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GLOBAL WARMING & ENVIRONMENTAL LAWS

CLIMATE CHANGE & THE ESA

by Melanie J. Rowland, NOAA Office of General Counsel, Northwest Region

Introduction & Overview

There now is scientific consensus that global warming is happening and that burning fossil fuels has contributed to the warming. See, e.g., *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers* (Feb. 2007) (online at http://www.ipcc.ch/). News articles about efforts to reduce the use of fossil fuels to lessen the magnitude of future warming — or about the observable effects of warming that has already taken place — appear almost daily.

Global warming is already contributing to myriad, serious natural resource impacts, both direct and indirect.

CURRENT GLOBAL WARMING IMPACTS INCLUDE:

- native species decline
- invasive species movement
- increased flooding and drought
- increases in forest fires and forest pests
- decreases in sea and land ice
- increases in sea level from melting land ice
- changes in ocean food webs from elevated sea temperature and acidity
- damage to coral reefs from increased intensity of hurricanes

[The list goes on. See, e.g., *Climate Change 2007: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers*, at 11 (April 2007) (online at www.ipcc.ch/)]

Many of these observable global warming impacts on the natural world and natural resources are likely to continue no matter what we do to reduce additional releases of greenhouse gasses. This article is primarily concerned with these current and ongoing effects of warming and how, in the face of these known impacts, our natural resource laws can still achieve their conservation objectives.

Global warming will affect natural resource laws in many areas. The search for non-fossil fuel energy sources is spawning projects on a scale that has a potential for serious impacts on the environment. Hydropower, wind power, and tidal and wave energy facilities all present issues for natural resource conservation. In the Western United States there has been a renewed call for more water storage capacity to mitigate the effects of expected increases in summer drought. Water storage facilities have impacts of their own on natural resources and are subject to several environmental laws.

Please Note: The views expressed in this article are those of the author. They do not necessarily represent the views of NOAA or any other government agency.

Global Warming

Species Decline

ESA Purposes

ESA "Listing"

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260 North Polk Street,
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Editors: David Light
David Moon

Phone: 541/ 343-8504
Cellular: 541/ 517-5608
Fax: 541/ 683-8279
email:
thewaterreport@hotmail.com
website:
www.TheWaterReport.com

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A plethora of laws, at the federal, state, and local levels, address natural resource use and conservation: the Endangered Species Act; Marine Mammal Protection Act; National Environmental Policy Act; Clean Water Act; public land laws; state and local land use planning laws; and the like. To varying degrees, implementation of all these laws will now have to account for, and respond to, effects of global warming on natural resource conservation.

In this article, however, I will focus on global warming and the Endangered Species Act. I have spent the last two decades working with the Endangered Species Act. The loss of biodiversity is already one of the most serious environmental problems we face today and global warming is accelerating the rate of species decline. The Endangered Species Act is the best tool we have to address this crisis.

The Endangered Species Act

A BRIEF PRIMER ON THE ESA (16 U.S.C. §§ 1531-43)

To understand how the Endangered Species Act (ESA) is being affected by global warming issues, it will be helpful to briefly review ESA's history and basic implementation structure.

Congress passed ESA in 1973 to implement the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and to strengthen earlier domestic endangered species legislation. While CITES deals only with trade in imperiled species, the ESA's scope is much broader. The purposes of ESA are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of" such species. (ESA § 2, 16 U.S.C. § 1531).

The ESA is administered by the US Fish and Wildlife Service (FWS) on behalf of the Secretary of the Interior and the National Marine Fisheries Service (NMFS or NOAA Fisheries), an agency of the National Oceanic and Atmospheric Administration (NOAA), on behalf of the Secretary of Commerce. The FWS has jurisdiction over terrestrial species, while NOAA Fisheries has jurisdiction over most marine species, including anadromous fish such as salmon and steelhead. (Anadromous fish spend part of their life cycle in fresh water and part in the ocean, so they are considered marine species for purposes of the ESA.)

The first step in ESA protection of a species is the "listing" of the species as either "threatened" or "endangered." An endangered species is "any species which is in danger of extinction throughout all or a significant portion of its range." (§ 1532(6)) A threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (§ 1532(20))

FWS and NOAA Fisheries (the Services) initially determine if a species is threatened or endangered due to any of the following factors:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms;
(E) other natural or manmade factors affecting its continued existence.
(§ 1533(a)(1))

If found to be threatened or endangered, the species is "listed" — i.e., placed on either the "threatened" or the "endangered" species list. Listing determinations must be made "solely on the basis of the best scientific and commercial data available" (§ 1533(b)(1)(A)) — a mandate of particular importance in light of the continuing growth of scientific research into global warming.

Once listed, a species is entitled to several protective measures. The listing agency must designate any habitat that is considered critical for conservation of the species (§ 1533(a)(3)) and develop and implement a recovery plan for a listed species that includes recovery objectives and measures to achieve conservation of the species. (§ 1533(f)(1)) The ESA imposes a duty on federal agencies to "consult" with fish and wildlife agencies on their proposed actions and to avoid jeopardizing any listed species. Prohibitions against "take" of a listed species are also established. Civil and criminal penalties apply to violations of ESA and implementing regulations.

The ESA assigns to federal agencies special responsibilities for conservation of listed species. Federal agencies have the affirmative duty to carry out programs to conserve listed species. (§ 1536(a)(1))

The federal agencies' consultation responsibilities under ESA § 7(a)(2) constitute one of the most significant protections afforded listed species. This section provides that each federal agency "shall, in consultation with…[FWS or NOAA Fisheries], insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of an endangered species or threatened species or result in the destruction or adverse modification" of the species' designated critical habitat.

Global Warming

Federal "Actions"

Biological Opinion

Indirect Effects

ESA "Take"

Ecosystem Alteration

Implementation Impacts

Thus ESA § 7(a)(2) includes not only a procedural duty to consult with the fish and wildlife agencies, but a substantive prohibition against jeopardizing the continued existence of a listed species or adversely modifying its critical habitat. (§ 1536(a)(2))

The phrase "actions funded or carried out" by a federal agency is interpreted broadly, and includes: the issuance of regulations; permits; leases; licenses; and all actions funded in whole or in part by federal appropriation. "Jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." (50 C.F.R. § 402.02) After conducting an analysis of likely effects of the action, the consulting agency explains and supports its determination in a document referred to as a "biological opinion."

It is especially pertinent to the issue of global warming and species protection that both the action agency and the consulting agency must use the best scientific and commercial data available in their analysis. (§ 1536(a)(2)) Moreover, the agencies must consider indirect, as well as direct, effects of the project or permit. Indirect effects are "caused by the proposed action and are later in time, but still are reasonably certain to occur." (50 C.F.R. § 402.02)

The ESA also includes protections for listed species that apply to all entities, including individuals, businesses, and state and local jurisdictions. Section 9 makes it unlawful for any "person" (broadly defined), to "take" a listed species. (§ 1538) "Take" is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect, or to attempt to engage in any such conduct." (§ 1532(19)) A prohibited taking by a non-federal entity may be permitted if it is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." (§ 1539(a)(1)(B)) Take by a federal agency may be exempted under § 1536(o)(2), if the consulting agency has determined that the proposed federal action is not likely to jeopardize the continued existence of a listed species or adversely modify its critical habitat.

Global Warming & the ESA

LISTING, RECOVERY PLANS, & CONSULTATION

There are currently almost 2,000 species worldwide listed as threatened or endangered under ESA. Of these, 1,351 are in the United States. Another four species are proposed for listing, and there are 278 candidate species. [See www.fws.gov/endangered/ for current information on listed, proposed, and candidate species.]

Global warming is likely to lead to more listings. One of the most alarming consequences of global warming is the alteration of ecosystems, potentially imperiling thousands of additional species. The World Conservation Union (IUCN) found that 15% to 37% of species sampled in six biodiversity-rich regions around the world could be driven extinct as a result of their inability to adapt to the climate change that is likely to occur between now and 2050. Warming appears to cause entire ecosystems to move to cooler climates — toward the poles or higher elevations. If human habitat destruction blocks their movement, there is no escape for these species or assemblages of species. [*See, e.g.*, "*Climate Change Set to Become the Most Serious Threat to Species*" IUCN News Release, Jan. 8, 2004.]

The Services must sort through an avalanche of scientific information about climate change and species effects, much of it inconclusive, and determine what it means for conservation.

GLOBAL WARMING QUESTIONS THE SERVICES FACE INCLUDE:

- Does global warming affect the determination as to whether a species is threatened or endangered?
- Is global warming relevant to the measures that should be in a listed species' recovery plan?
- Does global warming bear on the likelihood that a particular federal action will jeopardize a listed species' continued existence, or adversely modify its critical habitat and, if so, how?
- Should the agency grant a permit to "take" a listed species, considering the impacts of the taking in light of effects of global warming on the species' likely persistence?

If the answer to any of the above questions is yes, even more difficult questions arise:

- How does global warming bear on the question of endangerment, recovery, or jeopardy?
- What is the "best available science" with respect to a particular issue of species persistence and global warming?
- In the face of uncertainty about the nature and magnitude of future climate change, how does a federal agency "insure" that its proposed action is not likely to jeopardize a listed species?

Global Warming

Listing Examples

Global warming has been a significant factor in two recent listing proposals. The most widely known example is the FWS' January 2006 proposal to list polar bears (*Ursus maritimus*) as a threatened species because of the precipitous decline of Arctic sea ice upon which the bears depend for food, seasonal movement, resting, and mating. *See* 72 Fed. Reg. 1064 (Jan. 9, 2007). A less well-known (but earlier) example is NOAA Fisheries' final listing of elkhorn and staghorn corals (*Acropora palmata* and *A. cervicornis*, respectively) as threatened in May 2006. *See* 71 Fed. Reg. 26852 (May 9, 2006). Important factors in the decline of these corals are temperature-induced bleaching and damage from hurricanes — both likely linked to global warming. To date the corals are the only species listed primarily because of impacts of climate change, but the polar bear and others may soon join them.

In addition, a seabird species closely associated with glaciers in Alaska, the Kittzlitz's murrelet (*Brachyramphus brevirostris*), is a candidate species. Conservation groups have also filed a petition to list 12 species of penguins in November 2006, and FWS made an initial finding that listing 10 of the species may be warranted. [See 72 Fed. Reg. 37695 (July 11, 2007)] The 12 petitioned species live in the Antarctic, Sub-Antarctic, and Southern Ocean.

Recovery Plan Inclusion

Recovery plans for listed species have also begun to consider global warming. According to a study by the Center for Biological Diversity, 47 final or proposed recovery plans list climate change or its effects as a threat, possible threat, or factor in the species' decline. [See, Shane Jimerfield, Melissa Waage, and William Snape, "*Global Warming Threats and Conservation Actions in Endangered Species Recovery Plans: A Preliminary Analysis,*" Center for Biological Diversity (Feb. 1, 2007)]

Affected Plans

In the Northwest, the final recovery plan for Puget Sound Chinook salmon (*Oncorhyncus tshawytscha)*, and the proposed recovery plan for the Southern Resident killer whale (*Orcinus orca*), discuss how climate change is likely to affect the subject species and what this may mean for conservation efforts. [For the text of these plans, see www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Puget-Sound/PS-Chinook-Plan.cfm (Chinook) and www.nwr.noaa.gov/Marine-Mammals/Whales-Dolphins-Porpoise/Killer-Whales/ESA-Status/Orca-Recovery-Plan.cfm (killer whales).]

Hydrologic Impacts

With regard to Puget Sound Chinook salmon, for example, scientists estimate that populations in the Snohomish River are likely to decrease by up to 40 percent by 2050, in part because of hydrologic changes expected from global warming. The population could increase by nearly 20 percent over that time, however, if the recovery plan's restoration measures for riverine and estuarine habitat are implemented. [See James Battin, Matthew W. Wiley, Mary H. Ruckelshaus, Richard N. Palmer, Elizabeth Korb, Krista K. Bartz, and Hiroo Imaki, *Projected Impacts of Climate Change on Salmon Habitat Restoration.* Proceedings of the National Academy of Sciences (April 5, 2007). (www.pnas.org/cgi/content/abstract/104/16/6720)]

Section 7 Consultation Issues

The effects of climate change on species' persistence is also an emerging issue in ESA section 7 consultations. Consideration of climate change in jeopardy and adverse modification determinations has already been the subject of ESA litigation. A district court recently held that failure to consider the effects of climate change in making a "no jeopardy" determination for a large water project in California renders the determination arbitrary and capricious under the Administrative Procedure Act. In *Natural Resources Defense Council v. Kempthorne*, Case No. 1:05-CV-01207 OWW TAG (Order Granting in Part and Denying in Part Plaintiff's Motion for Summary Judgment, E.D. CA, May 25, 2007), the court held that FWS' biological opinion on the effects of the Central Valley Project on threatened Delta smelt (*Hypomesus transpacificus*) was arbitrary and capricious, in part because it failed to discuss the effects of climate change.

Failure to Consider

Central Valley Project

The Central Valley Project (CVP) and the State Water Project (SWP) are water diversion, storage, and delivery projects in the Sacramento and San Joaquin watersheds in California that affect several listed species, including Delta smelt (a resident fish and thus under FWS jurisdiction), and three listed species of salmon and steelhead (anadromous fish under NOAA Fisheries jurisdiction). It is one of the world's largest water development projects, with 20 reservoirs, 500 miles of major canals and aqueducts, and 12 million acre-feet of storage capacity. The combined watersheds encompass an area approximately 500 miles wide. The federal Bureau of Reclamation (Reclamation) and the State of California operate the projects together, to deliver water for agricultural, municipal, and other uses. Reclamation's status as a federal agency means that project operations are subject to consultation under ESA section 7. In 2004 and 2005, the Services completed biological opinions on the project's operations for the next 20 years, finding that operations would not jeopardize listed species or adversely modify their critical habitat.

BiOp Challenged

Conservation groups challenged both FWS and NOAA Fisheries' biological opinions. Among other claims, plaintiffs charged that the agencies ignored the effects of climate change on listed species. In its order, the court cited plaintiffs' evidence that climate change could result in hydrological patterns and water temperature changes that would adversely affect the Delta smelt. The court noted that despite this

Climate Change in the Pacific Northwest

Excerpts From: Puget Sound Recovery Plan, Volume I, Adopted January 19, 2007
See: www.sharedsalmonstrategy.org/plan/toc.htm

Data collected during the 20th century revealed widespread increases in average annual temperature and precipitation, and decreases in the April 1 snow water equivalent. Snow water equivalent is a common measurement for the amount of water contained in snowpack and is an important indicator for forecasting summer water supplies. 1990-2000 was the warmest decade on record, and was warmer than any other decade by 0.9ºF (CIG, 2004).

Long term models for climate change in the 21st century show evidence of trends including, "region-wide warming, increased precipitation, declining snowpack, earlier spring runoff, and declining trends in summer streamflow." (CIG, 2004) Most of the models predict warmer, wetter winters and warmer, drier summers for the Pacific Northwest.

Salmon and bull trout have lived in the Pacific Northwest for millions of years. As different species and populations of salmon have developed over time, they have acquired specific behaviors for their migration, rearing and spawning life cycles that are attuned to temperature and streamflow. This complex life cycle makes it difficult to predict how they will react to climate changes, and their response will also vary depending on the habitat conditions in a particular river system and estuary. Changes in temperatures away from optimal conditions can influence salmon and bull trout in each of their life stages. Even a small increase in temperature can change migration timing, reduce growth, reduce the supply of available oxygen in the water, and increase the susceptibility of fish to toxins, parasites and disease. The increase in stream temperatures can also contribute to a reduction in the preferred species of insects that are used for food (NWF, 2005). Earlier spring runoff and lower summer flows may make it difficult for returning adult salmon to negotiate obstacles. Excessively high levels of winter flooding can scour eggs from their nests in the streambeds and increase mortalities among overwintering juvenile salmon and bull trout.

Adaptive strategies to cope with the projected changes largely focus on the need to maintain salmon and bull trout populations through conservation and restoration of freshwater and estuarine habitat. Additionally, it has been recommended that harvest and hatchery managers pay particular attention to the time lag associated with impacts of natural variability in one season on the viability of populations in successive seasons. For example, productivity may decline following drought conditions and should be factored into hatchery production targets and harvest regimes; similar issues are already being considered during technical planning forums for harvest.

