recommendations and Review of Submittals for Los Angeles County Stormwater NPDES Compliance. Report to Natural Resources Defense Council, Los Angeles, California, 1995.

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Horner, R. R. Review of Draft Design Memorandum, Lakemont Boulevard Extension. Report to City of Bellevue, Washington, 1995.

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City of Bellevue Utilities Department (R. R. Horner contributing author). Characterization and Source Control of Urban Stormwater Quality. Report to Washington Department of Ecology, 1995.

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Horner, R. R. Program Recommendations and Review of California Department of Transportation Submittals for Santa Monica Bay Watershed Stormwater NPDES Compliance, Support Materials. Report to Natural Resources Defense Council, Los Angeles, California, 1994.

Horner, R. R. Peer Review of Assessment of Potential Impacts from Sediment and Phosphorus Loading to Lewis Creek and Lake Sammamish - Lakemont Boulevard Extension Project. Report to City of Bellevue, Washington, 1994.

Horner, R. R. Review of the Literature on Constructed Wetlands for Municipal Wastewater Treatment. Report to Kramer, Chin and Mayo, Inc., Seattle, Washington, 1994.

Engineering Technologies Associates, Inc. and R. R. Horner. Conceptual Framework for Hydrograph Classification. Report to Water Research Center, Huntington Valley, Pennsylvania, 1994.

Horner, R. R. Phantom Lake Stormwater Controls Evaluation, Review of Water Quality Data and Literature. Report to CH2M-Hill, City of Bellevue Storm and Surface Water Utility, and Boeing Computer Services Corporation, Bellevue, Washington, 1993.

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Horner, R.R. and P. Kalina. Water Quality Assessment of Portage Bay. Report to City of Seattle, 1991.

Horner, R.R. and C.R. Horner. Transport and Fate of Metal and Organic Toxicants in Arid-Region Wetlands. Report to U.S. Environmental Protection Agency, Corvallis Laboratory, 1991.

King County Resource Planning Section (R. R. Horner contributing author). Development of Guidance for Managing Urban Wetlands and Stormwater. Report to Washington Department of Ecology, Olympia, 1991.

Horner, R.R. and C.R. Horner. Use of Underdrain Filter Systems for the Reduction of Stormwater Runoff Pollutants: A Literature Review. Report to Kramer, Chin and Mayo, Inc., 1990.

Reinelt, L.E. and R.R. Horner. Characterization of the Hydrology and Water Quality of Palustrine Wetlands Affected by Urban Stormwater. Report prepared for the Puget Sound Wetlands and Stormwater Management Research Program, Seattle, WA, 1990.

Horner, R. R. Analysis of Proposed Surface Water Source Control Requirements for the Commencement Bay Nearshore/Tideflats Superfund Area. Report to Port of Tacoma, Washington, 1989.

Horner, R.R. and K.J. Raedeke. Guide for Wetland Mitigation Project Monitoring. Report to Washington State Department of Transportation, 1989.

Horner, R.R., J. Guedry, and M.H. Kortenhof. Improving the Cost-Effectiveness of Highway Construction Site Erosion and Pollution Control. Report to Washington State Department of Transportation, 1989.

Horner, R.R., J. Guedry, and M.H. Kortenhof. Highway Construction Site Erosion and Pollution Control Manual. Report to Washington State Department of Transportation, 1989.

Horner, R.R., M.V. Brenner, and C.A. Jones. Design of Monitoring Programs for Determining Sources of Shellfish Bed Bacterial Contamination Problems. Report to Washington Department of Ecology, 1989.

Horner, R. R. and C. R. Horner. A Technical Review of the Sediment/Toxicant Retention and Nutrient Removal Transformation Functions of WET 2.0. Report to AScI Corporation and U. S. Environmental Protection Agency, Duluth, Minnesota, 1989.

Horner, R. R. and M. Benjamin. Washington State Pulp and Paper Plant Water Treatment Effluent Limitations. Report to Technical Resources, Inc., Rockville, Maryland, 1988.

Tetra Tech, Inc., University of Washington (R.R. Horner), and Battelle Pacific Northwest Laboratories. Recommended Protocols for Measuring Conventional Water Quality Variables and Metals in Fresh Waters of the Puget Sound Region. Report to Puget Sound Estuary Program, U.S. Environmental Protection Agency, Region 10, Seattle, 1988.

Horner, R.R. Biofiltration Systems for Storm Runoff Water Quality Control. Report to Municipality of Metropolitan Seattle, Seattle, 1988.