The predicted increased winter flooding, decreased summer and fall streamflows, and elevated warm season temperatures in the streams and estuaries are likely to further degrade conditions for salmon that are already stressed from habitat degradation. Although the impacts of global climate change are less clear in the ocean environment, early modeling efforts suggest that, "warmer temperatures are likely to increase ocean stratification, which in the past has coincided with relatively poor ocean habitat for most Pacific Northwest salmon, herring, anchovies, and smelt populations." (CIG, 2004)

Indicator	Observed 20th century changes	Projected mid 21st century changes
Temperature	Region-wide warming of about 1.5ºF (1920-2000)	• 2020s: average increase of 2.7ºF • 2040s: average increase of 4.1ºF
Precipitation	Region-wide increase in precipitation since 1920	Uncertain, although most models project wetter winters and drier summers.
April 1 snowpack	Substantial declines (>30%) at most monitoring stations below 6,000 feet	Continued decrease in April 1 snowpack in mid and low elevation basins. Projected decrease in April 1 snowpack for the Cascades Mountains in Washington and Oregon relative to 20th century climate: • -44% by the decade of the 2020s (based on +3ºF avg. temp change) • -58% by the decade of the 2040s (based on +4.5ºF avg temp change)
Timing of peak spring runoff	Advanced 10-30 days earlier into the spring season during the last 50 years, with greatest trends in the PNW	Earlier peak spring runoff expected on the order of 4-6 weeks
Summer streamflow	Declining in sensitive PNW basins. Example: May-Sept inflows into Chester Morse Lake in the Cedar River watershed (WA) as a fraction of annual flows have decreased 34% since 1946.	Continued and more wide-spread declines. Example: April-Sept natural streamflow in the Cedar River (WA) projected to decrease 35% by the 2040s (based on a 2.5ºF increase in average temperature.

Observed and Projected Impacts of Climate Change in Major Climate/Hydrologic Indicators
(Sources: Mote et al. 1999; Miles et al. 2000; Mote 2003; Snover et al. 2003; Steward et al. 2004; Wiley 2004 as cited in CIG, 2004)

Consideration Required

evidence, FWS assumed that the hydrology of the water bodies affected by the projects would follow historical patterns.

THE COURT FOUND THAT

> FWS acted arbitrarily and capriciously by failing to address the issue of climate change in the [biological opinion]. This absence of <u>any</u> discussion in the [biological opinion] of how to deal with any climate change is a failure to analyze a potentially 'important aspect of the problem.'

Natural Resources Defense Council v. Kempthorne, *supra* at 84 (emphasis in original; footnote omitted).

It is no surprise that failure to consider climate change may be grounds for finding that an ESA decision is arbitrary and capricious. It is relatively simple to avoid such a finding (e.g. consider climate change). But it is no simple matter to determine precisely how climate change should factor into the decision.

Global Warming

Evaluation

Including climate change evaluation in consultation raises several questions:

- What is the best scientific information with respect to the likelihood, nature, and magnitude of change that can be expected in the area relevant to a particular species?
- What effect is that change likely to have on the species' persistence?
- Do the impacts of climate change affect the jeopardy determination for the action at issue?
- If in the face of climate change the action is likely to adversely affect the species' likelihood of survival and recovery, can the effects be mitigated, and how?

Science Debate

Debate about what is the best available science — and how well administration of ESA incorporates scientific data — is nothing new in the ESA world. As any ESA practitioner soon discovers, there are few questions to which science provides complete answers. For this reason, many courts have had occasion to interpret ESA's direction that the Services use the best scientific and commercial data available, in both the listing and consultation context.

Case Law Principles

Principles emerging from "best scientific and commercial data" case law include:

- Fish and wildlife agencies are to use the best scientific data available, not the best scientific data possible (*e.g., Bldg. Indus. Ass'n of Superior Cal. v. Norton*, 247 F.3d 1241 (D.C. Cir. 2001))
- The agencies may not delay completion of consultation because the available data is not conclusive, and must rely on "even inconclusive or uncertain data if that is the best available" *(e.g., S.W. Center for Biological Diversity,* 2002 WL 1733618 at *8 (D.D.C. 2002))
- That evidence is "'weak'" and thus not dispositive" does not mean that agencies may not rely on it (*e.g.*, *Greenpeace Action v. Franklin*, 14 F.3d 1324, 1336 (9th Cir. 1993))
- Courts will defer to an agency's scientific expertise unless it appears that the agency has been arbitrary and capricious in its consideration of scientific information (*e.g., Oceana, Inc. v. Evans*, 384 F. Supp. 203 (D.D.C. 2005))
- In the face of uncertainty, agencies should give the benefit of the doubt to the species (*e.g., Conner v. Burford*, 848 F.2d 1441, 1454 (9th Cir. 1988))

Uncertainty

The science of climate change has, in itself, stirred much controversy. This is partly because the predictive information about how much the Earth will warm, and what the ecosystem effects of that warming will be in any given location or for any given species, acknowledges uncertainty. [See, e.g., *National Assessment of the Potential Consequences of Climate Variability and Change* (http://usgcrp.gov/usgcrp/nacc/)] Yet many believe that if we do not consider these effects in conservation planning, we are likely to overlook a major factor in species decline. So how do we deal with the uncertainty in climate change information?

"Best Available Science"

There have been no cases to date in which a court has addressed whether FWS or NOAA Fisheries used the best available science regarding effects of global warming on species persistence. Case law on use of "best available science" by FWS and NOAA Fisheries with regard to other issues, however, suggests that: 1) the Services must consider relevant, credible information regarding potential effects of climate change on the species in question, even if the information is inconclusive; 2) courts will defer to the Services' scientific expertise in evaluating and applying information as to the effects of climate change unless an agency has been arbitrary and capricious in its consideration of the information; and 3) in a consultation, the Services should resolve uncertainties in climate change information by giving the benefit of the doubt to the species.

Considering Climate Change in a Water Project Consultation

California's Central Valley Water Project: A Case Study

Central Valley Project

In 2005, the NOAA Fisheries' Southwest Regional Office requested independent scientific review of the use of best available science in its biological opinion on effects of the Central Valley water project on listed species of salmon and steelhead. The reports generated in this review are instructive as to how the Services can work with climate change information in an ESA section 7 context.

BiOp Review

Three peer reviews were conducted, one by a Technical Review Panel convened by the California Bay Delta Authority (CBDA), and two by independent reviewers from the Center of Independent Experts (CIE). NOAA Fisheries' Southwest Fisheries Science Center (Science Center) then evaluated the peer reviews. The CBDA Technical Review Panel, one of the CIE reviewers, and the Science Center all agreed that the **b**iological **o**pinion (BO) should have included analysis of the potential effects of climate change.

Global Warming

Deficient Consideration

The Technical Review Panel summarized its findings:

> The BO assumes that the climate and hydrologic regime during the last century will persist into the future. The Panel does not believe that global climate change (e.g., temperature warming), and the consequent temperature and hydrological changes, received adequate treatment in the BO. This deficiency resulted in an important uncertainty being ignored that could affect the characterization of the risk to the [listed species].

Report of the Technical Review Panel on the Review of the Biological Opinion of the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (*Report*) , at 2 (Dec. 2005) (http://science.calwater.ca.gov/pdf/workshops/OCAP_review_final_010606_v2.pdf)

Warming Trend Impacts

The Technical Review Panel elaborated on this view as follows:

> Fisheries scientists have recognized the importance of considering climate change in management decisions regarding aquatic resources. In 1995, National Research Council of Canada published a compendium of symposium papers that focused on the effects of climate variability and long-term trends on numerous fish species in the northern Pacific, including northwest salmon stocks (Beamish 1995). A prominent theme was that the increasing probability for global warming could impact the distribution, productivity, and demographic structure of salmonid populations. Since then, increasing trends in water temperature (approximately one degree Celsius, spanning several recent decades) have been documented in the salmon-producing Fraser and Columbia Rivers (NRC 2004-b). In their report, the National Research Council highlighted that this alarming trend imposes increased risk on salmon stocks in those systems into the foreseeable future. Recent climate change has also been reported for the Central Valley (e.g., Cayan et al. 2001).

Report at 32.

The NMFS Science Center concurred with the Technical Panel's and the CIE reviewer's findings as to consideration of climate change. [See *NMFS Science Center Evaluation of the Peer Review of the Long-Term Central Valley Project and State Water Project Operations Section 7 Consultation*, May 25, 2006 (*Science Center Evaluation*)] The *Science Center Evaluation* detailed the potential impacts of climate change on fish in the Central Valley.

Range of Impact

The NMFS Science Center Evaluation states:

> The obvious impacts of climate change include direct effects on the fish. For example, as temperatures rise, suitable summer habitat will shift towards higher elevations. In many cases, populations will not be able to track this shift because of impassable barriers (e.g., populations below dams). In other cases, suitable habitat will disappear from the basin (e.g., some spring chinook streams that are relatively low-elevation such as Butte and Cottonwood creeks). Also, the relatively modest increases in temperature-related mortality that are predicted under future operation as described in the [biological assessment] are contingent on 'critically dry' water-year types remaining rare, and 'wet' years remaining common. Regional climate forecasts for the Central Valley suggest that critically dry water-years will become the most common water-year type within this century (VanRheenen 2004). According to the [biological assessment], temperature-related mortality of winter-run chinook eggs in wet years is about 2%, but in critically dry years, it may exceed 40% (pg. 9-32).

Science Center Evaluation at 6.

Developing Scenarios

As practical matter, how should the Services take into account information regarding potential impacts of climate change? In the CVP biological opinion, NOAA Fisheries had predicted how well the fish would do under various scenarios that included assumptions as to ocean conditions, effects of hatchery production, effects of predators, and many other factors. The Technical Review Panel suggested that in addition to the variables that were considered, NOAA Fisheries could develop a series of scenarios that represent a range of possible future climate and water demand situations.

Prediction & Risks

The Technical Review Panel stated:

> The Panel suggests that additional scenarios, which include potential future global climate conditions, be included in the analysis. This would better characterize the uncertainty associated with future conditions when compared to the baseline case. The Panel agreed that different water-flow year types were an appropriate way to stratify the analysis, and that use of long-term historical data was an important component of a full assessment. But we contend that the inclusion of some worst case conditions (e.g., long sequence of dry years), in concert with regionally warming temperatures, would better characterize the uncertainty in predictions and risks to the ESUs [i.e. **e**volutionarily **s**ignificant **u**nits of the listed species].

Global Warming

The Science Center agreed that this would be a positive step and that "it could be done [with] available information in a timely manner" (Science Center Evaluation at 7).

Sufficient Consensus

The Technical Review Panel also noted:

> There is information available that could assist NMFS in formulating the additional scenarios we are suggesting. Expected changes in climate for the Central Valley have been reported in several technical and refereed papers (Dettinger and Cayan 1995; Cayan et al. 2001; Knowles and Cayan 2002; Mote 2003; Hayhoe et al. 2004; Dettinger 2005). Some of this information has also been presented in regional scientific conferences, such as at the CALFED Science Conferences. While there is disagreement among the climate models about likely effects on precipitation and other climate-related variables, there is sufficient consensus about temperature changes and enough information to bound likely changes in precipitation and other variables to warrant incorporation into some of the scenarios examined in the BO. In summary, the predicted trend is for warming, reduced snow pack in the Sierra Nevada, wetter winters with more flooding, and drier summers.

Report at 33.

Reclamation and NOAA Fisheries have reinitiated consultation on the CVP to consider effects on critical habitat and green sturgeon, and NOAA Fisheries has indicated that it will "consider incorporating the recommendations of the peer review and NMFS science committee recommendations into the biological opinion that will result." See *NMFS Public Statement in Response to Peer Reviews Conducted on NMFS Central Valley Project and State Water Project Operations Biological Opinion*, 11/08/06 (see http://swr.nmfs.noaa.gov/cvpop.htm)

Conclusion

Analytic Needs

The need to analyze the potential impacts of climate change in ESA decision making will vary greatly among species and projects. In an ESA section 7 consultation, considerations such as the life history of the affected species, the nature and location of the type of action, the spatial scope of the action, the temporal scope of the action, and the nature and degree of potential ecosystem impacts of climate change in the area in which the project will take place, will dictate the scope of climate change analysis needed. Climate change is likely to be a significant factor, for example, with regard to large water projects like the CVP and the Columbia River power system, coastal development projects, and forest management plans. The objective should be to assure that uncertainty created by potential climate change is factored into the decision, using the best available information and best professional judgment.

Greater Efforts

As new research reduces uncertainty, we may conclude that conserving biodiversity in the context of climate change will require even greater efforts than we thought. New studies indicate that climate models have been underestimating the rate and degree of climate change and its impacts. For example, both the Arctic ice cap and the Greenland ice sheet are melting far faster than scientists predicted. In another example, University of North Carolina researchers have found that coral reefs in the Pacific are dying much faster than previously thought, due to climate change, disease, and coastal development. These phenomena exacerbate the threats to Arctic and Pacific marine species. We may find that other predictions of climate change effects are too conservative.

In a warming world, the ESA is facing its greatest challenge.

For Additional Information:
Melanie J. Rowland, National Oceanic and Atmospheric Administration (NOAA) Office of General Counsel, Northwest Region, 206/ 526-6537 or email: Melanie.Rowland@noaa.gov

Melanie J. Rowland is a senior attorney in the Office of General Counsel of the NOAA in Seattle, where she advises the National Marine Fisheries Service on Endangered Species Act matters concerning pacific salmon and marine mammals. Her practice concentrates on habitat conservation plans and ESA section 7 consultations. She is co-author of the country's leading wildlife law treatise, *The Evolution of National Wildlife Law*. Prior to her position at NOAA, Ms. Rowland served as Senior Counsel with The Wilderness Society, and then was a Visiting Scholar at the University of Washington's School of Law and Institute for Environmental Studies, where she taught environmental law, conservational biology, and wildlife law.

Stormwater BMPs

INTERNATIONAL STORMWATER BMP DATABASE UPDATE

by Eric Strecker, PE, GeoSyntec Consultants, (Portland, OR)
Jane Clary, Wright Water Engineers, Inc. (Denver, CO)
Marcus Quigley, P.E. (GeoSyntec Consultants, Acton, MA)
and Jonathan Jones, (Wright Water Engineers, Inc. (Denver, CO)

Introduction

BMP Database Goals

The International Stormwater BMP Database (Database) project began in 1996. The project's original long-term goal, which remains the central focus of the project, is to gather sufficient technical design and performance information to improve BMP selection and design so that local stormwater problems can be cost-effectively addressed. The US Environmental Protection Agency (EPA) initially funded the project through the Urban Water Resources Research Council (UWRRC) of the American Society of Civil Engineers (ASCE) via multiple grants. In 2004, the project transitioned to a more broadly supported coalition of partners led by the Water Environment Research Foundation (WERF). The coalition supporting the project now includes the American Public Works Association (APWA), the Federal Highway Administration (FHWA), the EPA and the Environmental and Water Resources Institute (EWRI) of ASCE. Wright Water Engineers, Inc., and GeoSyntec Consultants (Project Team) have continued as the entities maintaining and operating the Database clearinghouse and web page, answering questions, conducting analyses of newly submitted BMP data, conducting updated performance evaluations of the overall data set, and disseminating project findings (see Strecker et al, TWR #6).

Enhancements

This article provides an update on the Database growth over the last decade and identifies recent and ongoing enhancements to improve the user friendliness of the Database, such as a spreadsheet-based data entry format and improved summary data formats. Example uses of the Database and plans for the future of the project are also described. A separate follow-up article is also being prepared that will present findings from the recently completed re-evaluation of the database.

Components

Over the last decade, the International Stormwater BMP Database project has made significant progress in expanding the technical base of knowledge regarding BMP performance. The multi-faceted approach that has developed over the years includes the following components:

- Providing guidance on BMP monitoring and reporting to enable more robust analysis of BMP studies for the overall technical community (Detailed BMP Monitoring Guidance Document)
- Developing a centralized storage tool for BMP studies that is available for public use, which can be used for research regarding the factors that lead to better BMP performance and for better selection of BMPs appropriate for various site conditions
- Providing recommendations for standardized measures to assess BMP performance that are based on statistically-sound approaches
- Completing periodic interpretive reports that provide performance data for individual BMP studies, as well as for overall BMP types (e.g., detention basins)
- Developing a website where all of the project's progress and tools can be accessed for public use

An overview of each component follows, with more detailed information available on all of these topics from the project website (www.bmpdatabase.org). Additionally, several examples of how the Database has been used are also provided.

Stormwater BMP Database: Monitoring and Reporting Protocols

Parameters

Through the work of many members of the UWRRC and other invited experts in the mid-1990s, a detailed list of monitoring and reporting protocols for various BMP types was developed. These protocols laid the foundation for the BMP Database, which is the cornerstone of the overall project. Based on these protocols, the Database encompasses a broad range of parameters including test site location, watershed characteristics, climate data, BMP design and layout characteristics, monitoring instrumentation, and monitoring data for precipitation, flow and water quality.

Uses

The Database can be used in two ways: 1) as a tool for entities to methodically track and store their own BMP data; and 2) as an international resource of compiled BMP monitoring data useful to the overall user community.