URS Consultants, R.R. Horner, Matrix Management Group, Weston/Northwest Cartography, and Water Resources Associates. City of Puyallup Stormwater Management Program. Report to City of Puyallup, 1988.

Welch, E.B., J. Oppenheimer, R.R. Horner, and D.E. Spyridakis. Silver Lake Water Quality Nutrient Loading and Management. Report to City of Everett, 1988.

Horner, R.R. Environmental Monitoring and Evaluation of Calcium Magnesium Acetate (CMA)--Final Report. Report to National Research Council, National Academy of Sciences, 1988.

Horner, R.R., E.B. Welch, S.R. Butkus, and D.E. Spyridakis. Management Significance of Bioavailable Phosphorus. Report to Municipality of Metropolitan Seattle and State of Washington Water Research Center, 1987.

Horner, R.R. and S.E. Cassatt. Effectiveness of Wetlands Creation in Mitigating Highway Impacts. Report to Washington State Department of Transportation, 1987.

Horner, R.R. and M.H. Kortenhof. Improving the Cost-Effectiveness of Highway Construction Site Erosion/Pollution Control, Phase 1. Report to Washington State Department of Transportation, 1987.

Horner, R.R., B.W. Mar, L.E. Reinelt, and J.S. Richey. Design of Monitoring Programs for Determination of Ecological Change Resulting from Nonpoint Source Water Pollution in Washington State. Report to Washington State Department of Ecology, 1986.

Horner, R.R., E.B. Welch, M.R. Seeley, and J.M. Jacoby. Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase II. Report to National Science Foundation, 1986.

Horner, R.R., J.S. Richey, and D.P. Lettenmaier. Source Control of Transit Base Runoff Pollutants--Final Report. Report to Municipality of Metropolitan Seattle, 1985.

Welch, E.B., R.R. Horner, D.E. Spyridakis, and J.I. Shuster. Response of Lake Sammamish to Past and Future Phosphorus Loading. Report to Municipality of Metropolitan Seattle, 1985.

Horner, R.R. and S.R. Wonacott. Performance Evaluation of a Detention Basin and Coalescing Plate Oil Separator for Treating Urban Stormwater Runoff. Report to State of Washington Water Research Center and U.S. Geological Survey, 1985.

Cahn, D.C. and R.R. Horner. Preliminary Investigation of Sewage Sludge Utilization in Roadside Development. Report to Washington State Department of Transportation, 1985.

Horner, R.R. Highway Runoff Water Quality Research Implementation Manual, Vol. 1-2, FHWA WA-RD 72.1,2. Report to Washington State Department of Transportation, 1985.

Horner, R.R. Suggested Revisions to WSDOT Manuals for Implementing Washington State Highway Runoff Water Quality Research Results, FHWA WA-RD 72.3. Report to Washington State Department of Transportation, 1985.

Mar, B.W., D.P Lettenmaier, R.R. Horner, J.S. Richey, R.N. Palmer, S.P. Millard, and M.C. MacKenzie. Sampling Design for Aquatic Ecological Monitoring, Vol. 1-5. Final Report on Electric Power Research Institute, Project RP1729-1, 1985.

Horner, R.R., J.S. Richey, D.P. Lettenmaier, and J.F. Ferguson. Source Control of Transit Base Runoff Pollutants, Task 1--Interim Report. Report to Municipality of Metropolitan Seattle, 1984.

Brown and Caldwell Engineers and R.R. Horner. Moses Lake Clean Lake Project, Phase I. Report to Moses Lake Irrigation and Rehabilitation District, 1984.

Mar, B.W., D.P. Lettenmaier, J.S. Richey, R.R. Horner, R.N. Palmer, S.P. Millard, and G.L. Thomas. Sampling Design for Aquatic Ecological Monitoring, Phase II--Methods Development, Vol. 1-2. Report to Electric Power Research Institute, 1984.

Horner, R.R. Highway Runoff Water Quality Technology Transfer Workshop Handbook. Prepared for Washington State Department of Transportation, 1983.

Pedersen, E.R., R.R. Horner, and G.L. Portele. SR 528 - 4th Street Extension, Marysville, Snohomish County, Washington: Draft Environmental Impact Statement. Prepared for City of Marysville, 1983.

Horner, R.R., B.W. Mar, B. Chaplin, and F. Conroy. Implementation Plan for Highway Runoff Water Quality Research Results. Report to Washington State Department of Transportation, 1983.

Little, L.M., R.R. Horner, and B.W. Mar. Assessment of Pollutant Loadings and Concentrations in Highway Stormwater Runoff, FHWA WA-RD-39.17. Report to Washington State Department of Transportation, 1983.