New Software Access

Originally, these components were released as a single software package on CD in 1999. Since then, the CD software package has been abandoned. The software is now distributed from the project website (www.bmpdatabase.org). Researchers can search and download data on-line, as well as download a spreadsheet package and user's guide to track their own BMP studies. The user's guide provides an overview of the Database and descriptions of each requested data field. Additionally, users can download detailed monitoring guidance in a EPA and ASCE sponsored companion report to the project titled *Urban Stormwater BMP Performance Monitoring* (USEPA and ASCE 2002).

Stormwater BMPs

Data Sets

Stormwater BMP Database: Centralized Storage Tool

The Database has roughly increased almost 6 times in size since its initial release in 1999 and now contains 343 studies as of October 2007, as summarized in Tables 1, 2 and 3. Table 1 highlights the locations of the BMP studies for structural (e.g. detention ponds, biofilters, wetlands, etc.) and non-structural (e.g. street sweeping, catch basin cleaning, etc). The largest data sets are available for biofilters (grass swales), due in large part to a large data set provided by the California Department of Transportation (CalTrans). A few examples of entities who either routinely provide data or have provided large data sets in the past include: Washington State Department of Transportation, Urban Drainage and Flood Control District (Denver, CO), Dr. Shaw Yu (University of Virginia), Dr. Robert Traver (Villanova University); City of Portland, Oregon; Dr. Betty Rushton, Southwest Florida Water Management District; Dr. Robert Pitt, University of Alabama; Dr. Michael Barrett, University of Texas-Austin; University of New Hampshire; the New York City Department of Environmental Protection; and many others. The Harris County Flood Control District in Houston, TX is also working towards adapting the BMP Database as its in-house storage tool, with routine submission of studies to the Database anticipated in the future.

(S= Structural; NS = Non-structural)

State	S	NS	Total	State	S	NS	Total
AL	14		14	NJ	3		3
CA	62	2	64	NY	6		6
CO	11		11	OH	1		1
CT	1		1	OR	13		13
FL	79		79	PA	2		2
GA	2		2	TX	19		19
IL	1	4	5	VA	29		29
MD	5		5	WA	24	12	36
MI	5		5	WI	4	8	12
MN	7		7	Canada	1		1
NC	8	2	10	Sweden	1		1
NH	17		17	**Total**	**315**	**28**	**343**

Table 1
Summary of Structural and Non-Structural BMP Performance Studies Included in the Database as of October 2007

BMP Category	Totals
Biofilter (Grass Swales, etc.)	71
Detention Basin	35
Hydrodynamic Device	37
Infiltration Basin	2
Media Filter	54
Percolation Trench/Well	10
Porous Pavement	10
Retention Pond	62
Wetland Basin	20
Wetland Channel	14
Total Structural	315
Total Non-structural (maintenance practices)	28
Overall Total	343

Table 2
Summary of BMPs Types Included in the Database as of October 2007

State	# of Non-Structural BMPs	Maintenance Practices - Catch Basin Cleaning	Maintenance Practices - Street Sweeping
CA	2		2
IL	4		4
NC	2		2
WA	12	8	4
WI	8		8
Total	28	8	20

Table 3
Summary of Non-structural BMPs Included in the Database as of October 2007
(Primary Non-structural BMP Data Source: National Urban Runoff Program [NURP] Data from the early 1980s)

Stormwater BMPs

Standardized Protocols

Percent Removal Approach Misleading

Performance Assessment

Lognormal Distribution

BMP Performance

Recommended

Erosion

Outputs from Database

Spreadsheets

BMP Performance Assessment Approaches

To develop standardized BMP performance protocols, the Project Team identified a wide variety of measures that had been used historically to assess BMP performance, resulting in wide variations in reported BMP effectiveness. A key finding from this process was that the commonly used simplistic approach of assessing BMP performance based only on the percent difference between mean concentrations (i.e., percent pollutant removal; calculation methods for percent removal are quite varied, but are only part of the problem with this measure) was misleading under many, if not most, conditions. Percent removal is misleading for a number of reasons (see www.bmpdatabase.org/Docs/FAQPercentRemoval.pdf for more details), including:

- Percent removal is primarily a function of influent quality and therefore is more representative of how dirty the inflow is rather then how well the BMP is functioning. Ironically, to maximize percent removal, the catchment upstream should be "dirty" (which does not encourage use of good source controls or a "treatment train" design approach).
- The variability in percent removal is almost always much broader than the uncertainty of effluent pollutant concentrations. These variations in percent removal have little relationship to the effluent quality achieved.
- BMPs with high percent removal (e.g., >80% removal of TSS) may have unacceptably high concentrations of pollutants in effluent (e.g., >100 mg/L TSS), which can lead to a false determination that BMPs are performing well or are "acceptable," when in fact, they are not.
- A number of other reasons as described in the reference article above.

As a result of these determinations the Project Team developed a BMP performance assessment approach that fully accounted for the statistical characteristics inherent to stormwater quality data. For example, the Project Team determined that the lognormal distribution was most representative for describing the majority of water quality data examined. (Note: a lognormal distribution assumes that the logarithms of the data of interest are normally distributed. This distribution is often utilized to represent data sets that are highly variable, such as stormwater quality. The team also uses non-parametric statistical tests that do not require that a distribution be assumed). Using the log-transformed data as a starting point, the Project Team selected a variety of statistical plots to describe the data based on their ability to quickly and accurately depict BMP efficiency and convey information that is statistically relevant (e.g., central tendency, confidence in mean values, and variability). Methods were selected for application to individual BMP studies, as well as for application to groups of BMPs. The performance assessment approaches are summarized in *Development of BMP Performance Measures,* which is downloadable from the project website. The methods include a variety of statistical tests and graphs that include both parametric and non-parametric analyses. These methods have been applied to periodic analysis of the BMP data as the Database has grown since that time.

Ultimately, the Project Team recommends that BMP performance be described as:

- The amount of runoff that is "prevented" (reduced) in the BMP (e.g., through infiltration, pond evaporation, evapotranspiration, etc.)
- The amount of runoff that is treated (versus bypassed or relatively untreated)
- The concentration characteristics of the treated effluent

Where hydromodification is an issue, a fourth measure is the ability of the BMP to reduce downstream erosion impacts. These measures form the basis of a much more robust way to evaluate performance, as well as to be able to predict the potential effectiveness of BMPs in watershed and site planning efforts.

BMP Database: Interpretation & Findings

Data entered in the BMP Database are analyzed on an individual BMP basis, as well as according to BMP categories.

Downloadable outputs from the BMP Database website include:

- Individual BMP Summaries (PDFs): Analysis results for individual BMP studies meeting analysis protocols can be downloaded in PDF format through on-line searches of the BMP Database.
- Data Summaries in Excel Format: Most requests that the Project Team receives focus on water quality and flow data. These outputs are conducive to an Excel spreadsheet-type output. Currently, two spreadsheet formats are available for download on the website: 1) a table containing all storm events for BMPs meeting analysis criteria; and 2) a table containing the statistical analysis results for the BMPs meeting the analysis criteria. Users can download these tables and use Excel's auto-filter feature to focus on analytes of interest or BMP types of interest, etc. These spreadsheets are simple and easy to use and do not require extensive knowledge of database usage.

Stormwater BMPs

Analysis Summary

- Overall Database in Microsoft Access: This format is appropriate for individuals with database usage skills, who are able to create their own custom queries. The primary audience for the overall Database has been researchers at universities.
- Summary Analysis Reports: A summary analysis report is prepared roughly annually that provides a condensed version of the data analysis that identifies how groups of BMP perform for commonly reported water quality constituents.

The analysis data set is becoming more robust from a statistical perspective with roughly 30 constituents having between 1,000 to 5,000 and more records each. Another 30 constituents have between 100 and 1,000 samples each, and several hundred additional constituents have up to 100 records each.

Example Uses & Applications of the Database

Although researchers and municipal staff are increasingly recognizing that percent removal is not an appropriate technique to use in characterizing BMP performance, many continue to struggle with a reasonably understandable approach to replace the easy-to-understand, but misleading, percent removal approach. The Project Team routinely receives inquiries from engineers and researchers regarding how they can use the Database with regard to water quality issues such as TMDLs, storm drainage and/or quality criteria manuals and applications to individual development projects.

Database Applications

A few examples of how the Database has been used to date include:

- In 2005, the Database provided much of the foundation of the WERF (2005) report titled *Critical Assessment of Stormwater Treatment and Selection Issues*, which focuses on a unit treatment process based approach to BMP selection and provides a practical alternative approach to the "percent removal" BMP selection approach.
- In 2006, the National Cooperative Highway Research Program (NCHRP) released *Evaluation of Best Management Practices for Highway Runoff Control*, which also used the BMP Database as a key underlying data component.
- For the Lahontan Regional Water Quality Control Board in California, GeoSyntec Consultants has used the Database to estimate potential effects of BMPs on load reductions to support the development of achievable TMDLs for Lake Tahoe.
- Dr. Michael Barrett, Professor at the University of Texas, used the underlying data in the Database in recent WERF projects to characterize the performance of BMPs and their life-cycle costs in *Post-project Monitoring of BMPs/SUDs to Determine Performance and Whole-Life Costs: Phase 2*, which was published by WERF, AwwaRF, and UKWIR (2005).
- Washington State Department of Transportation (WSDOT) has provided and continues to provide data to the project because WSDOT perceives benefits from the no-cost statistical analyses of their data sets and recognizes the benefit to the overall state of the practice.
- In Oregon, GeoSyntec Consultants used the Database in the development of the Clackamas County Stormwater Master Plan and assisted the Municipal NPDES Stormwater Permit holders in use of the Database for modeling the potential effects of their BMPs in meeting Benchmarks.
- In Columbia, Missouri, WWE used the Database to assess the level of protection that could be expected from the use of multiple BMPs in series.
- In Arkansas, WWE used the Database to assess potential nutrient loadings from a proposed development in an area draining to a lake used for municipal water supply.
- In the course of monitoring the performance of various stormwater treatment systems in Colorado, WWE has used the Database to compare performance of local BMPs against comparable BMPs nationally. These comparisons have been especially valuable on those occasions when observed performance has not fulfilled expectations.
- For multiple large development projects in Southern California, the information from the Database has been used to assist in BMP selection and design and modeling predictions of overall performance for compliance with the State's Environmental Policy Act.
- Also in California both environmental groups and dischargers have used or cited the Database in debates over whether effluent standards are appropriate for stormwater permits.

Next Steps

The International BMP Database is an ongoing long-term project. The 2007-2008 scope of work will focus on the following tasks:

Scope of Future Work

Data Entry: Entering approximately 25-30 new datasets annually (Ongoing)

Public Involvement: During 2007, the Project Team will continue to target and work with large data providers to "open the pipeline" of BMP study submissions, which will benefit the overall technical community (Ongoing)

Stormwater BMPs

Tools

New BMP Studies

Refinements to Data Entry Spreadsheets and Improvements to the Spreadsheet-Database Upload Tool: Refinements have been made and are in the downloadable spreadsheets.

Upgrades to the Project Website/Retrieval Tools and Output Formats: A significant upgrade to the website (www.bmpdatabase.org) to improve user friendliness, both in terms of navigating to desired information and providing data retrieval tools that are easier to use has been implemented.

Updates to the Summary Data Analyses: The project team has reanalyzed the BMP Database and the new summaries were expected to be posted to the website prior to publication of this article.

Conclusion

The International Stormwater BMP Database project provides tools useful for those desiring a better understanding of BMP monitoring and performance, in need of tools to store and manage BMP data, and in need of guidance regarding BMP performance data interpretation. The Project Team operates a clearinghouse that provides assistance to the technical community on these topics and continues to actively seek new BMP studies for inclusion in the Database. Feel free to contact any of the authors for more information or visit the project website (www.bmpdatabase.org).

For Additional Information:

Eric Strecker, PE, Principal, GeoSyntec Consultants (Portland, OR), 503/ 222-9518 or email: estrecker@geosyntec.com

Jane Clary, PE, Chief Executive Officer, Wright Water Engineers, Inc. (Denver, CO), 303/ 480-1700 or email: clary@wrightwater.com

Marcus Quigley, PE, Project Engineer, GeoSyntec Consultants, (Boxborough, MA), 978/ 263-9588 or email: mquigely@geosyntec.com

Jonathan Jones, PE, Chief Executive Officer, Wright Water Engineers, Inc. (Denver, CO), 303/ 480-1700 or email: jonjones@wrightwater.com

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Eric W. Strecker, P.E. is a Principal and Water Resources Practice Leader with GeoSyntec Consultants in Portland, Oregon. He has over 23 years of stormwater management experience, including national level applied research efforts for EPA, FHWA, WERF, and NCHRP as well as state and local stormwater management , design and research projects throughout the western United States.

Jane Clary is a Senior Water Resources Scientist with Wright Water Engineers, Inc. She specializes in watershed management, water quality protection, and stormwater management. She has served as the Project Coordinator for the Stormwater BMP Database for the past ten years.

Marcus Quigley, P.E. is project engineer in GeoSyntec Consultants in Boston, Massachusetts. He has more than 11 years of experience in stormwater management, including stormwater modeling, monitoring, and management planning.

Jonathon E. Jones, P.E. is the Chief Executive Officer of Wright Water Engineers, Inc. in Denver, Colorado, where he has worked for over 25 years. He works on urban stormwater management projects around the United States.

Sediments

SEDIMENTS UPDATE

CONFERENCE LINKS LAW, SCIENCE & PUBLIC POLICY

by Heather Brunelle and Cindy Ryals, Kennedy/Jenks Consultants (Portland, OR)

INTRODUCTION

Regional Perspectives

On September 24, 2007, the Environmental Law Education Center's Sediment Conference took place in Portland with the theme of *Law, Science, and Public Policy*. Regional perspectives on the law, public policy, and science of sediment investigation and cleanup were presented, with a focus on the Portland Harbor Superfund Site. The conference concluded with a panel discussion regarding the pathway to a **r**ecord **o**f **d**ecision (ROD) for the Portland Harbor Superfund Site.

The following article presents an abbreviated summary of the conference presentations and panel discussion in the order of presentation at the conference.

PUBLIC POLICY

DEQ Progress

Oregon Progress

Dick Pedersen, Deputy Director of the Oregon Department of Environmental Quality (DEQ), began the day by discussing the State of Oregon's (State's) progress in sediment site cleanup and remaining challenges.

Examples of the DEQ's progress include: the issuance of over 1,000 No Further Action (NFA) determinations since 1994; the recently released DEQ Guidance for Assessing Bioaccumulative Chemicals in Sediment (updated April 3, 2007); and the Joint Source Control Strategy (JSCS) Program with the US Environmental Protection Agency (EPA).

EPA Grants

DEQ is targeting EPA grant funding to assist with high priority sediment projects at the Columbia Slough and Scappoose Bay. The Portland Harbor Superfund Site is the most visible and challenging sediment site in Oregon and is also the most comprehensively studied site to date. DEQ is overseeing the upland portion of the Portland Harbor cleanup.

Specific examples of DEQ progress on RODs and sediment site cleanup include activities at: PGE Station L; Rhodia; Wagner Mining; McCormick & Baxter Creosoting Company; and Young's Bay.

Cleanup Challenges

In considering some of the challenges in sediment cleanup, Mr. Pedersen mentioned the urban nature of most sites; the lack of consensus on methods to evaluate bioaccumulation risks related to sediment contamination; the site-specific nature of effective remedies, and meeting the needs of natural resource trustees and public concerns with cleanup remedies. He stressed that that there is no "one-size-fits-all" solution to sediment cleanup projects. He concluded his talk by emphasizing the importance of collaboration between the different parties involved in the cleanup process of a sediment site.

FOR MORE INFORMATION, CONTACT: Dick Pedersen, email: pedersen.dick@deq.state.or.us; DEQ website: www.deq.state.or.us/lq/cu/nwr/PortlandHarbor/

City of Portland Efforts

Portland Harbor Superfund

Next, Rick Applegate, the Portland Harbor Superfund Administrator for the City of Portland (City), discussed the role and progress of the City regarding the Portland Harbor Superfund Site.

The Lower Willamette Group (LWG) is a group of public and private entities who have agreed to fund the Portland Harbor **r**emedial **i**nvestigation and **f**easibility **s**tudy (RI/FS). So far, more than $55 million has been invested by LWG. Twenty five percent of this expense has been funded by the City.

Report Available

A recent milestone in this process is the "*Comprehensive Round 2 Report*" — which was submitted to EPA by the LWG in February of 2007 and is the first comprehensive assemblage of Portland Harbor Site data (*Report* available on EPA website: see below). The target for the LWG and regulatory management teams is to complete the RI by the end of 2008, the FS by the end of 2009, and the ROD by 2010.

Chemicals of concern for the Portland Harbor Site include: **p**oly**c**hlorinated **b**iphenyls (PCBs), dioxins, and **p**olycyclic **a**romatic **h**ydrocarbons (PAHs), among others. The City strives to maintain a strong stewardship role and to work cooperatively with EPA, DEQ, and tribal governments.

Ecosystem Needs

Mr. Applegate pointed out that the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process addresses risk related to the Portland Harbor Site, but not necessarily all of the needs of the ecosystem. Therefore, the City would like to explore the means to achieve restoration beyond what can be achieved under CERCLA. He also believes it would be beneficial for invited parties to resolve allocation of responsibility without litigation, which is expensive and could delay the remedy.

Sediments

Actions Needed

Mr. Applegate concluded by summarizing the actions that need to occur for a successful cleanup program for the Harbor, including: completing the RI/FS and ROD; resolving Natural Resource Damage Assessment (NRDA) issues; designing an institutional structure for implementing cleanup and source control; and negotiating cost allocation.

For more information, contact: Rick Applegate, email: ricka@bes.ci.portland.or.us; City website: www.portlandonline.com/bes/index.cfm?c=dcbdi

EPA Activities

EPA Policies

To conclude the policy portion of the conference, Dan Opalski, Director of the Office of Environmental Cleanup for EPA Region 10, gave an overview of EPA policies and developments in addressing contaminated sediment.

Dredging

Site Characterization

Mr. Opalski began by discussing the recent National Research Council (NRC) report on the effectiveness of dredging, and the EPA Office of Inspector General (OIG) review of sediment management. He noted that the conclusions were not new findings, and that the NRC report found that dredging can be effective under the appropriate conditions. Above all, he noted EPA Region 10's agreement with the NRC conclusion that good site cleanup begins with good site characterization. Several examples of high priority sediment sites in Region 10 were presented, including Portland Harbor.

Integration Need

Mr. Opalski emphasized the need to honor the vast investment of time and resources on Portland Harbor and the need to integrate EPA programs, upland source control, and upstream source control. Mr. Opalski closed by stating that the measure of success in the Portland Harbor cleanup will need to be evaluated over the long term and that individual choices need to contribute to a larger, shared vision of the future.

For more information, contact: Dan Opalski, email: opalski.dan@epa.gov; EPA website: http://yosemite.epa.gov/r10/cleanup.nsf/sites/ptldharbor

LEGAL ISSUES

Cost Recovery Case

David Ashton, Assistant General Counsel for the Port of Portland, discussed the latest legal developments in sediment cleanup. In particular, he focused on the recent US Supreme Court case of *United States vs. Atlantic Research Corporation* (*ARC*), 551 U.S. ___ (June 11, 2007) and the potential implications for cost recovery and contribution remedies. Mr. Ashton provided background on the cost recovery remedies under CERCLA and the struggle of the courts to reconcile those remedies contained in sections 9607(a) and 9613(f). His presentation included an analysis of several cases that led to the *ARC* decision, including the *Cooper vs. Aviall*, 543 U.S. 157 (2004), US Supreme Court ruling. Following the *Aviall* case, it was unclear whether a **p**otentially **r**esponsible **p**arty (PRP) could seek recovery for non-enforcement actions. While *ARC* resolved the matter that a PRP who incurs response costs during site investigation and cleanup has a 9607(a) recovery remedy, the opinion left many more questions unresolved.

Contribution v. Reimbursement

[**Editor's Note:** The Supreme Court ruled unanimously in *ARC* that Section 9607(a) of CERCLA allows potentially responsible parties (PRPs) to sue other PRPs for cost recovery. The government had claimed that the phrase "any other person" in Section 9607(a) was meant to include only non-PRPs, but the Court, relying on the plain language of the statute, held that "the Government's interpretation makes little textual sense." Since almost any party likely to incur clean-up costs could be designated a PRP, the government's interpretation risked rendering Section 9607(a) functionless. The Court explained that its interpretation would not result in improper overlap between Section 9613(f) and Section 9607(a). A party can sue another PRP for contribution under 9613(f), but the party can only sue under Section 9607(a) for reimbursement of its own clean-up costs. Therefore, parties cannot take advantage of Section 9607(a)'s longer limitations period by bringing contribution claims under 9607(a). The Oyez Project, *United States v. Atlantic Research Corp*., 551 U.S. ___ (2007); www.oyez.org cases/2000-2009/2006/2006_06_562/]

Litigation Failure

Mr. Ashton also presented the Outboard Marine Corporation Superfund Site at Waukegan Harbor as an example of how litigation has failed to be an effective way to resolve sediment site cleanups. "Politics can sometimes subvert worthy alternative funding mechanisms for sediment cleanups such as the Great Lakes Legacy Act."

For more information, contact: David Ashton, email: david.ashton@portofportland.com

Sediments

SCIENCE ISSUES

Transition Zone Water Study

Transition Zone Water

William Locke, P.E., Principal Hydrologist for Integral Consulting, gave an overview of **t**ransition **z**one **w**ater (TZW) issues at contaminated sediment sites, including a definition of TZW and its important processes. The groundwater/surface water transition zone (also known as the hyporheic zone) is the interval where a mixture of both groundwater and surface water compose some percentage of the water occupying interstitial space in the sediments. The study of TZW includes specialized investigative methods and physical and chemical lines of evidence. One aim of these methods is to determine the significance of TZW in terms of relative contribution to total chemical concentrations and the implications for in-water remedies and upland source control. He explained that while chemical patterns in TZW and sediment can correspond to upland groundwater characteristics, this is not always the case. There may be an incomplete pathway from upland sources to TZW, or there may be legacy chemicals and concentrations in TZW that do not link to existing upland sources. In-water sediment sources or other unaccounted for sources to TZW concentrations can also confound attempting source identification from TZW sampling. Mr. Locke concluded by presenting broader perspectives on groundwater pathways and sediment sites and the implications for remedy selection, timing, and cost.

For more information, contact: Bill Locke, email: wlocke@integral-corp.com

Bioaccumulative Chemicals

Screening Values

Evaluation Tasks

Sediment Evaluation and Risk Assessment

Mike Poulsen, Toxicologist for the Northwest Region Cleanup Section of DEQ, presented DEQ's *Guidance for Assessing Bioaccumulative Chemicals in Sediment* (updated April 3, 2007). The sediment bioaccumulation assessment process is laid out as a series of steps in the guidance document, and allows for the use of either generic or site-specific screening values for sediment and tissue, based on protection of aquatic organisms, wildlife, and human health. The assessment process that was described addresses bioaccumulation only, and not direct toxicity to benthic organisms, which may also need to be considered. The flow chart from the guidance showing the steps in the assessment process is shown in Figure 1. While DEQ does not require that the stepwise process presented in the flowchart be followed, it is a helpful means of identifying the tasks that will be required to complete a bioaccumulation evaluation. Mr. Poulsen also summarized DEQ's role in the Regional Sediment Evaluation Team, which is developing similar guidance on sediment bioaccumulation.

The DEQ guidance is available at: www.deq.state.or.us/lq/pubs/docs/cu/GuidanceAssessingBioaccumulative.pdf

For more information, contact: Mike Poulsen, email: poulsen.mike@deq.state.or.us

Floating Percentile Method

Freshwater Sediment Quality

Regional Sediment Evaluation Team Activities

Teresa Michelsen, PhD, is the principal at Avocet Consulting & Mediation Solutions and serves as Chair of the Regional Sediment Evaluation Team (RSET) Bioaccumulation Subcommittee. Ms. Michelsen gave an overview of RSET and the **f**loating **p**ercentile **m**ethod (FPM) which is being used to develop freshwater sediment quality guidelines. RSET is a multi-agency group assembled to revise the existing regional Dredge Material Evaluation Framework (DMEF) to create the Northwest Region Sediment Evaluation Framework (SEF) for use by federal and state agencies.

RSET has technical subcommittees that are continuing to evaluate bioaccumulation, toxicity testing, and chemical analyte topics. RSET has already issued the Interim Final SEF (September 2006). The FPM is a process that allows for the optimization of a series of statistical parameters (such as false negative and false positive rates) to calculate sediment quality guidelines that achieve a specific set of reliability targets. Based on comments on the draft FPM presented in the Interim Final SEF, RSET will be: including chronic data with a wider geographical diversity in the FPM data set; developing an automated process for conducting FPM calculations; and recalculating freshwater sediment quality values for inclusion in the next revision of the SEF. The goal is to complete the recalculation process for presentation at the 2008 Sediment Management Annual Review Meeting (SMARM). Dr. Michelsen mentioned that the Washington State Department of Ecology is expected to promulgate these freshwater sediment quality guidelines once this process is completed.

The Interim Final SEF is available at: www.nws.usace.army.mil/publicmenu/DOCUMENTS/DMMO/RSET_Interim_Final.pdf

For more information, contact: Teresa Michelsen, email: teresa@avocetconsulting.com

Sediments

Risk Assessments

Inherent Complexities

Bioaccumulative Chemicals

Ecological and Human Health Risk Assessments

Laura Kennedy, Kennedy/Jenks Consultants, provided background for ecological and human health risk assessments, and addressed many of the uncertainties inherent in the process. Ms. Kennedy discussed the current framework for risk assessment, major issues for evaluating risk due to fish consumption, and implications for data collection at complex sediment sites. Both EPA and DEQ provide guidance documents for risk assessment, but these documents do not specifically address the complexities of sediment sites. In addition, both EPA and the NRC provide sediment guidance on managing risks, but do not specifically address risk assessment. However, there is a need to integrate both when addressing cleanup at a sediment site. Because of the complexities inherent in large sediment sites, a large amount of uncertainty exists in assessing risk, particularly in exposure assumptions, since fish consumption tends to drive risk for bioaccumulative chemicals at sediment sites. Ms. Kennedy emphasized the importance of considering the risk assessment and development of remedial goals when planning data collection at sediment sites.

For more information, contact: Laura Kennedy, email: laurakennedy@kennedyjenks.com

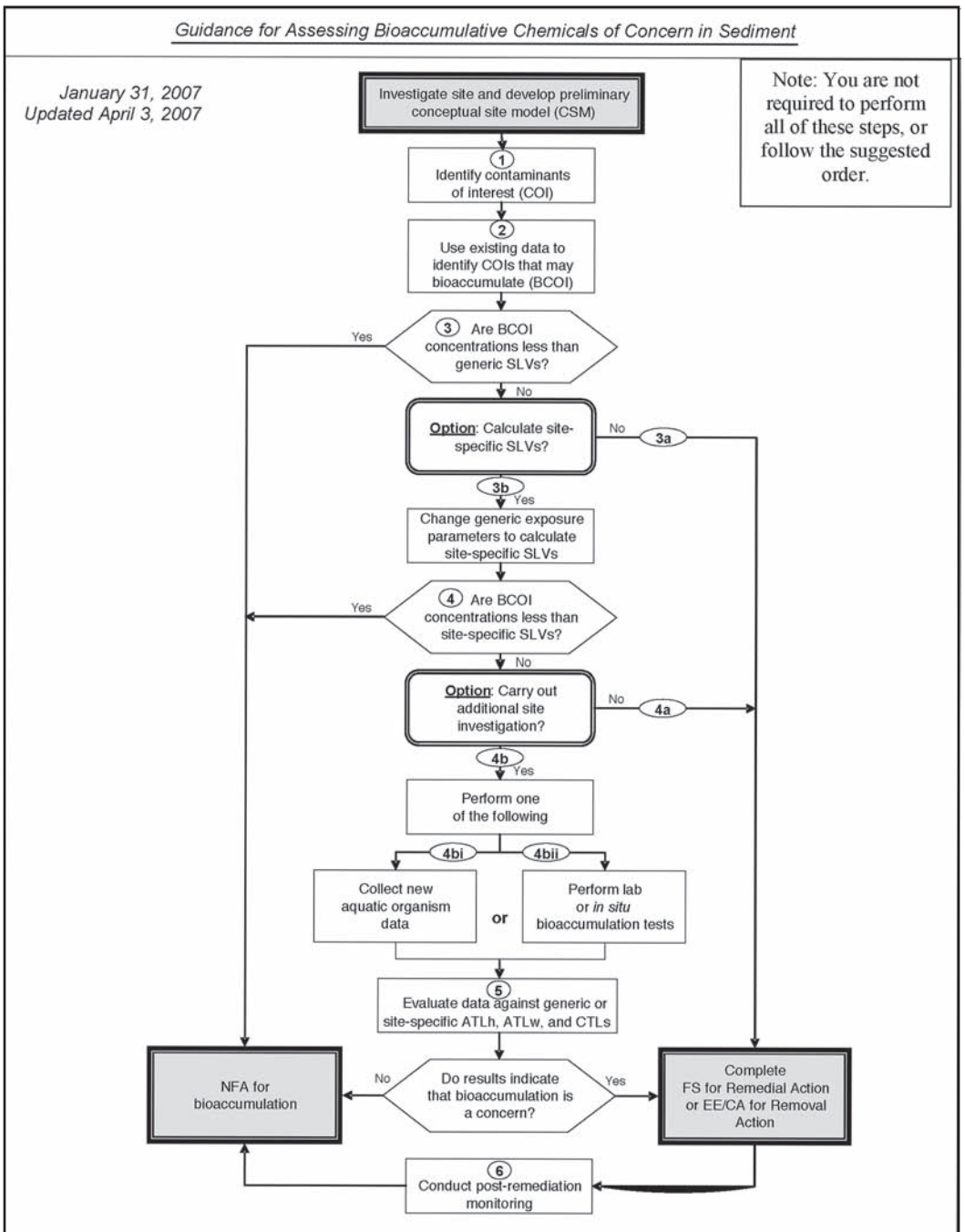


Figure 3. Assessing Chemicals for Bioaccumulation

Sediments

ROD Requirements

Challenges to Obtain ROD

Risk Reduction

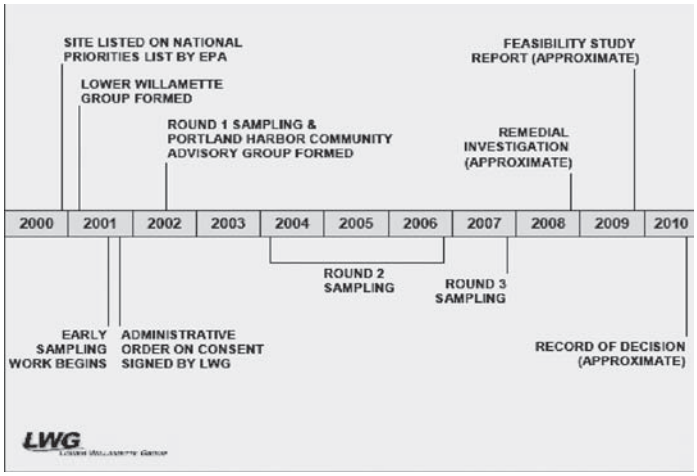
"The Road to the ROD"

The Conference closed with a panel discussion on the Portland Harbor Superfund Site and requirements for obtaining a ROD. The panel included: Eric Blischke, co-Project Remedial Manager for the Portland Harbor site for EPA Region X; Jim Anderson, Manager of the DEQ Portland Harbor Section; Jim McKenna, Port of Portland and co-Chair of the LWG; Christopher Rycewicz, Partner of Miller Nash LLP; and Lisa Bluelake, Staff Attorney for the Confederated Tribes of the Grand Ronde. Eric Blischke and Jim McKenna presented updates on the Portland Harbor RI/FS. Jim McKenna presented an estimated timeline showing the process from the site listing to obtaining the Portland Harbor Superfund Site ROD, as displayed in Figure 2. The data and analysis available to date were discussed, as presented in the LWG's Comprehensive Round 2 Report. Sampling efforts have extended from river mile 2 to river mile 11, and analyses range from physical parameters to chemicals in various media. Jim Anderson presented updates to the Joint Source Control Strategy (JSCS) Program. Lisa Bluelake presented the tribal governments' involvement with Portland Harbor, with a focus on the Confederated Tribes of the Grand Ronde. The panel discussion, moderated by Teresa Michelson, followed these brief presentations, and focused on challenges to obtaining a Portland Harbor ROD.

Challenges mentioned by the Panelists include:

- Resolving cost allocation
- Reaching a common vision for the ROD
- Site boundary determinations
- Consensus on remedial goals
- Organization and management of multiple sediment management areas (SMAs) for implementing the remedies

The panel discussed coordination of the NRDA and CERCLA processes, data collection requirements, and tribal interests (e.g., protection of lamprey). The panel also discussed the complexity of risk reduction given upstream sources and recontamination from upland sources.



Conclusion

Sediment sites present unique challenges given the complexity of investigation, risk assessment, and managing cleanup. As discussed during the conference, much progress has been made in the evolution of law, public policy, and science of sediment site investigation and cleanup, and in the coming years additional advancements will be made.