Horner, R.R., and E.B. Welch. Velocity-Related Critical Phosphorus Concentrations in Flowing Water. Final Report to National Science Foundation for award number (CME) 79-18514, 1982.

Horner, R.R., and E.B. Welch. Impacts of Channel Reconstruction on the Pilchuck River, FHWA WA-RD-39.15. Report to Washington State Department of Transportation, 1982.

Mar, B.W., R.R. Horner, J.F. Ferguson, D.E. Spyridakis, and E.B. Welch. Summary - Highway Runoff Water Quality, 1977-1982, FHWA WA-RD-39.16. Report to Washington State Department of Transportation, 1982.

Horner, R.R. and B.W. Mar. Guide for Water Quality Assessment of Highway Operations and Maintenance, FHWA WA-RD-39.14. Report to Washington State Department of Transportation, 1982.

Mar, B.W., D.P. Lettenmaier, R.R. Horner, D.M. Eggers, R.N. Palmer, G.J. Portele, J.S. Richey, E.B. Welch, G. Wiens, and J. Yearsley. Sampling Design for Aquatic Ecological Monitoring, Phase 1. Report to Electric Power Research Institute, 1982.

Portele, G.J., B.W. Mar, R.R. Horner, and E.B. Welch. Effects of Seattle, Area Highway Stormwater Runoff on Aquatic Biota, FHWA WA-RD-39.11. Report to Washington State Department of Transportation, 1982.

Wang, T.S., D.E. Spyridakis, B.W. Mar, and R.R. Horner. Transport, Deposition, and Control of Heavy Metals in Highway Runoff, FHWA WA-RD-39.10. Report to Washington State Department of Transportation, 1982.

Chui, T.W., B.W. Mar, and R.R. Horner. Highway Runoff in Washington State: Model Validation and Statistical Analysis, FHWA WA-RD-39.12. Report to Washington State Department of Transportation, 1981.

Mar, B.W., J.F. Ferguson, D.E. Spyridakis, E.B. Welch, and R.R. Horner. Year 4, Runoff Water Quality, August 1980-August 1981, FHWA WA-RD-39.13. Report to Washington State Department of Transportation, 1981.

Horner, R.R. and S.M. Grason. An Ecological Study of the Monocacy Creek and its Groundwater Sources in the Vicinity of Camels Hump. Report to the Monocacy Creek Watershed Association, Bethlehem, Pennsylvania, 1981.

Horner, R.R. and E.B. Welch. Background Conditions in the Lower Pilchuck River Prior to SR-2 Construction. Report to Washington State Department of Transportation, 1979.

Horner, R.R. and B.W. Mar. Highway Runoff Monitoring: The Initial Year, FHWA WA-RD-39.3. Report to Washington State Department of Transportation, 1979.

Horner, R.R. and E.B. Welch. Effects of Velocity and Nutrient Alterations on Stream Primary Producers and Associated Organisms, FHWA WA-RD-39.2. Report to Washington State Department of Transportation, 1978.

Horner, R.R., T.J. Waddle, and S.J. Burges. Review of the Literature on Water Quality Impacts of Highway Operations and Maintenance. Report to Washington State Department of Transportation, 1977.

Horner, R.R. A Method of Defining Urban Ecosystem Relationships Through Consideration of Water Resources. U.S. Man and the Biosphere Project 11 Report, 1977.

Horner, R.R. and R. Gilliom. Bear Lake: Current Status and the Consequences of Residential Development. Report to Bear Lake Residents' Association, Kitsap County, Washington, 1977.

PRESENTATIONS AND DISCUSSIONS

*Presented by a co-author. In all other cases, I presented the paper.

Stormwater Runoff Flow Control Benefits of Urban Drainage System Reconstruction According to Natural Principles. Puget Sound/Georgia Strait Research Meeting; Vancouver, British Columbia; April 2003.

Structural and Non-Structural Best Management Practices (BMPs) for Protecting Streams. Invited presentation at the Engineering Foundation Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation; Snowmass, Colorado; August 2001.

Performance of a Perimeter ("Delaware") Sand Filter in Treating Stormwater Runoff from a Barge Loading Terminal. Invited presentation at the Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999.

Regional Study Supports Natural Land Cover Protection as Leading Best Management Practice for Maintaining Stream Ecological Integrity. Invited presentation at the Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999.

Watershed Determinants of Ecosystem Functioning. Invited presentation at the Engineering Foundation Conference on Effects of Watershed Development on Aquatic EcosystemsUrban Runoff and Receiving Systems; Snowbird, Utah; August 1996.

Overview of the Puget Sound Wetlands and Stormwater Management Research Program. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995.

Guidelines for Managing Urban Wetlands. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995.

Urbanization Effects on Wetland Hydrology and Water Quality. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995 (prepared with B. Taylor and K. Ludwa).*

Constructed Wetlands for Urban Runoff Water Quality Control. Invited presentation at National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993.

Training for Construction Site Erosion Control and Stormwater Facility Inspection. Invited presentation at National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993.

Toward Ecologically Based Urban Runoff Management. Invited presentation at The Engineering Foundation Conference on Urban Runoff and Receiving Systems; Crested Butte, Colorado; August 1991.

How Stormwater Harms Shellfish. Invited presentation at the Pacific Rim Shellfish Sanitation Conference; Seattle, Washington; May 1991.

Environmental Evaluation of Calcium Magnesium Acetate for Highway Deicing Applications. Invited presentation at Conference on Calcium Magnesium Acetate, An Emerging Chemical for Environmental Applications; Boston, Massachusetts; May 1991.

Issues in Stormwater Management. Statement to State Senate Environment and Natural Resources Committee; Olympia, Washington; January 1991.

Urban Stormwater Impacts on the Hydrology and Water Quality of Palustrine Wetlands in the Puget Sound Region. Invited presentation at Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1991 (prepared with L.E. Reinelt).

The Impact of Nonpoint Source Pollution on River Ecosystems. Invited presentation at the Northwest Rivers Conference; Seattle, Washington; November 1990.

Research Program Overview and Discussion of Hydrologic and Water Quality Studies. Presented at the Puget Sound Wetlands and Stormwater Management Research Program Workshop; Seattle, Washington; October 1990.

Control of Urban Runoff Water Quality. Invited presentations at American Society of Civil Engineers Urban Stormwater Short Courses; Bellevue, Washington; April, 1990; Portland, Oregon; July 1990.

Various Aspects of Erosion Prevention and Control. Invited presentations at University of Wisconsin Erosion Control Short Course; Seattle, Washington; July 1990.

Examination of the Hydrology and Water Quality of Wetlands Affected by Urban Stormwater. Presented at the Society of Wetland Scientists Annual Meeting; Breckenridge, Colorado, June 1990 (prepared with L.E. Reinelt).*

Analysis of Plant Communities of Wetlands Affected by Urban Stormwater. Presented at the Society of Wetland Scientists Annual Meeting; Breckenridge, Colorado; June 1990 (prepared with S.S. Cooke).*

Environmental Evaluation of Calcium Magnesium Acetate. Invited presentation at the Symposium on the Environmental Impact of Highway Deicing; Davis, California; October 1989.

Application of Wetland Science Principles in the Classroom and Community. Invited presentation at the Annual Meeting of the Association of Collegiate Schools of Planning; Portland, Oregon; October 1989.

Structural Controls for Urban Storm Runoff Water Quality. Invited presentation at the Northwest Regional Meeting of the North American Lake Management Society; Seattle, Washington; September 1989.

The Puget Sound Wetlands and Stormwater Management Research Program. Invited presentation at the U.S. Environmental Protection Agency Workshop on Wetlands and Stormwater; Seattle, Washington; September 1989.

An Overview of Storm Runoff Water Quality Control. Invited presentation at the American Water Resources Association Workshop on Forest Conversion; LaGrande, Washington; November 1988.

Progress in Wetlands Research. Invited presentation at the Pacific Northwest Pollution Control Association Annual Meeting; Coeur d'Alene, Idaho; October 1988.

Long-Term Effects of Urban Stormwater on Wetlands. Invited presentation at the Engineering Foundation Conference on Urban Stormwater; Potosi, Missouri; July 1988.

Highway Construction Site Erosion and Pollution Control: Recent Research Results. Invited presentation at the 39th Annual Road Builders' Clinic; Moscow, Idaho; March 1988.

Urban Stormwater and Puget Trough Wetlands. Presented at the 1st Annual Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; March 1988 (prepared with F.B. Gutermuth, L.L. Conquest, and A.W. Johnson).

Preliminary Comparative Risk Assessment for Hanford Waste Sites. Presented at Waste Management 88; Tucson, Arizona; February 1988 (prepared with R.F. Weiner and J. Kettman).*

What Goes on at the Hanford Nuclear Reservation? Invited presentation at the Northwest Association for Environmental Studies Annual Meeting; Western Washington University, Bellingham, WA; November 1987.