For Additional Information, Contact: Heather Brunelle and Cindy Ryals, Kennedy/Jenks Consultants (Portland), 503/ 295-4911

Cindy Ryals is an environmental scientist with Kennedy/Jenks Consultants in Portland. She has a masters degree in environmental science and management from the University of California at Santa Barbara, and a bachelor of science degree in zoology, with a business certificate, from the University of Wisconsin. Her experience is in human health and ecological risk assessment, water resource management, and renewable energy. Ms. Ryals' current work focuses on environmental risk assessments and remedial investigations, including work on the Portland Harbor Superfund Site. She has examined potential risks to both human and ecological receptors from contaminants in multiple environmental media using EPA and other regulatory agency-approved models. Additionally, Ms. Ryals provides support for field investigations, data management, and fate and transport modeling.

Heather Brunelle is an environmental scientist in the Portland office of Kennedy/Jenks Consultants. Ms. Brunelle has a bachelor's degree in chemistry from the University of Connecticut and a master of environmental management degree from Duke University. Her area of expertise is in human health and ecological risk assessment and risk management. She has conducted a number of risk assessments that were the basis for establishing risk-based cleanup criteria at levels protective for both human and ecological receptors. She has also identified mitigation strategies to minimize or eliminate potential risks.

Dams

WATER QUALITY STANDARDS & HYDROPOWER DAMS

FINDING CONCRETE SOLUTIONS

by Rebecca Sherman (Hydropower Reform Coalition), Brett Swift (American Rivers) and Rick Eichstaedt (Center for Justice)

INTRODUCTION

Water Quality Impacts

Dams and other surface water diversion structures have direct impacts on water quality. They impound rivers, holding back debris and sediment that otherwise would naturally wash downstream. As organic materials store up, they decay, foster algal growth, and absorb oxygen. Instream pollution settles and intensifies, contaminating not only the surface stream but fish and the groundwater table. Downstream, the river is starved of structural materials. Without anchoring replenishment, the existing material erodes more quickly. Dams create unnatural water temperatures, often warming the river to levels that cannot sustain aquatic life. Spill from dams can increase levels of dissolved gases in the river and adversely affect fish. The complex and dynamic self-correcting nature of a river is literally obstructed. Solving water quality problems at dams therefore often requires complex restorative solutions.

FERC Licenses Expiring

Over a third of all Federal Energy Regulatory Commission (FERC) licenses in the Pacific Northwest will expire between 2000 and 2012 (see FERC website: www.ferc.gov/industries/hydropower/gen-info/licensing/licenses.xls). As with hydropower dams throughout the West, most Northwest dams were built and received federal operational licenses more than 50 years ago — at a time when the federal Clean Water Act (CWA) did not exist. Today, in response to mass FERC license expiration combined with the present necessity for CWA compliance at federal dams, natural resource managers across the region are performing the first overall examination of water quality impacts from dams. In most instances these impacts have remained unaddressed for decades. Now, not only must the required mitigation measures remedy decades-old impacts, they must also be designed to protect water quality for the next fifty years.

This article examines how water quality is regulated at hydropower dams, how those regulatory mechanisms are running into limitations, and how regulators are responding to those limitations. First, we describe existing regulatory mechanisms under the CWA, including the use attainability analysis process, site-specific criteria, and other approaches as applied to dams. Second, we examine two ongoing licensing processes on rivers in the Pacific Northwest which some public resource advocates are raising concerns.

REGULATING HYDROPOWER DAMS UNDER the CWA

Nonpoint Source

Dams have always held a curious place under our water quality regulations. The US Environmental Protection Agency (EPA) has consistently asserted that dams are *nonpoint* sources (as opposed to end-of-pipe "point" sources). Dams are therefore not required to obtain a CWA National Pollutant Discharge Elimination System (NPDES) permit. *National Wildlife Federation v. Gorsuch*, 693 F.2d 156 (D.C. Cir. 1982) held that dams are nonpoint sources subject to state control because they do not add pollutants and, therefore, are not required to obtain an NPDES permit. In *National Wildlife Federation v. Consumer Power Company*, 862 F.2d 580 (6th Cir 1988), the court also decided that a hydroelectric facility was not required to obtain an NPDES permit because it did not add pollutants. However, the US Supreme Court has determined that hydropower dam operations do result in a *discharge* for purposes of CWA Section 401 authority (33 U.S.C. § 1341).

Section 401 Authority

Dam "Discharges"

That dams cause discharge was definitively settled in the 2006 US Supreme Court case *S.D. Warren vs. Maine Board of Environmental Protection*, 126 S.Ct. 1843 (2006). In that case, dam owner S.D. Warren protested that its multi-dam project did not issue a discharge due to its "run-of-river" operational scheme and because "the mere flow of the Presumpscot River through Warren's existing dams does not constitute a discharge into the Presumpscot River" (*Brief for Petitioner* at 13). The Supreme Court disagreed. In a unanimous decision, the Court held that "a dam does raise a potential for a discharge, and state approval is needed." [See Glick, TWR #28]

Water Quality Certification

The "state approval" referenced by the Court is Section 401 of the CWA, which applies to any federally-authorized activities that may result in a discharge:

> Any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates…

CWA § 401, 33 U.S.C. 1341

Dams

State Standards

Non-Fed Facilities

CWA § 401 water quality certifications (commonly referred to as "401 certifications") are the regulatory mechanism for ensuring that federally-licensed activities will comply with applicable water quality standards. States have an obligation to adopt water quality standards — subject to EPA review and approval — which are at least as protective as federal standards. In the absence of such adoption, federal standards are imposed by EPA.

In addition, hydropower facilities that are not owned by the federal government and which meet a set of broad criteria fall under the jurisdiction of FERC. Such facilities must obtain a federal license from FERC in order to operate. See *Handbook for Hydroelectric Project Licensing and 5 MW Exemptions From Licensing,* FERC 2004: www.ferc.gov/industries/hydropower/gen-info/handbooks/licensing_handbook.pdf

A federal license "is required to construct, operate, and maintain a non-federal hydroelectric project that is or would be (a) located on navigable waters of the United States; (b) occupy U.S. lands; (c) utilize surplus water or water power from a U.S. government dam; or (d) be located on a stream over which Congress has Commerce Clause jurisdiction, where project construction or expansion occurred on or after August 26, 1935, and the project affects the interests of interstate or foreign commerce." Federal Power Act § 4(e) (16 U.S.C. 797).

Mandatory Conditions

Issuance of the FERC license triggers application of 401 certifications. In addition to confirming that 401 certifications apply to FERC-licensed hydropower dams, the Supreme Court has also confirmed that states may require any conditions necessary to ensure compliance with state water quality standards in its certification. Other cases establish that the conditions of a 401 certification are mandatory in a federal license — FERC may not alter the terms of a state certification, but rather must include them in any federal license issued for a hydropower facility. *PUD No. 1 of Jefferson County v. Washington Dep't of Ecology*, 511 U.S. 700 (1994); and *American Rivers v. FERC* (Turnbridge Mill), 129 F.3d 99 (2nd Cir.1997), respectively.

As a result of this broad authority and the fact that many hydropower dams have never complied with water quality standards, 401 certifications are a powerful river restoration tool. Many hydropower dams have obtained new FERC licenses with 401 certification conditions that will result in significant and comprehensive improvements in water quality.

Federally Owned Dams

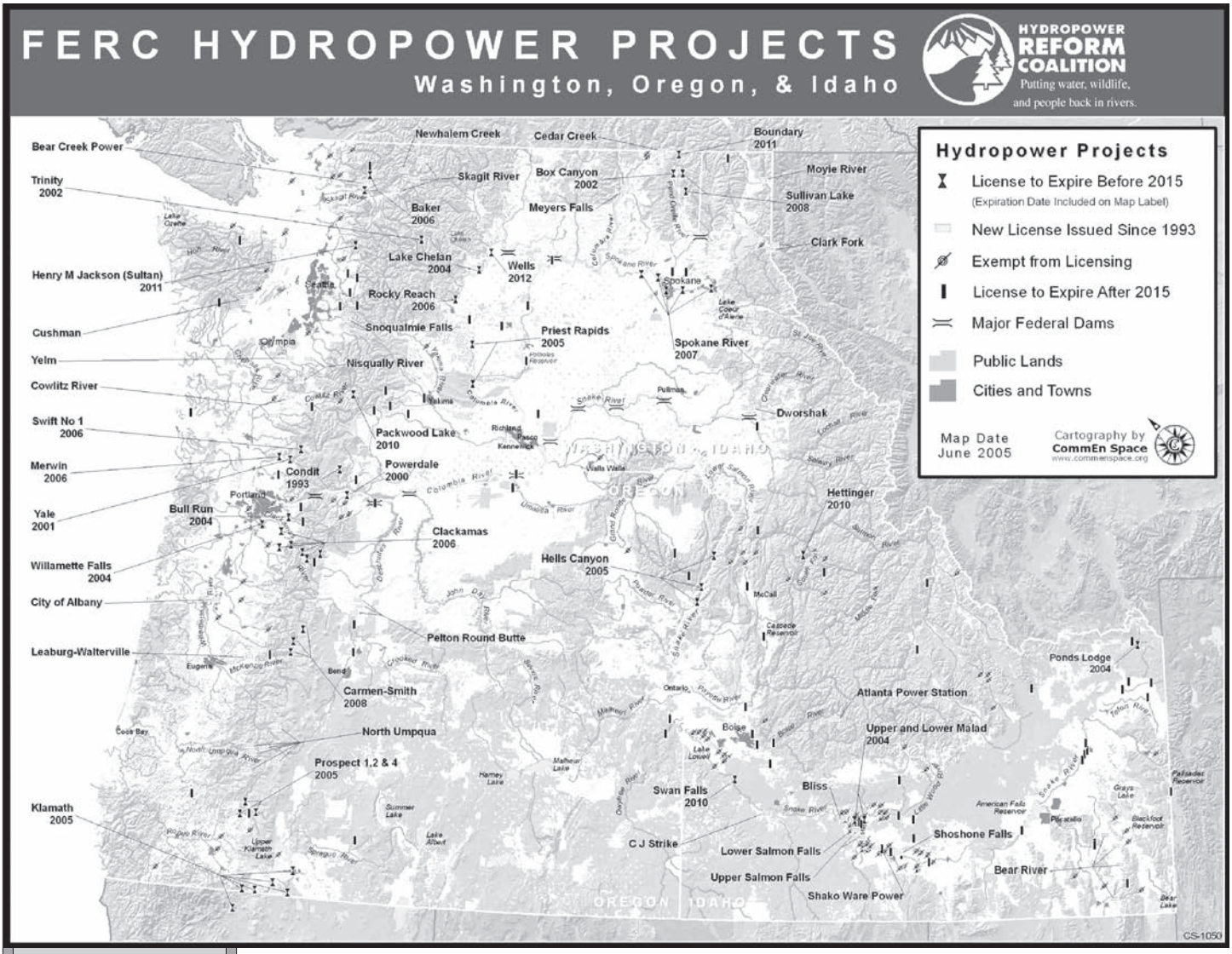
An even more complicated issue is how to apply water quality standards to federally-owned dams, where no FERC license is required and therefore, no 401 process is applicable. This issue was examined in litigation filed by a number of environmental groups against the US Army Corps of Engineers (Corps). The litigants claimed that the Corps' operation of the four federal dams on the lower Snake River in Washington violated state water quality standards for temperature and total dissolved gas. The environmental groups argued that Section 313 of the CWA (33 U.S.C. § 1323(a) — which provides that federal facilities are subject to the requirements of the CWA when the government "engaged in any activity resulting, or which may result, in the discharge or runoff of pollutant" — obligates the federal dams to comply with state water quality standards. The federal district court in Oregon agreed, holding that the Corps had failed to consider its obligations and must address its CWA obligations. *National Wildlife Fed'n v. Army Corps of Eng'rs,* 132 F. Supp. 2d 876, 895 (D.Or. 2001). As a result, state and federal agencies began a still uncompleted effort to develop a **t**otal **m**aximum **d**aily **l**oad (TMDL) to address the temperature and total dissolved gas impacts of the federal dams on the Snake and Columbia River (see EPA's website: http://yosemite1.epa.gov/R10/water.nsf). The decision is widely viewed as a compelling legal case for the application of state water quality standards to all federal dams.

Regardless of the legal mechanism for compliance or the status of the dam owner, remedial action to fix decades of water quality impairment inevitably poses a practical challenge. Hydropower dams present this challenge in a particularly remarkable way. As dams are often considered permanent in-river structures, there are severe limits to the range of acceptable mitigation. On the other hand, hydropower dams also generate electricity, so there is direct financial support for mitigation as well as a financial interest in avoiding operationally-restrictive measures. States must follow a simple standard — there must be "reasonable assurance" that water quality standards will be met before a state can issue a 401 certification. All parties are motivated in FERC's timeframe: the state to finish the process efficiently and ensure protection of state water quality standards; the dam owner to complete the licensing process; and resource interests to have environmental measures implemented as quickly as possible under a new license. This combination of limited mitigation options, broad motivation, financing, and a basic but strong standard typifies hydropower dams' place at the front line of regulatory response with water quality challenges — a response which includes use attainability analysis, site-specific criteria, and other more creative tools.

"Reasonable Assurance" Standard

Designated Use

As noted, federal regulations require states to develop adequately protective water quality standards or accept federal standards. Water quality standards are "provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such



Dams

Site-Specific Criteria

waters based upon such uses." (40 C.F.R. § 131.3) In setting such standards, a state may consider the unique characteristics of a particular site and adopt *site-specific criteria* in accordance with 40 C.F.R. § 131.11(b)(l)(ii). The state may only adopt site-specific criteria after a rigorous scientific review and rulemaking that establishes that the most sensitive existing use will be fully protected with less restrictive criteria. This can be done by proving that either the resident species of a water body are less sensitive than those species used to develop a water quality criterion or that the nature of the site, itself, renders the pollutant less damaging. Adoption of new criteria is always optional. Chapter 3.7 of EPA's *Water Quality Standards Handbook* underscores the complexity of adopting site-specific criteria and suggests three separate procedures for completing the process (EPA-823-B-94-005; August 1994 with some additional new information (June 2007), see EPA's website: www.epa.gov/waterscience/standards/handbook/chapter03.html#section7). Your authors are not aware of any successful site-specific criteria process related to hydropower dams. Although, as described later, Idaho Power Company is currently seeking site-specific criteria for the Snake River below the Hells Canyon Hydroelectric Complex.

Hells Canyon Proposal

Importantly, establishing site-specific criteria does not affect the associated designated uses. Rather, a finding must be made that the more specific criteria will still fully protect designated uses. In contrast, a Use Attainability Analysis (UAA) results in modification or removal of a designated use and associated criteria (40 C.F.R. § 131.10 (g)). Typically, a petition for a UAA will be filed by an independent party requesting to modify or remove one or more of the stream's current uses. The modified use may be a more specific subset of the current use, such as a seasonal use. Usually, the requested change has less restrictive associated water quality standards.

UAA Modification

Dams

Designated Use

In order to alter uses, a state must undertake "a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors." (40 C.F.R. § 131.3 (g)). However, a state may not remove a designated use from its water quality standards if the designated use is either a current use of the stream or a use that has existed at any time since November 28, 1975 (40 C.F.R. § 131.10(g) and (h)(1)). The state also must include an assessment of impacts of the entire waterbody to ensure that all pollution control and reduction measures are being implemented. In other words, if there are multiple causes of a water quality problem, control of all those causes must be explored prior to use modification under a UAA.

State Removal or Subcategory

As noted, a state may remove a designated use that is not an existing use or may establish subcategories of a use. "Existing" is defined as any use that existed between November 28, 1975 and the present. Nor may the state remove a designated use that is "attainable" (40 C.F.R § 131.10(g)). There are six distinct conditions under which a use may be considered unattainable (40 C.F.R. § 131.10 (g)(1) - (g)(6)).

Relevant Tests

Only two of these tests are relevant to dams:

(g)(4) Dams, 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 or to operate such modification in a way that would result in the attainment of the use;

(g)(6) Controls more stringent than those required by § 301 (b) and 306 of the Act would result in substantial and widespread economic and social hardship.

UAA Implementation

Nationally, the UAA process has only been implemented in about half of the states. In the Northwest, there are few examples of water quality standard changes as a result of the UAA process and no examples of the process being used in relation to dam-related impacts. (See Teresa Kuba, EPA Region 10 Handout at: www.deq.state.id.us/water/assist_business/workshops/uaa_regional_national_overview_uaa_workshop_handout.pdf).

Several dam operators have increasingly looked to UAAs and site-specific criteria as a potential solution to meeting water quality standards. So far, it is not clear that either of these paths is well-adapted to the licensing process or to dam-related violations. Case studies at the end of this article will examine such instances.