The Puget Sound Wetlands and Stormwater Management Research Program. Invited presentation at the Pacific Northwest Pollution Control Association Annual Meeting; Spokane, Washington; October 1987.

Design of Cost-Effective Monitoring Programs for Nonpoint Source Water Pollution Problems. Invited presentation at the American Water Resources Association, Puget Sound Chapter, Annual Meeting; Bellevue, Washington; November 1986.

A Review of Wetland Water Quality Functions. Invited plenary presentation at the Conference on Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding; Port Townsend, Washington; May 1986.

Nonpoint Discharge and Runoff session leader. American Society of Civil Engineers Spring Convention; Seattle, Washington; April 1986.

Prevention of Lake Sammamish Degradation from Future Development. Invited presentation at the American Society of Civil Engineers Spring Convention; Seattle, Washington; April 1986.

Design of Monitoring Programs for Nonpoint Source Water Pollution Problems. Invited presentation at the American Society of Civil Engineers Spring Convention; Seattle, Washington, April 1986 (prepared with L.E. Reinelt, B.W. Mar, and J.S. Richey).*

Nonpoint Pollution Control Strategies for Moses Lake, Washington. Presented at the Fifth Annual Meeting of the North American Lake Management Society; Lake Geneva, Wisconsin; November 1985 (prepared with R.C. Bain, Jr., and L. Nelson).

Response of Lake Sammamish to Urban Runoff Control. Presented at the Fifth Annual Meeting of the North American Lake Management Society; Lake Geneva, Wisconsin; November 1985 (prepared with J.I. Shuster, E.B. Welch, and D.E. Spyridakis).*

A General Approach to Designing Environmental Monitoring Programs. Invited presentation at the Pacific Section AAAS Symposium on Biomonitors, Bioindicators, and Bioassays of Environmental Quality; Missoula, Montana; June 1985 (prepared with J.S. Richey and B.W. Mar).

Panel Discussion on the Planning Process for Non-point Pollution Abatement Programs. Non-point Pollution Abatement Symposium; Milwaukee, Wisconsin; April 1985.

Nutrient Transport Processes in an Agricultural Watershed. Presented at the Fourth Annual Meeting of the North American Lake Management Society; McAfee, New Jersey; October 1984 (prepared with E.B. Welch, M.M. Wineman, M.J. Adolfson, and R.C. Bain Jr.).*

Nutrient Transport Processes in an Agricultural Watershed. Presented at the American Society of Limnology and Oceanography Annual Meeting; Vancouver, British Columbia; June 1984 (prepared with M.M. Wineman, M.J. Adolfson, and R.C. Bain, Jr.).

Factors Affecting Periphytic Algal Biomass in Six Swedish Streams. Presented at the American Society of Limnology and Oceanography Annual Meeting; Vancouver, British Columbia; June 1984 (prepared with J.M. Jacoby and E.B. Welch).*

A Conceptual Framework to Guide Aquatic Monitoring Program Design for Thermal Electric Power Plants. Presented at the American Society for Testing and Materials Symposium on Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Freshwater Ecosystems; Philadelphia, Pennsylvania; November 1983 (prepared with J.S. Richey, and G.L. Thomas).

Panel Discussion. Public Forum: Perspectives on Cumulative Effects; Institute for Environmental Studies; University of Washington; Seattle, Washington; August 1983.

A Guide for Assessing the Water Quality Impacts of Highway Operations and Maintenance. Presented at the Transportation Research Board Annual Meeting; Washington, D.C.; January 1983 (prepared with B.W. Mar).

Assessment of Pollutant Loadings and Concentrations in Highway Stormwater Runoff. Presented at the Pacific Northwest Pollution Control Association Annual Meeting; Vancouver, British Columbia; November 1982 (prepared with B.W. Mar and L.M. Little).

Phosphorus and Velocity as Determinants of Nuisance Periphytic Biomass. Presented at the International Workshop on Freshwater Periphyton (SIL); Vaxjo, Sweden; September 1982 (prepared with E.B. Welch and R.B. Veenstra).*

The Development of Nuisance Periphytic Algae in Laboratory Streams in Relation to Enrichment and Velocity. Presented at the American Society of Limnology and Oceanography Annual Meeting; Raleigh, North Carolina; June 1982 (prepared with R.B. Veenstra and E.B. Welch).

A Predictive Model for Highway Runoff Pollutant Concentrations and Loadings. Presented at the Stormwater and Water Quality Model Users' Group Meeting; Alexandria, Virginia; March 1982 (prepared with B.W. Mar).