REGULATORY RESPONSE

To demonstrate how these regulatory options have played out on the state level, we will now profile the policy-level response of the states of Washington and Oregon. Both states have many hydropower dams over which they have actively asserted compliance obligations. Seeing compliance through to the details — from selecting the proper regulatory path to designing effective mitigation measures — highlights the significant challenges.

Washington

Upcoming Relicensings

The state of Washington has one of the greatest number of relicensings in the country, with 24 of its 53 projects seeking some stage of certification review in the last ten years. On top of this volume, Washington has and is currently entertaining proposals for new hydropower projects. As a result, the responsible agency, the Washington State Department of Ecology (Ecology), has exceptional expertise in writing 401 certifications — but also has an exceptionally heavy workload.

Dam Compliance Schedules

In 2003, Ecology submitted revised water quality standards to EPA for approval, including a proposed addition to its regulations regarding "dam compliance schedules." In a letter dated February 10, 2005, EPA responded to the dam compliance schedule provision, informing Ecology that no approval was necessary for this provision to go into effect — EPA did not consider the dam compliance provision a water quality standard under section 303(c) of the CWA. Ecology promptly adopted the provision into the Washington Administrative Code (WAC 173A-201A-510(5)).

Quality Attainment Plan

Washington state regulations require owners of dams that contribute to water quality violations to develop a water quality attainment plan. The plan outlines a series and sequence of measures that must be taken to meet a particular water quality standard that is currently violated. The plan's schedule — now a dam compliance schedule — can last no more than ten years.

Reasonable Assurance

In order to issue a 401 certification, Ecology must find that there is reasonable assurance that water quality standards will be met under the terms of its certification. The dam compliance schedule regulations specify that Ecology may take a water quality attainment plan into consideration when making that determination. Key to the legal execution of the dam compliance schedules provision is the completion of water quality attainment plans in *advance* of a water quality certification issuance. Only then can Ecology make the necessary legal finding of reasonable assurance. Also, a compliance schedule may not simply

Dams

Lake Chelan Certification

PCHB Decision

Ecology Guidance

Regulatory Gap

"Economic Feasibility"

"Feasible" Issues

extend the compliance deadline by ten years and permit experimentation with a range of measures for which there are insufficient analyses showing how they will improve water quality. Rather, the schedule and its accompanying plan must identify specific measures that will be implemented and the supporting analyses showing a likelihood of standard attainment.

There was much controversy surrounding one of Ecology's first uses of a dam compliance schedule in a 401 certification. Chelan County Public Utility District's Lake Chelan Dam received certification in 2003, and the certification was immediately appealed to the Pollution Control Hearings Board (PCHB) by the Confederated Tribes of the Umatilla (Tribes) with assistance from the Columbia River Inter-Tribal Fish Commission (CRITFC). The Tribes challenged the Lake Chelan 401 certification on a number of grounds, including a failure by Ecology to establish reasonable assurance that water quality standards would be met, and inappropriate consideration of "biological objectives" over numeric criteria.

While the April 2004 decision by the PCHB reformed several substantive conditions of the Lake Chelan certification, it upheld Ecology's legal assertions. The decision supported the use of dam compliance schedules as an adaptive management mechanism while establishing only a minimal test for reasonable assurance. The Board even agreed that Ecology acted properly when it explicitly sought to meet biological objectives and did not do so for numeric criteria. While the Board relied heavily on the information gap in the case — very little was known about the potential of a river reach that had been dewatered for 76 years — the Lake Chelan decision opened the legal door for future dam compliance schedules.

Dam compliance schedules are now regularly used in Washington. Ecology's FERC guidance indicates that schedules are advisable whenever water quality standards are not met. See *Water Quality Certifications for Existing Hydropower Dams Guidance Manual*. March 2005, Publication No. 04-10-022, pp.13, 15 (Ecology website: www.ecy.wa.gov/programs/wq/ferc/index.html). Since late 2002, Ecology has used a compliance schedule in most issued water quality certifications for parameters including temperature and total dissolved gas. In each instance save one, the schedule stretched for the maximum ten-year period.

What happens at the end of a dam compliance schedule is still in question. Washington's regulations expressly contemplate the use of UAAs or site-specific criteria if water quality standards are still not met. However, it is entirely possible that a dam compliance schedule may run its course without the required standards for establishing site-specific criteria or UAAs being met. It is possible that an applicability assessment will conclude that such standards cannot be met for a particular site. This regulatory gap — a place where compliance schedules end and site-specific criteria and UAA cannot begin — is still a significant unknown. Ecology has indicated that it is considering the issuance of a second ten-year dam compliance schedule, which critics have characterized as another iteration of confusing non-compliance.

In anticipation of difficult decisions related to increasing use of UAAs, site-specific criteria, and dam compliance schedules, Ecology is creating a guidance document. The guidance is not yet complete, in part because the draft raised many challenging policy and legal questions (*Guidance for Evaluating the Feasibility of Controls to Meet Water Quality Standards for Dams in Washington: DRAFT for Public Review*, August 2006. Publication No. 06-10-xxx). Issued in August 2006, the draft attempted to outline how Ecology would consider "economic feasibility" when applying water quality standards to dams. Dam owners asked Ecology to develop a specific process to ascertain when the financial implications of meeting water quality standards outweighed the environmental benefit.

The term "feasibility" is obviously central to this discussion. Both the UAA federal regulations and Washington's dam compliance schedule regulations include the term "feasible" as a test. UAAs are only available when the use in question is not "feasible" to attain; and the dam compliance regulations specify that the dam owner must undertake "all reasonable and feasible improvements" to meet water quality standards.

There is significant disagreement over whether "feasible" should mean the same thing in both the UAA and dam compliance schedule contexts, and how to define "feasible" at all. Do economics even belong in the definition of feasible, or is feasibility purely a technological question? If economics are part of the consideration, should it be based solely on the finances of the dam owner? Are the costs of not complying to be considered? What is the role of broader social costs? Adding to the confusion, UAA regulations identify a stringent test for dams under one of its doorways to a UAA and then provide a separate doorway for "substantial and widespread economic and social hardship." (40 C.F.R. § 131.10 (g)(4) and (g)(6), respectively).

Critics point to the inequity of a system that relies exclusively on company finances — dam owners who operate their facility poorly or who have a marginally beneficial facility could conceivably meet the test more easily than well-run or profitable dams. This inequity among dam owners could lead to inequitable treatment among the streams under Ecology's charge.

Dams

Oregon Approach

Oregon

In contrast to Washington, Oregon does not have regulations establishing dam compliance schedules. While Oregon recognizes that some measures may take time to implement and therefore compliance with water quality standards will not be achieved immediately, it requires dam owners to identify a suite of measures that will be implemented and provide supporting analyses establishing how the measures will result in compliance with water quality standards.

Guidance

Similar to Washington, Oregon recognized the increasing interest in using UAAs and site-specific criteria with regard to dam operations. In response, Oregon formed a stakeholder group to develop a UAA guidance document that would also include some discussion of site-specific criteria. After many meetings and substantial input, the Oregon Department of Environmental Quality (ODEQ) ultimately published an Internal Management Directive (IMD) in April 2007. The IMD "guides [O]DEQ on internal procedures" and "does not create rights or obligations on the part of public or regulated entities." (*Oregon Use Attainability Analysis and Site-Specific Criteria Internal Management Directive*, ODEQ, p. iv (April 2, 2007).

Economics

In addition to highlighting the complexity of both processes, the IMD makes clear that numerous questions remain unanswered, reflecting the ongoing uncertainty as to what requirements are necessary for a UAA versus site-specific criteria.

Net Environmental Improvement

Substantively, the IMD's discussion of economics poses several problems. While ODEQ asserts that economics are a factor in any determination, the agency does not justify this broad interpretation. The plain language of the federal regulations only mentions economics when evaluating whether there will be substantial and widespread economic and social impacts, as set forth in 40 C.F.R. 131.10(g)(6). On the other hand, ODEQ notes that the comparative costs of not requiring compliance with the water quality standard and the economic benefits of clean water should be also considered. Adding a novel approach, ODEQ will consider whether the process will lead to a net environmental improvement, although the IMD does not describe how that agency will specifically consider environmental benefits when making a final determination. ODEQ also identifies the relatively new concept of "water quality trading" as an alternative to a UAA or site-specific criteria.

Water Quality Trading

Ultimately, while providing an informative overview of how ODEQ intends to proceed, the guidance does little to resolve the key issues mentioned above. If ODEQ "internal procedures" result in any UAA or site-specific criteria proposals that weaken water quality standards, such resolution will prove necessary.

LICENSING EXAMPLES

To illustrate the complicated interweaving of water quality regulations and responsibilities, we will now examine two current hydropower dam licensing processes where these complexities have arisen and the problems with the processes as viewed by some public interest groups.

Priest Rapids

As noted above, in 2005 Washington State's Department of Ecology adopted dam compliance schedules into its regulations. Recently, Ecology incorporated a compliance schedule in the 401 certification issued for the Grant County Public Utility District's Priest Rapids Hydroelectric Project. This 1800-megawatt (MW) project consists of two dams — Wanapum and Priest Rapids — located on the Mid-Columbia River just upstream of the Hanford Reach. The 401 certification raises multiple questions regarding the use of dam compliance schedules and their relationship to any subsequent rulemaking action that may be necessary.

Quality Attainment Plan

First, under the regulations pursuant to WAC 173A-201A-510(5), the dam owner is required to develop a water quality attainment plan that includes a schedule for compliance not to exceed 10 years. According to the regulations, Ecology may rely on an *approved* water quality attainment plan when determining whether there is reasonable assurance that the dam will not cause or contribute to a violation of water quality standards. Importantly, the plan must precede reasonable assurance, which in turn must precede the 401 certification. In the Priest Rapids certification, Ecology references a specific section of the 401 certification itself as constituting the required water quality attainment plan. In addition, several of the conditions set forth in the applicable section were developed by Ecology and not contained in any water quality attainment plan developed by Grant County Public Utility District (PUD).

Failure to Comply

Second, throughout the certification, Ecology calls for Grant County PUD to undertake evaluations of and implement reasonable and feasible measures to address various water quality parameters. The ramifications of failing to comply with water quality standards vary depending on the water quality parameter at issue — none of which are particularly strict. For example, with regard to **t**otal **d**issolved

Dams

gas (TDG), if studies show that the project is not in compliance with applicable numeric criteria at the end of ten years (the time period specified in the dam compliance regulations) Ecology merely requires Grant County PUD to prepare an updated and revised feasibility study and implementation plan. With regard to biological objectives set forth in the certification, Grant County PUD may either continue to adaptively manage until the goal is attained or modified or it may petition Ecology for a rule change. Similar inconsistencies between compliance approaches to different parameters exist elsewhere in the 401 certification.

Regulatory Gap

In the event that Grant County PUD ultimately fails to comply with water quality standards by the end of a ten year period, there is still no guarantee that it will — alternatively — have made the necessary showing for either a UAA or site-specific criteria. The enormous Priest Rapids project may find itself in the regulatory gap noted above — i.e. violating water quality standards and unable to adjust them to match its circumstances. Such failure would call into question the efficacy of the dam compliance schedule as outlined and enforced by Ecology.

Hells Canyon

Quality Issues

A number of challenging water quality issues have been posed in the relicensing for Idaho Power Company's Hells Canyon Complex of dams on the Snake River along the Oregon-Idaho border. The Complex is composed of three large dams that generate over 1,100 MW, and its FERC license expired in 2005. These dams impact a number of water quality parameters, including: dissolved oxygen; temperature; and total dissolved gas in the Snake River. These impairments occur both upstream and downstream of the dams.

Snake River TMDL

A TMDL for the Snake River was completed in September 2004, in advance of major water quality decisions in the Hells Canyon licensing. The States of Oregon and Idaho attempted in the Snake River TMDL to address the mix of point, nonpoint, and dam-related impacts for a range of water quality parameters. (See ODEQ's website: www.deq.state.id.us/water/data_reports/surface_water/tmdls/snake_river_hells_canyon/snake_river_hells_canyon.cfm).

Oxygen Allocations

For example, the agencies examined the impacts of Idaho Power's Hells Canyon Complex and assigned each dam a specific allocation of oxygen to put back into the river:

> In addition to the total phosphorus load allocations for the Upstream Snake River segment (RM 409 to 335) and the tributaries, a dissolved oxygen load allocation has been established for Brownlee Reservoir (RM 335 to 285) (IPCo) to offset the calculated reduction in assimilative capacity due to the Hells Canyon Complex reservoirs.

Snake River-Hells Canyon Subbasin Assessment and Total Maximum Daily Loads at 449.

Water Quality Targets

In your authors' view, this approach fairly allocates the responsibility of the dissolved oxygen problem between all sources, point, nonpoint, and otherwise. The broad view of the TMDL, regarding various parameters, identified Idaho Power's responsibilities and set water quality targets that could guide the 401 certification process for the states. FERC's Final Environmental Impact Statement, issued August 31, 2007, adopted the TMDL (Hells Canyon FEIS at 36 at: www.ferc.gov/industries/hydropower/enviro/eis/2007/08-31-07.asp).

Temperature Standard

Compliance with the temperature standard is a fundamental piece of the TMDL. However, Idaho Power Company (IPC) has asserted that the temperature standard of 13 degrees Celsius that applies to the Snake River reach is "not the right standard." (*Proposal to Initiate a Process for Site-Specific Criteria for the Hells Canyon Reach*, IPC (May 2006). The company submitted a site-specific criteria proposal to the Idaho Department of Environmental Quality (IDEQ) and ODEQ in May 2006, proposing that the agencies adopt a warmer temperature standard during part of the Snake River fall chinook salmon spawning period. IPC argues that the designated use — fall chinook spawning — will be fully supported under this new, less restrictive temperature standard. Most agencies disagreed with IPC's assertion and questioned the data upon which IPC relied to establish that the use will be fully protected. Agreement was not reached among the expert agencies, tribes, and other stakeholders that fall chinook spawning would be fully protected under the proposed site specific criteria. To date, neither IDEQ nor ODEQ have acted on IPC's proposal.

Site-Specific Criteria

401 Certification

Despite the power company's efforts to relax the temperature standard, currently ODEQ and IDEQ are focusing their efforts on IPC's 401 certification applications pending before them. The certification application does not presume approval of the proposed site-specific criteria. It is possible that the states will choose to issue a 401 certification that requires a subsequent change to the TMDL, or to issue a certification that ignores the TMDL altogether. Either of these approaches raise legal issues.

Dams

Temperature Control Structure

Some parties to the relicensing (other than IPC) argue that the states should issue a 401 certification that would allow the Hells Canyon Complex to meet the existing temperature standard. They advocate for major structural modifications, such as the construction of a temperature control structure. This structure would enable dam operators to draw colder water from the bottom of Brownlee Reservoir to address downstream temperature impacts (letter from Michelle Pirzadeh, EPA, to Magalie R. Salas, FERC (October 9, 2007). Temperature control towers are a relatively new technology, although two of the pioneering structures are located in central Oregon on the McKenzie and Deschutes rivers.

Given the complexity of the issues at Hells Canyon, certification has been delayed for at least another year — until the temperature and other issues are resolved (Personal Communication from Doug Conde, Idaho Attorney General's Office).

Conclusion

Contentious Process

The issues surrounding hydropower dams and their relicensing remain at the front line of Clean Water Act regulatory challenges. As noted above, contention surrounds many aspects of these processes, including the implementation of UAAs, site-specific criteria, and other challenging water quality problems.

Just how these CWA processes are implemented with regard to hydropower projects will set precedent for other members of the regulated community facing their own unique range of water quality problems. This likelihood of precedent has attracted the interest of many water quality stakeholders — from public advocates who want to maintain the integrity of the Clean Water Act and water quality standards across the board, to other users that want to help dam operators push forward processes for relaxing regulatory requirements.

This article has outlined the current controversy. It may also preface upcoming conflicts. Your authors expect that many of the legal issues described herein will eventually be settled in the courts.

For Additional Information:
Rebecca Sherman, email: rebecca@hydroreform.org;
Brett Swift, 503/ 827-8648 or email: bswift@americanrivers.org;
Rich Eichstaedt, 509/ 835-5211 x307 or email: ricke@cforjustice.org;

Rebecca Sherman worked for the Hydropower Reform Coalition as its Northwest Coordinator, based in Portland, Oregon from 2003 to 2007. The Coalition (www.hydroreform.org) is a consortium of over 130 river conservation and recreation organizations working to improve rivers by changing hydropower dam operations. The Coalition focuses exclusively on non-federal hydropower projects regulated by the Federal Energy Regulatory Commission (FERC). During Rebecca's tenure, she spoke and published widely on the importance and restoration potential of reforming hydroelectric dams.