Stream Periphyton Development in Relation to Current Velocity and Nutrients. Presented at American Society of Limnology and Oceanography Winter Meeting; Corpus Christi, Texas; January 1979 (prepared with E.B. Welch).

A Comparison of Discrete Versus Composite Sampling of Storm Runoff. Presented at the Northwest Pollution Control Association Annual Meeting; Victoria, British Columbia; October 1978 (prepared with B.W. Mar and J.F. Ferguson).*

A Method of Defining Urban Ecosystem Relationships Through Consideration of Water Resources. Presented at UNESCO International Man and the Biosphere Project 11 Conference; Poznan, Poland; September 1977.

GRADUATE AND UNDERGRADUATE COURSES TAUGHT (University of Washington)

Civil and Environmental Engineering 552, Environmental Regulations; 8 quarters.

Landscape Architecture 590, Urban Water Resources Seminar; 3 quarters.

Landscape Architecture 522/523, Watershed Analysis and Design; 15 quarters.

Engineering 260, Thermodynamics; 1 quarter.

Engineering 210, Engineering Statics; 2 quarters.

Civil Engineering/Water and Air Resources 453, Water and Wastewater Treatment; 1 quarter.

Civil Engineering/Water and Air Resources 599, Analyzing Urbanizing Watersheds; 1 quarter.

CONTINUING EDUCATION SHORT COURSES TAUGHT (University of Washington; multiple offerings)

Infiltration Facilities for Stormwater Quality Control

Wetlands Ecology, Protection, and Restoration

Storm and Surface Water Monitoring

Fundamentals of Urban Surface Water Management

Applied Stormwater Pollution Prevention Planning Techniques

Construction Site Erosion and Pollution Control Problems and Planning

Construction Site Erosion and Pollution Control Practices

Construction Site Erosion and Sediment Control Inspector Training

Inspection and Maintenance of Permanent Stormwater Management Facilities

Biofiltration for Stormwater Runoff Quality Control

Constructed Wetlands for Stormwater Runoff Quality Control

LOCAL COMMITTEES

Stormwater Panel advising Puget Sound Partnership, 2007.

Technical Advisory Committee, City of Seattle Environmental Priorities Project, 1990-91.

Environmental Toxicology Graduate Program Planning Committee, University of Washington, 1990.

Habitat Modification Technical Work Group, Puget Sound Water Quality Authority, 1987.

Underground Injection Control of Stormwater Work Group, Washington State Department of Ecology, 1987.

Nonpoint Source Pollution Conference Advisory Committee, 1986-87.

Puget Sound Wetlands and Stormwater Management Research Committee, 1986-90.

Accreditation Review, University of Washington Department of Landscape Architecture, 1986.

Planning Committee for University of Washington Institute for Environmental Studies Forum on Perspectives on Cumulative Environmental Effects, 1983.

CONSULTING

Columbia Riverkeeper and Northwest Environmental Defense Center; Portland Oregon; Assessment of Oregon Department of Environmental Quality's actions regarding setting Water Quality-Based Effluent Limits; 2020.

Coast Law Group, Encinitas, California; Technical assistance in a Clean Water Act legal case and expert testimony; 2019-2020.

Monterey County District Attorney, Monterey, California; Assessment of pollution issues at two construction company yards; 2019-2020.

Seneca Lake Guardian, Seneca Falls, New York; Assessment of potential water quality problems associated with an industrial plant; 2019.

Endangered Habitats League, Los Angeles, California; Assessment of stormwater management systems proposed for a large residential development; 2018-2019.

Ziontz Chestnut Law Firm, Seattle, Washington; Assistance with implementation of a court order on a settled case.

U.S. Department of Justice; Technical assistance in a Clean Water Act legal case; 2017-2018.

Kampmeier & Knutsen PLLC, Portland, Oregon; Technical assistance in a Clean Water Act legal case; 2017.

Black Warrior Riverkeeper, Birmingham, Alabama; Review and comment on a total maximum daily load assessment for the Black Warrior River; 2017.

DeLano and DeLano, Escondido, California; Assessment of stormwater management systems proposed for residential and commercial developments; 2012-present.

Salmon-Safe, Inc.; assessment of sites for possible certification representing practices that protect salmon; 2004-present.

Puget Soundkeeper Alliance and Smith and Lowney, PLC, Seattle, Washington; Technical assistance in Clean Water Act legal cases and expert testimony; 1996, 2002-present.

Natural Resources Defense Council, Los Angeles, California; Technical and program analysis and expert testimony on legal cases involving municipal and industrial stormwater NPDES permit compliance and assistance in reacting to California municipal stormwater permits; 1993-present.

Santa Monica Baykeeper (now Los Angeles Waterkeeper); Technical and program analysis and expert testimony on legal cases involving municipal and industrial stormwater NPDES permit compliance; 1993-present.

Orange County Coastkeeper; Assistance with legal cases involving industrial and construction site pollution control and monitoring and expert testimony; 2001-present.

Lawyers for Clean Water; Assistance with legal cases involving stormwater discharges and expert testimony; 2004-2018.

Earthjustice; Report and testimony regarding Washington state municipal stormwater permit before Pollution Control Hearing Board; 2008, 2013; assessment of Washington, DC combined sewer overflow control plan; 2015.

Tulane Environmental Law Clinic; Assessment and declaration on a legal case involving discharge under an industrial stormwater permit and expert testimony; 2015.

San Diego Coastkeeper, San Diego, California; Technical and program analysis and expert testimony on potential legal cases involving municipal and industrial stormwater NPDES permit compliance; liaison with City of San Diego; 1996-2011 and 2019.

Stillwater Science and Washington Department of Ecology; Water quality modeling for Puget Sound Characterization, Phase 2; 2010-2011.

City of Seattle Public Utilities; Analysis of technical aspects of stormwater management program; 2000-2008.

Ventura Coastkeeper; Technical and program analysis and expert testimony on legal cases involving municipal and industrial stormwater NPDES permit compliance; 2010-2015.

San Diego Airport Authority; Peer review of consultant products, training; 2004-2006.

U. S. Federal Court, Central District of California; Special master in Clean Water Act case; 2001-2002.

Storm Water Pollution Prevention Program, City of San Diego; Advising on response to municipal stormwater NPDES program; 2001-2002.

Kerr Wood Leidel, North Vancouver, B.C.; subconsultant for Stanley Park (Vancouver, B.C.) Stormwater Constructed Wetland Design; 1997-1998.

Clean South Bay, Palo Alto, California; Technical and program analysis and expert testimony on potential legal cases involving municipal and industrial stormwater NPDES permit compliance; 1996.

Resource Planning Associates, Seattle, Washington; Assistance with various aspects of monitoring under Seattle-Tacoma International Airport's stormwater NPDES permit; 1995-1997.

Watershed Management Institute, Crawfordsville, Florida; Writing certain chapters of guides for stormwater program development and implementation and maintenance of stormwater facilities; 1995-2003.

King County Roads Division, Seattle, Washington; Teaching two courses on construction erosion and sediment control; 1995.

Snohomish County Roads Division, Seattle, Washington; Teaching a course on construction erosion and sediment control; 1995.

Alaska Marine Lines, Seattle, Washington; Performance test of a sand filter stormwater treatment system; 1994-95.

Economic and Engineering Services, Inc., Bellevue, Washington; Assessment of the potential for water quality benefits through modifying existing stormwater ponds; technical advice on remedying operating problems at infiltration ponds; 1994-96.

Washington State Department of Transportation, Olympia, Washington; Teaching courses on construction erosion and sediment control; 1994.

City of Bellevue, Washington; Peer review of documents on potential erosion associated with a road project; analysis of stormwater quality data; 1993-95.

City of Kelowna, B. C., Canada; Teaching short courses on constructed wetlands and erosion and sediment control; 1993.

Oregon Department of Environmental Quality, Portland, Oregon; Technical review of Willamette River Basin Water Quality Study reports; 1992-93.

Whatcom County, Bellingham, Washington; Mediation on lakeshore development moratorium among county, water district, and local community representatives; 1993.

Boeing Commercial Airplane Company, Renton, Washington and Sverdrup Corporation, Kirkland, Washington (at request of City of Renton); Review of stormwater control system design; design of performance monitoring study for system; 1992-94.

Golder Associates, Redmond, Washington; Technical advisor for study of stormwater infiltration; 1992.

Smith, Smart, Hancock, Tabler, and Schwensen Attorneys, Seattle, Washington; Technical advice on a legal case involving a stormwater detention pond; 1992.

PIPE, Inc., Tacoma, Washington; Teaching a course on the stormwater NPDES permit; 1992.

CH_2M-Hill, Inc., Bellevue, Washington and Portland, Oregon; Technical seminar on constructing wetlands for wastewater treatment; literature review on toxicant cycling in arid-region wetlands

constructed for waterwater treatment; literature and data review on lake nutrient input reduction; expert panel on TMDL analysis for Chehalis River; 1989-1995.