Brett Swift serves as Deputy Director of American Rivers Northwest Regional office. She works primarily on FERC hydropower relicensings in the states of Washington, Idaho and Oregon. Prior to joining American Rivers, Brett worked as a research attorney, then assistant director at the Northwest Water Law and Policy Project, at the Northwestern School of Law of Lewis and Clark College. She earned a B.A. in History at Trinity College in Hartford, Connecticut, and she earned her law degree at the University of Colorado.

Rick Eichstaedt serves as the Spokane River staff attorney for the Center for Justice representing organizations that work to protect and restore the Spokane River watershed. Rick had the honor of representing the Nez Perce Tribe in Idaho for seven years on a variety of environmental, natural resource, cultural resource, and treaty-right protection cases. Rick received his J.D. and a certificate in environmental and natural resources law from the Northwestern School of Law of Lewis and Clark College in Portland, Oregon. He received a B.A. in political science and anthropology from Hamline University in St. Paul, Minnesota.

Nutrient Assessment

NUTRIENT NUMERIC ENDPOINT DEVELOPMENT

ON A MORE PRUDENT PATH?

A Brief Reply to the Response of Dr. Jonathan Butcher and Ms. Cynthia Gorham Test

by Jeremy N. Jungreis, Nossaman (Guthner, Knox and Elliott, LLP)
and Dr. Scott Thomas (Stetson Engineers, Inc.)

Regulated Community

The response of Dr. Butcher and Ms. Gorham-Test, published in The Water Report in September (#43), generally provides a fair characterization of the Nutrient Numeric Endpoint (NNE) approach — from the regulator's perspective. Unfortunately, many of the concerns raised in our article published in TWR Issue #42 from the perspective of the regulated community — the community that will face the daunting task of finding a way to meet the numeric water quality standards and **t**otal **m**aximum **d**aily **l**oad (TMDL) targets generated through the NNE process — remain largely unresolved.

Secondary Indicators

We again wish to emphasize that the NNE concept itself has promise. There is logic in looking to secondary indicators (such as benthic algae concentrations, pH or dissolved oxygen levels) as evidence of impairment rather than focusing exclusively on nutrient concentrations in the water column or statistical assumptions based on ecoregional reference data. Compare *National Strategy for the Development of Regional Nutrient Criteria*, US Environmental Protection Agency (1998), which proposes that 25th percentile of all nutrient data in each ecoregion be deemed an "unimpacted reference condition" for purposes of establishing water quality criteria.

Watershed Data v. Assumptions

However, as noted in TWR Issue #42, the NNE process itself must be premised upon a sufficient quantum of relevant data from the watershed where it will be applied. Assumptions about the extent of existing impairment where actual field data is lacking — as will often be the case where **b**eneficial **u**se **r**isk **c**ategories (BURCs) are used — should be premised upon reference conditions in same or similar ecosystems. BURCs for Southern California coastal rivers should be premised upon reference conditions in the intermittent and ephemeral streams that predominate in an arid Mediterranean climate, just as BURCs for high flow perennial streams such as the Klamath River (the subject of one NNE Pilot Study), should be premised upon secondary indicators that occur naturally in cooler, wetter, climates with year round precipitation.

Nutrient Factors

Moreover, future applications of NNE must take into account a number of factors (such as the level of algae grazing, shading, ratios of chlorophyll *a* to ash free dry weight of algae, and ratios of organic to inorganic nitrogen in the water column) if NNE process is to accurately predict the ability of a watershed to assimilate nutrients. These factors are addressed in the NNE approach, but they were not adequately accounted for in the NNE pilot study of the Santa Margarita River (SMR) — thereby undermining the scientific validity of the numeric nutrient targets suggested therein. While NNE "spreadsheet models" (which Butcher and Gorham Test refer to as the "NNE Tool") may have been developed as simple scoping level tools that must, by necessity, make broad assumptions about a number of factors, the simple nature of the NNE Tool does not relieve regulators of their obligation to *validate* NNE's predictions — particularly where suggested nutrient targets are orders of magnitude more stringent than existing state water quality standards. On this note, we question the fairness of placing the burden of rebutting the NNE "scoping level" model, which makes conservative (and possibly inaccurate) assumptions about the impact of important variables, on the regulated community. Affluent communities may be able to afford the type of calibrated site-specific model that Butcher and Gorham-Test suggest as a "follow-on" to the NNE scoping model. However, many communities will not have the resources to do so — possibly leaving those communities with TMDL targets that cannot be met.

Burden of Rebutting Model

Natural Background

Butcher and Gorham-Test take issue with the assertion that the NNE will be used to set nutrient criteria and TMDL targets that are more stringent than natural background levels. They note that the NNE Tool will never intentionally be used to set TMDL targets in this manner. Data collection in the SMR and its tributary systems is taking place at this time as part of a stakeholder initiative to better understand the river and its assimilative capacity. This data collection should yield important information about background levels of nitrogen and phosphorus in Southern California streams. However, we note that the burden to prove "natural background levels" should not be placed, as it has to a degree in the SMR, on the regulated community as a condition of avoiding an unattainable TMDL. Identification of a natural background "baseline" should be the responsibility of the cognizant regulatory agency as part of that agency's continuing obligation to evaluate the propriety of water quality standards, before embarking upon a TMDL to enforce those standards (see 33 U.S.C. §1313(c) (requiring triennial review of water quality standards)).

"Baseline" Responsibility

Nutrient Assessment

Regulatory Status

Peer Review

While we agree with Butcher and Gorham-Test's assertion that NNE does not yet enjoy a "regulatory status" in California, NNE continues to be a moving target. Previous assertions to stakeholders at meetings of the California State Water Resources Control Board (State Board) and Regional Water Quality Control Board (Regional Board) indicate that NNE remains available for use in the development of nutrient TMDLs, and some of the Regional Boards are beginning to use the NNE for just that purpose. *See e.g.,* Los Angeles Regional Water Quality Control Board, *Public Notice: Machado Lake Algae, Ammonia, Eutrophication, and Odors TMDL—Public Meeting* (October 25, 2007) at: www.waterboards.ca.gov/losangeles/html/meetings/tmdl/DominguezChannel/07_1025/ML_NNE_public_meeting.pdf. A scientific peer review process of the entire NNE Framework, conducted by the State Board or the US Environmental Protection Agency (EPA) at a programmatic level, should remain a minimum precondition for use of the NNE tool at the local level. See generally California Health & Safety Code § 57004 (b) (detailing requirements for scientific peer review).

We do note that the conversation regarding NNE has taken a more productive turn in recent months. At stakeholder meetings in San Diego during August and September of 2007, officials at the State Board indicated an intention to conduct a formal scientific peer review of the NNE process — hopefully with opportunities for public participation.

Distinct BURCs

State Board officials have also acknowledged that BURCs were initially set very conservatively vis-à-vis the amount of algal mass deemed to indicate presumptive impairment of beneficial uses. At the August 2007 stakeholder meetings, EPA and the State Board both indicated a willingness to consider development of distinct BURCs for Northern and Southern California in order to ensure that assumptions which drive nutrient target calculations are based on actual (not assumed) impairment of beneficial uses. The State Board should go even further. If BURCs are to be used in lieu of field data, then a state as ecologically and climatologically diverse as California likely requires a number of validated BURCs.

UAAs

Finally, whether NNE or some other process is ultimately used to establish nutrient TMDLs, EPA and the State Board should encourage (and where appropriate provide grants to fund) Regional Board and stakeholder efforts to conduct Use Attainability Analyses (UAAs) on 303(d) listed waters prior to the development of nutrient TMDLs. UAAs are "a structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological, and economic factors…" (40 CFR § 131.10(g)). UAAs are undertaken where a use either does not exist or is inappropriate for the particular water segment in question. *Id.* Such an approach makes sense and accords with state policy. *See generally* California State Water Resources Control Board, *State of California: SB 469 TMDL Guidance, a Process For Addressing Impaired Waters In California* at § 6.3 (June 2005). There is no reason to develop TMDLs for water bodies that are fundamentally healthy but burdened by water quality standards and/or beneficial uses that no longer reflect the priorities of the watershed.

Beneficial Uses

Society benefits where watersheds are able to accommodate the economic realities of human habitation, while at the same time ensuring that desired ecological values are preserved. The NNE Pilot Studies yielded overly restrictive nutrient targets, in part, because water quality standards are often oriented to the protection of beneficial uses that do not currently (and are not anticipated to) exist. For example, as conceded in the NNE Pilot Study of the SMR, the COLD beneficial use may be inappropriate for the SMR and other coastal streams in Southern California for a variety of reasons, yet the use (and restrictive nutrient standards needed to obtain it) remains a legally enforceable requirement. Reclassification of the most nutrient sensitive uses, whenever absence of the use is documented via use attainability analysis, ensures that TMDLs are utilized in a efficient manner. To wit, watersheds are protected against nuisance algae concentrations and eutrophication at the same time that important initiatives (such as water reclamation) are able to move forward.

For Additional Information:

Jeremy N. Jungreis, Nossaman, Guthner, Knox and Elliott (Orange County, CA), 949/ 833-7800 or email: jjungreis@nossaman.com

Scott Thomas, PhD, Stetson Engineers, Inc. (Diamondhead, MS), 228/ 342-0239 or email: Scottt@stetsonengineers.com

Jeremy Jungreis is an Of Counsel with the Orange County, CA law firm of Nossaman, Guthner, Knox and Elliott. He specializes in environmental, land use and water law —with a particular focus on water quality, water allocation and air quality compliance. He is the Programs Vice Chair of the American Bar Association Water Resources Committee, and is a frequent lecturer on environmental topics throughout the United States and abroad. He is also a Major in the United States Marine Corps Reserve—where he serves as water law counsel for Marine Corps installations in the Western United States.

Scott Thomas is an ecologist with Stetson Engineers specializing in watershed planning, environmental planning and permitting, and water quality. Dr. Thomas is coordinator of the Santa Margarita River Water Quality Monitoring Group and facilitates the Watershed Stakeholders Advisory Committee. He obtained his PhD. in Environmental Biology and Public Policy from George Mason University, an MA in Business and Management from Webster

WATER BRIEFS

ANTI-SPECULATION DOCTRINE CO

WATER SUPPLY PLANNING

The Colorado Supreme Court (Court), in a decision authored by Justice Greg Hobbs, recently clarified requirements for governmental water supply agencies when they apply for rights to secure a water supply for the future. The Court reversed a water court decree and remanded the case to the water court to make necessary findings of fact on several issues in *Pagosa Area Water and Sanitation Dist., et al. v. Trout Unlimited*, Case No. 06SA338 (Oct. 22, 2007).

The water court entered a conditional decree for two water districts (Districts) that included a planning period extending nearly 100 years. The decree granted a conditional water storage right extending to the year 2100 for 29,000 acre-feet (AF) of water, along with the right to fill and refill the reservoir continuously to achieve a total annual amount of stored water of 64,000 AF, utilizing a 100 cubic foot per second (cfs) rate of diversion. The decree also granted the Districts a "right of reuse" for that water, as well as deciding that the Districts would have an additional right for "direct flow" of 80 cfs from the San Juan River independent from the storage right.

Trout Unlimited asserted that the Districts "did not carry their burden of proving their intent to make a non-speculative conditional appropriation. It argues that the water court should not have adjudicated conditional water rights in amounts premised on demands projected nearly one hundred years into the future. It also argues that the districts intend to sell some of the water to customers outside their boundaries, and that the districts do not have a specific plan and intent for the recreation, fish and wildlife, and aesthetic uses listed in the decree." *Slip Op.* at 3-4.

The Court held that "a governmental water supply agency has the burden of demonstrating three elements in regard to its intent to make a non-speculative conditional appropriation of unappropriated water: (1) what is a reasonable water supply planning period; (2) what are the substantiated population projections based on a normal rate of growth for that period; and (3) what amount of available unappropriated water is reasonably necessary to serve that population for the planning period, above its current water supply. In addition, the governmental agency must show under the 'can and will' test that it can and will put the conditionally appropriated water to beneficial use within a reasonable period of time." *Id.* at 4-5.

The Court determined that the water court failed to make sufficient findings of fact to enable the Supreme Court to review the water court's judgment and decree. The unresolved factual findings included: what is a reasonable water supply planning period for the Districts; what are the substantiated population projections for future growth in the Districts; what are the future land use mixes and per capita water usage requirements taking into account implementation of water conservation measures; considering water reuse, what is the measure of consumptive use the Districts reasonably need to serve their population in the future during the reasonable planning period; and have the Districts met the "can and will" test for a conditional appropriation of water.

Justice Hobbs' opinion discussed the anti-speculation underpinning of Colorado water law, particularly as it relates to municipal or governmental agency water rights, and, in contrast, "optimum beneficial use" of water (see Slip. Op at 14-22). The decision also discussed the various standards and limitations that are necessary where future supplies are being contemplated for entities such as municipalities (governmental supply agencies). *Id.* at 20-21. The Court's opinion dealt with the "can and will" requirements for such water rights (under the "can and will" test, there must be a substantial probability that the intended appropriation will reach fruition. *City of Thornton v. Bijou Irrigation Co.,* 926 P.2d 1, 42 (Colo. 1996)). In conclusion, Judge Hobbs' noted potential "appropriate decree provisions, which may include 'reality checks' and volumetric limitation provisions for the districts' conditional appropriation." *Id.* at 34.

For info: Complete case on Colorado Bar website: www.cobar.org

COALBED METHANE MT

ANTI-DEGRADATION & NUMERIC STANDARDS

A state district court judge issued a decision upholding Montana's water quality standards regulating coalbed methane production. In the October 18 ruling, District Judge Blair Jones sided with state regulators and conservation groups in upholding numeric water quality standards for electrical conductivity (EC) and sodium adsorption ratio (SAR) and classification of EC and SAR as "harmful parameters." The decision also upheld Montana's anti-degradation standard. Judge Jones' decision upholds water quality standards adopted by Montana's Board of Environmental Review (BER) in 2003 and 2006. The 2003 standards were adopted by US EPA, while the 2006 anti-degradation standard has yet to be approved by EPA and is the subject of a pending federal lawsuit.

The state adopted the 2003 numeric water quality standards following requests by Northern Plains Resource Council (NPRC) and the Tongue River Water Users Association to protect agriculture from pollution and crop losses caused by coalbed methane development. A number of energy companies, led by Fidelity Exploration and Production, Marathon Oil Co., Marathon subsidiary Pennaco Energy Inc., Nance Petroleum Corp. and Yates Petroleum Corp, appealed the rules, arguing that the BER acted improperly in establishing the water quality protections, which they alleged were too restrictive and without a sound scientific basis.

In the ruling, Judge Jones noted that the federal 9th Circuit Court of Appeals "has concluded that CBM produced water is a 'harmful pollutant' necessitating a National Pollutant Discharge Elimination System (NPDES) permit before discharge into surface waters." Citing *Northern Plains Resource Council v. Fidelity Exploration & Dev. Co*., 325 F.3d 1155, 1162 (9th Cir. 2003), *cert. denied* 540 U.S. 967 (2003). Order on Summary Judgment Motions at 4, Case No. DV 06-68 (10/17/07).

Judge Jones rejected each of the five claims industry lawyers offered to overturn the numeric water quality standards for EC and SAR. He found that BER's "exercise of rulemaking authority was consistent with authorizing legislation and that BER did not act arbitrarily or capriciously in the exercise of that discretion" so the state was warranted in taking "proactive measures to protect water quality." Order at 11 and 19, respectively. "Given the long term projection for massive CBM development, the [numeric standard] rules were 'reasonably necessary' to ensure consistency in permitting, and for promoting the overriding goal of protecting irrigated agriculture as a designated [beneficial] use." *Id.* at 20.

The plaintiffs argued that the standards should be based on the assimilative capacity of the river to absorb pollutants. The ruling, however, stated that such an approach is "impermissible under the CWA. *Southeast Alaska Conservation Council v. United States Army Corps of Engineers*, 486 F.3d 638, 644 (9th Cir. 2007). Adoption of plaintiffs' argument would require this Court not only to impermissibly second-guess the BER,

but also potentially authorize disposal of water effectively transforming the Powder River Basin into a waste water treatment plant." *Id*. at 22.

BER initiated its 2006 rulemaking after NPRC petitioned the state to institute an anti-degradation (aka nondegradation) policy, which is designed to protect the existing water quality of Montana surface waters by preventing incremental decline. Judge Jones ruled that "what the BER did in 2006 was treat discharges of EC and SAR for purposes of nondegradation review in the same manner as all other constituents for which there are numeric standards...The rules protect high quality water by requiring permit writers to stop short of allowing degradation right up to the standard." *Id.* at 27. The court went on to state that, "Finally, the effect of the new nondegradation criteria is simply to require CBM developers to obtain an authorization to degrade, which is not the equivalent of a moratorium on CBM development. Where high quality water is at stake, the law mandates this result and does not allow the DEQ or BER to forego such review." *Id*. at 28.