Kramer, Chin and Mayo, Inc., Seattle, Washington; Watershed analysis in Washington County and Lake Oswego, Oregon; literature review in preparation for stormwater infiltration system design; literature review and contribution to design of constructed wetland for municipal wastewater treatment; 1989-1995.

Woodward-Clyde Consultants, Portland, Oregon and Oakland, California; Analysis of wetland capabilities for receiving urban stormwater; design of a constructed wetland for urban stormwater treatment; technical advisor on Washington Department of Ecology and City of Portland stormwater manual updates; 1989-1995.

R.W. Beck and Associates, Seattle, Washington; Assessment of pollutant loadings and their reduction for one master drainage planning and two watershed planning efforts; 1989-92.

Boeing Computer Services Corporation, Bellevue, Washington; mediation among Boeing, citizens' group, and City of Bellevue on stormwater control system design; 1990.

Parametrix, Inc., Bellevue, Washington; Review of Kitsap County Drainage Ordinance; 1990.

U.S. Environmental Protection Agency, Duluth Laboratory; Review of certain provisions of WET 2.0 wetland functional assessment model; 1989.

King County Council, Seattle, Washington; Review of King County Surface Water Design Manual; 1989.

Port of Tacoma, Washington; Assessment of stormwater control strategies; 1989.

Municipality of Metropolitan Seattle, Seattle, Washington; Assessment of land treatment systems for controlling urban storm runoff water quality; 1988-1992.

Impact Assessment, Inc., La Jolla, California (contractor to Washington State Department of Ecology); Socioeconomic impact assessment of the proposed high-level nuclear waste repository at Hanford, Washington; 1987.

Technical Resources, Inc., Rockville, Maryland (contractor to U. S. Environmental Protection Agency); assessment of water treatment waste disposal at pulp and paper plants; 1987-88.

Dames and Moore, Seattle, Washington; analysis of the consequences of a development to Martha Lake; 1987.

Harper-Owes, Seattle, Washington; project oversight, data analysis, and review of limnological aspects for Lake Chelan Water Quality Assessment Study; 1986-88.

URS Corporation, Seattle, Washington and Columbus, Ohio; presentation of a workshop on nonpoint source water pollution monitoring program design; analysis of innovative and alternative wastewater treatment for Columbus; development of a stormwater utility for Puyallup, Washington; watershed analysis for Edmonds, Washington; 1986-88.

Entranco Engineers, Bellevue, Washington; environmental impact assessment of proposed highway construction; technical review of Lake Sammamish watershed management project; technical review of Capital Lake wetland development; 1981-82; 1987-88; 1990.

Washington State Department of Ecology, Olympia, Washington; review of literature on wetland water quality, preparation of conference plenary paper, and leading discussion group at conference; analysis in preparation for a Shoreline Hearing Board case; 1986-87.

Richard C. Bain, Jr., Engineering Consultant, Vashon Island, Washington; analysis of watershed data and development of a policy for septic tank usage near Moses Lake, Washington; 1984-87.

University of Washington Friday Harbor Laboratory; analysis of adjacent port development and preparation of testimony for Shoreline Hearing Board; 1986.

Washington State Department of Transportation and Morrison-Knudsen Company, Inc./H.W. Lochner, Inc., Joint Venture, Mercer Island, Washington; environmental assessment of disposal of excavated material by capping a marine dredge spoil dumping site; 1984.

Foster, Pepper, and Riviera Attorneys, Seattle, Washington; analysis and testimony on provisions to reduce pollutants in stormwater runoff from a site proposed for development; 1983.

Williams, Lanza, Kastner, and Gibbs Attorneys, Seattle, Washington; collection and analysis of water quality data to support a legal case and preparation of testimony; 1982.

Herrera Environmental Consultants, Seattle, Washington; lake data analysis and report preparation; 1982-83.

Brown and Caldwell Engineers, Seattle, Washington; data collection and analysis for watershed study; 1982-83.

City of Marysville, Washington; environmental impact assessment of proposed bridge construction; 1982-83.

F.X. Browne Associates, Inc., Lansdale, Pennsylvania; contributions to manual on lake restoration for U.S. Environmental Protection Agency; preparation of funding proposals and permits for lake restoration; lake data analysis; literature reviews and analysis of septic tank contributions to lake nutrient loading and availability of different forms of nutrients; 1980-83.

Reston Division of Prentice-Hall, Inc., Reston, Virginia; review of and contributions to texts on environmental technology; 1978-79.

Butterfield, Joachim, Brodt, and Hemphill Attorneys, Bethlehem, Pennsylvania; analysis of environmental impact statements; expert witness; 1973.