For info: Dan Feinberg, NPRC, 406/248-1154; Complete Order available at NPRC's website: www.northernplains.org/

SUPERFUND SUCCESS MT
RESTORATION PROJECT

Silver Bow Creek was contaminated for over a century by mining-related discharges from the Butte, Montana mining district that resulted in surface water quality unsuitable for aquatic life. Recently, however, the Montana Department of Fish, Wildlife & Parks (FWP) reported that populations of trout have been found in the stream, which was once considered "dead." An FWP survey found 54 brook trout as well as four westslope cutthroat trout. Those numbers represent the greatest improvement in terms of diversity of species and number of fish since FWP began surveys in 2002.

Silver Bow Creek became a Superfund site in 1983. At that time, the contamination was so ubiquitous and water quality exceedances so large that it was widely believed that water quality standards could never be met. Cleanup has been ongoing since 1999 as part of a Superfund remedial action. See Frandsen, TWR #26.

In a 1999 state, federal and tribal settlement, Atlantic Richfield Company (ARCO) agreed to pay $215 million to the State to resolve certain claims. From the settlement amount, $80 million plus interest was set aside for Montana's Department of Environmental Quality (DEQ) and US EPA to implement the remedy for Silver Bow Creek. Some of the remaining amount is being used to enhance the cleanup of Silver Bow Creek through various habitat improvements and restoration actions. DEQ and EPA are coordinating the cleanup of the Silver Bow Creek remedy with the Natural Resource Damage Program (NRDP). In 2000, NRDP of the Montana Department of Justice formed a partnership with DEQ, bringing a restoration component to the project that goes beyond remediation required under Superfund.

For info: Angela Frandsen, CDM, 406/441-1400 or email: frandsenak@cdm.com; DEQ website: www.deq.state.mt.us/

SUPERFUND SETTLEMENT CA
GROUNDWATER CONTAMINATION

EPA and the US Department of Justice (DOJ) recently settled for a total of $12.5 million with 39 parties for the clean up of the South El Monte area of the San Gabriel Valley Superfund Site located outside Los Angeles. The site was Superfund-listed in 1984 after industrial solvents and other materials had contaminated soil and groundwater with volatile organic compounds, perchlorate and other chemicals.

The settlement filed last week in Los Angeles federal court includes a consent decree with 13 parties for their share of groundwater cleanup costs, based on their past and present payments for the site, totaling about $9.2 million; and a consent decree with 26 parties who have adequately demonstrated limited financial means to pay for the groundwater cleanup costs, and who collectively pay about $3.3 million.

Meanwhile, Keith Takata, EPA Superfund Director in the region, said EPA "will continue to oversee cleanup work and pursue other potentially liable parties to recover cleanup costs." Three local water companies are currently operating cleanup systems. EPA will use funds from today's settlements to reimburse the water companies through a cooperative agreement with the San Gabriel Basin Water Quality Authority.

For info: Wendy Chavez, EPA, 415/ 947-4248 or EPA Superfund website: www.epa.gov/superfund/index.htm

DISCHARGES RULING WEST
NPDES PROHIBITION - IMPAIRED WATERWAYS

A recent decision by the 9th Circuit Court of Appeals prohibits issuance of an NPDES permit under the Clean Water Act (CWA) for discharges into waterways that do not meet water quality standards, even if the new discharge is offset by the elimination of a pollution source upstream. *Friends of Pinto Creek v. United States Environmental Protection Agency* (*Pinto Creek*), Cause No. 05-70785 (9th Cir., October 4, 2007).

Pinto Creek is included on Arizona's CWA § 303(d) list of "impaired waters" for dissolved copper. The Carlota Copper Company (Carlota) proposed to construct and operate a 3000-acre open-pit copper mine and processing facility the Creek. Project design included a series of seven retention ponds to capture runoff and sediment from waste rock disposal areas. Each pond would release stormwater if a large storm exceeded pond capacity. Retention pond discharges were considered point sources requiring a NPDES permit. Carlota also proposed to augment stream flow from either groundwater or other sources, with the augmentation outfall also requiring an NPDES permit. After issuance of a draft permit, Carlota offered to partially remediate a nearby abandoned mine site to offset Carlotta's discharges. EPA issued the final NPDES permit, and the Friends of Pinto Creek appealed to the 9th Circuit.

The 9th Circuit rejected Carlotta's and EPA's assertions and their construction of the relevant statute concerning discharge of pollutants to a stream segment that already exceeds its water quality standards for that pollutant (40 C.F.R. § 122.4(i)). "The error of both the EPA and Carlota is that the objective of that section [CWA] is not simply to show a lessening of pollution, but to show how the water quality standards will be met if Carlota is allowed to discharge pollutants into the impaired waters." *Order* at 6.

The Court also found, contrary to EPA, that if point sources other than Carlotta's point source require compliance schedules to achieve the water quality standard not in compliance "the EPA must locate *any* such point sources and establish compliance schedules to meet the water quality standard before issuing the new permit. If there are not adequate point sources to meet this requirement, then a permit cannot be issued unless the state or Carlota agrees to establish a schedule to limit pollution from a nonpoint source or sources sufficient to achieve water quality standards." *Id.* at 7.

For info: See next TWR for a more thorough discussion of *Pinto Creek*. Complete case available at: http://caselaw.lp.findlaw.com/scripts/getcase.pl?court=9th&navby=year&year=2007-10

CALENDAR

November 15 CA
Managing Greenhouse Gas Emissions Workshop, San Francisco. RE: Preparing Effective Greenhouse Gas Inventories & Conducting Greenhouse Gas Emission Calculations According to WRI/ WBCSD Greenhouse Gas Protocols and Other State Registry Protocols, such as the California Climate Action Registry Protocols. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

November 15-16 WA
The Mighty Columbia, Seattle. Hotel Monaco. RE: State & Federal Rulings, Climate Change, Hatchery Reform, Quality/Quantity Interrelationship, Transfers & Marketing, Canadian Considerations, Hydropower & Windpower. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

November 19 CA
Proposed Water Quality Control Plan for Enclosed Bays & Estuaries, Sediment Quality Objectives - State Water Resources Control Board Public Hearing, Sacramento. Resources Bldg., 1416 9th Street, 10am-12pm. The draft Staff Report and proposed Plan may be obtained on the SWRCB website: www.waterboards.ca.gov/bptcp/sediment.html. Submit comments by email no later than 12pm on November 16 to: commentletters@waterboards.ca.gov. For info: Chris Beegan, SWRCB, 916/ 341-5577 or email: (cbeegan@waterboards.ca.gov)

November 27-30 CA
2007 ACWA Fall Conference & Exhibition, Indian Wells. Renaissance Esmeralda Resort & Hyatt Grand Champions. Sponsored by the Association of California Water Agencies. For info: www.acwa.com//events/acwa_events.asp

November 28-30 OR
Oregon Water Resources Congress Annual Meeting, Hood River. Hood River Inn. For info: OWRC, 503/ 363-0121, email: owrc_info@yahoo.com, or website: www.owrc.org

November 29-30 AK
Permitting Strategies in Alaska, Anchorage. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

November 29-30 CA
14th Annual California Aquatic Bioassessment Workgroup (CABW) Meeting, Davis. UC Davis, 8am-4pm. For info: Jim Harrington, California Dept. of Fish & Game, 916/ 358-2862 or email: jharring@ospr.dfg.ca.gov

November 29-30 NM
52nd Annual New Mexico Water Conference, "Beyond the Year of Water: Living Within Our Water Limitations," Santa Fe. La Fonda Hotel. Sponsored by the New Mexico Water Resources Research Institute. For info: Peggy Risner, NMWRRI, 505/ 646-4337, website: http://wrri.nmsu.edu/conf/conf07/conf.html

November 29-30 FL
Florida Wetlands Conference, Tampa. Marriot Waterside. For info: CLE International, 800/ 873-7130 or website: www.cle.com

November 29-30 CO
Land Use Law Conference, Denver. For info: CLE International, 800/ 873-7130 or website: www.cle.com

November 29-30 NJ
Natural Resources Damages Litigation Conference, Newark. For info: Law Seminars Int'l, 800/ 854-8009, email: registrar@lawseminars.com, or website: www.lawseminars.com

November 29-30 OR
Oregon Water Resources Commission Meeting, TBA. For info: Cindy Smith, OWRD, 503/ 986-0876, or website: www.wrd.state.

November 30 OR
Life After Rapanos & EPA/Corps Guidance on CWA Section 404 Jurisdiction, Portland. Sponsored by Environmental & Natural Resources Section (OSB). For info: shackbart@osbar.org

December 1-6 CA
Water Scarcity, Global Changes & Groundwater Management Responses International Conference, Irvine. University of California Irvine. Convened by UNESCO & UC Irvine. For info: Jean Fried, Civil & Environmental Engineering, 714/ 679-6888 or email: jfried@uci.edu

December 2-4 TX
2007 Water Summit: Texas Water Development Board, San Antonio. Henry B. Gonzalez Convention Center. RE: Wide variety of water-related topics. For info: www.twdb.state.tx.us

December 3-4 FL
Artificial Recharge of Ground Water Course, Orlando. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

December 3-4 CA
Coastal Law Conference, Los Angeles. For info: CLE International, 800-873-7130 or website: www.cle.com

December 3-4 FL
Introductory Statistics for Environmental Professionals Course, Orlando. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

December 3-4 NM
Land Use Law Conference, Albuquerque. For info: CLE International, 800-873-7130 or website: www.cle.com

December 3-14 Indonesia
UN Climate Change Conference, Bali. Nusa Dua. For info: Kevin Grose, UN, +49 228 815 1528, email: kgrose@unfccc.int or website: http://unfccc.int/meetings/cop_13/items/4049.php

December 4 AZ
Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) Workshop, Phoenix. RE: Clean Water Act, Scope of the NPDES Program, other water regulations (e.g., SPCC, Wetlands), case studies and more. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

December 4 CA
Statewide Water Recycling Policy Hearing, Sacramento. Cal/EPA Hqtrs., 1001 I Street. For info: SWRCB website: www.waterboards.ca.gov/water_recycling_policy/index.html

December 4 WA
Understanding the Amended Model Toxics Control Act (WAC 173-340) Training, Seattle. WETC Headquarters. For info: Renata Sobol, NW Environmental Training Center, 206/ 762-1976, email: rsobol@nwetc.org or website: www.nwetc.org

December 4-7 FL
2007 NGWA Groundwater Conference & Expo, Orlando. RE: Issues and Challenges Affecting Groundwater Industry. Drilling Operations and Well Construction; Business Management and Professional Development. For info: National Ground Water Association, 800/ 551-7379, email: customerservice@ngwa.org, or website: www.ngwa.org

December 5-6 WA
Establishing Soil, Groundwater, and Surface Water Cleanup Levels Under the Model Toxics Control Act Training, Seattle. NWETC Headquarters. For info: Renata Sobol, NW Environmental Training Center, 206/ 762-1976, email: rsobol@nwetc.org, or website: www.nwetc.org

December 5-7 WA
Washington State Water Resources Association 2007 Annual Convention, Spokane. Davenport Hotel. For info: WSWRA, 360/ 754-0756 or website: www.wswra.org

December 6-7 CA
Eminent Domain, San Francisco. For info: CLE International, 800-873-7130 or website: www.cle.com

December 6-7 OR
Northwest Environmental Conference & Trade Show, Portland. Red Lion Hotel Jantzen Beach. For info: Northwest Environmental Business Council (NEBC), 800/ 985-6322, 503/ 227-6361, or website: www.nebc.org/

December 9-11 CA
28th Annual International Irrigation Show, San Diego. For info: Irrigation Association, website: www.irrigation.org/show/default.aspx?pg=attend.htm&id=14

December 10-14 ID
Idaho Environment Summit (2nd Annual), Boise. For info: IES, 888/ 301-0185, email: info@idahosummit.org, or website: www.idahosummit.org

December 11-13 OR
Northwest Power & Conservation Council Meeting, Portland. Council Offices: 851 SW Sixth Avenue, Ste. 1100. For info: NWPPC, 800/ 452-5161 or website: www.nwcouncil.org

December 12 TX
Environmental Auditing Essentials, Dallas. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

December 12 WA
Tax Benefits of Building Green Seminar, Seattle. State Convention & Trade Center. Presenters: Julio Gonzalez & Marky Moore. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

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December 12-13 WA
Natural Resource Damage Assessment Workshop, Seattle. NWETC Headquarters. For info: Renata Sobol, NW Environmental Training Center, 206/ 762-1976, email: rsobol@nwetc.org or website: www.nwetc.org

December 13-14 CO
National Environmental Policy Act, Denver. For info: CLE International, 800/ 873-7130 or website: www.cle.com

December 13-14 OR
Oregon Environmental Quality Commission Meeting, Portland. For info: Helen Lottridge, DEQ, 503/ 229-6725, or website: www.deq.state.or.us/about/eqc/EQCagendas.htm

December 13-14 OR
Oregon Land Use Law, Portland. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

December 17 OR
Oregon Greenhouse Gas Reporting Advisory Committee, Portland. DEQ Headquarters, Conference Rm EQC A, 10th floor, 811 SW 6th Ave., 9am-4pm. For info: DEQ website: www.deq.state.or.us/aq/climate

December 18-20 WV
Understanding and Applying Environmental Flows Training, Shepherdstown. USFWS National Conservation Training Center. RE: Development of Environmental Flows & Use of Indicators of Hydrological Alteration Software; sponsored by The Nature Conservancy. For info: Diedre A. Paterno Pai, TNC, 303/ 541-0344, email: dpaterno-pai@tnc.org, or website: www.nature.org/initiatives/freshwater/conservationtools/art21768.html; or NCTC website: http://training.fws.gov

January 1-10 LA
Optimizing Decision-Making and Remediation at Complex Sediment Sites, New Orleans. Wyndham at Canal Place. For info: Sediment Management Workgroup website: www.smwg.org/

January 11 CA
California State Water Board Funding Fair 2008, Sacramento. Cal/EPA Bldg. RE: Water & Related Environmental Funding Opportunities Available Through the State. For info: Erin Ragazzi, SWB, 916/ 341-5733, email: enragazzi@waterboards.ca.gov or website: www.waterboards.ca.gov/funding/fundingfair2008.html

January 14-15 NV
Nevada Water Law Conference, Reno. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 16 CA
Implementing Sustainable Development Programs, Irvine. RE: How Companies Can Achieve Competitive Business Advantage Through Sustainable Business Approaches; Successful Programs Presented & Discussed. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

January 21 AK
Permitting Strategies in Alaska, Anchorage. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 22-23 CO
Colorado Water Conservation Board Meeting, Denver. For info: www.cwcb.state.co.us/

January 24-25 WA
15th Annual Endangered Species Act Seminar, Seattle. State Convention & Trade Center. For info: The Seminar Group, 800/ 574-4852, email: info@theseminargroup.net, or website: www.theseminargroup.net

January 24-25 NM
Law of the Rio Grande SuperConference, Albuquerque. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 28-29 FL
Growth and Water Supply Conference, West Palm Beach. For info: CLE International, 800/ 873-7130 or website: www.cle.com

January 30 IL
Water Environment Federation Midyear Meeting, Chicago. RE: Knowledge and Technology Exchange within the Water and Wastewater Fields. For info: WEF website: www.weftec.org

February 1-2 OR
Pacific Northwest Groundwater Exposition, Portland. For info: National Ground Water Association, 800/ 551-7379 or website: www.ngwa.org

February 11 CA
Long Range Planning & Water Policy in California, Ontario. Ontario Convention Center. For info: American Ground Water Trust, 800/ 423-7748 or website: www.agwt.org/workshops.htm

February 13 OR
Fishing the Past to Feed the Future: Archaeology, Historical Ecology, and Restoration of Marine Ecosystems, Eugene. University of Oregon, Many Nations Longhouse. For info: Christina Davis, ENR, 541/ 346-1395, email: cdavis6@uoregonl.edu, or website: www.law.uoregon.edu/org/jell/climate.php

February 19-21 OR
Northwest Hydroelectric Association Conference, Portland. Marriott Hotel. For info: NWHA, 541/ 610-3311 or website: www.nwhydro.org

February 20-22 CA
2008 Environmental Industry Summit, San Diego. Coronado Island Marriott Resort. For info: Summit website: www.ebiusa.com/Summit2007/

February 21 CO
Clean Water Act and the National Pollutant Discharge Elimination System (NPDES) Workshop, Denver. RE: Clean Water Act, Scope of the NPDES Program, other water regulations (e.g., SPCC, Wetlands), case studies and more. For info: Trinity Consultants, 800/ 613-4473 or website: www.trinityconsultants.com/Training/

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